Chapter 9

Duffin Creek Water Pollution Control Plant Expansion and Upgrades

The Regional Municipality of York
The Regional Municipality of Durham

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9. Duffin Creek WPCP Expansion and Upgrades

9.1 Overview

The Duffin Creek Water Pollution Control Plant (WPCP) is a conventional activated sludge-based wastewater treatment facility located on the northern shore of Lake Ontario in Pickering, Ontario. The plant treats wastewater from The Regional Municipality of York (York Region) and The Regional Municipality of Durham (Durham Region). This municipal wastewater treatment plant is jointly owned by Durham Region and York Region and is operated by Durham Region.

The liquid treatment processes are divided into three treatment trains referred to as Stages 1, 2 and 3 (constructed in 1993, 1978 and 2010, respectively; shown in Figure 9.1). Stages 1&2 each have a rated average daily flow (ADF) capacity of 160 megalitres per day (ML/d), and Stage 3 has a rated ADF capacity of 310 ML/d, for a total of 630 ML/d. The existing plant is designed to service a sewershed population of 1.55 million (M) people.

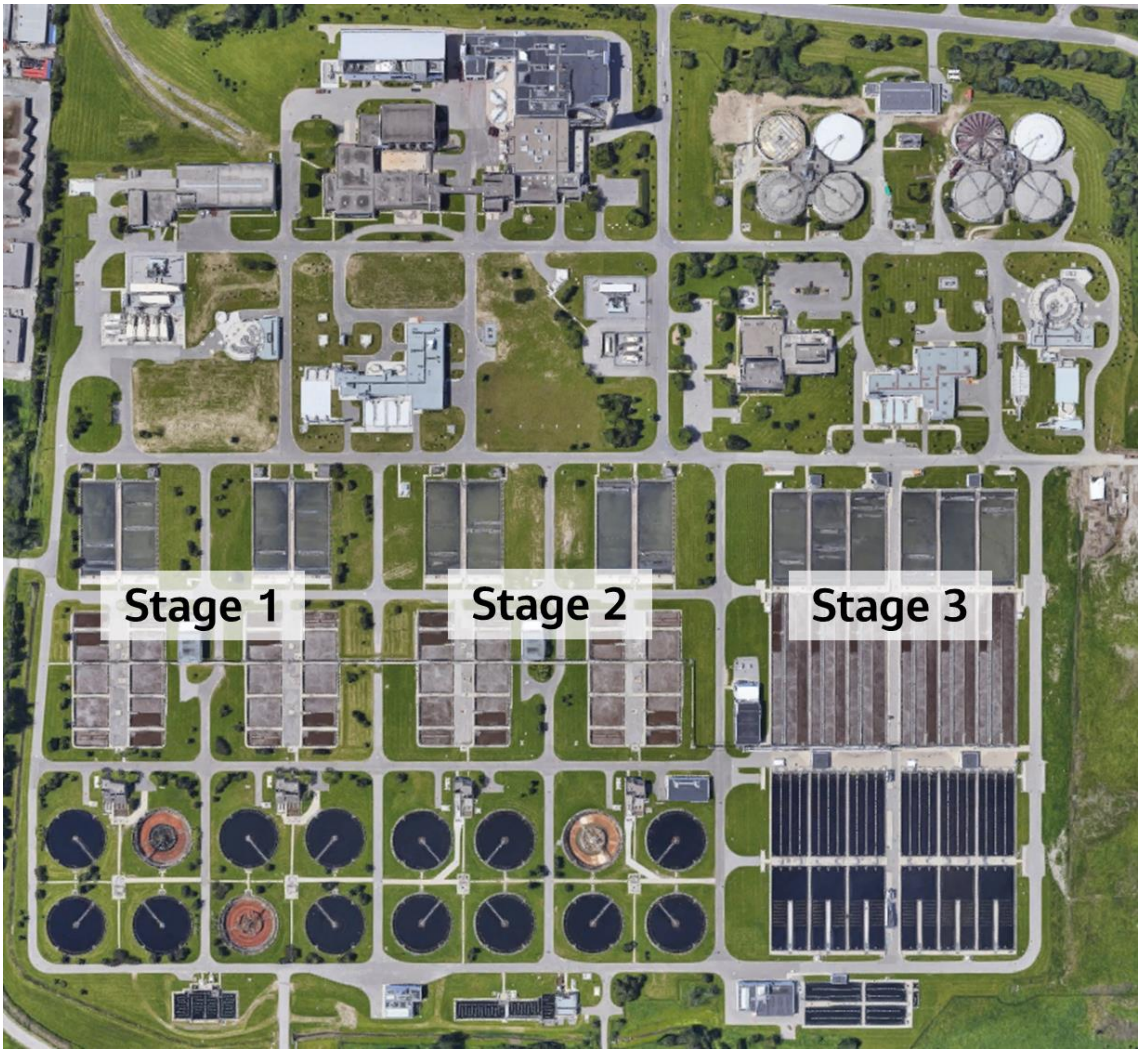

Figure 9.1 Aerial View of Duffin Creek WPCP

The liquid treatment process consists of preliminary treatment (also referred to as headworks, which consists of screening and aerated grit removal), rectangular primary clarifiers, aeration tanks, circular and rectangular secondary clarifiers and chlorine contact chambers for disinfection. Iron salts (ferric chloride, ferric sulphate or ferrous chloride) are added to preliminary and secondary treatment for chemical phosphorus removal. Polymer can also be added to the primary and secondary clarifiers to improve solids removal, which the plant uses intermittently as required. Disinfected effluent is dechlorinated with sodium bisulphite before being discharged through an outfall approximately 1 kilometre offshore in Lake Ontario.

For solids handling, waste activated sludge (WAS) is co-thickened with primary sludge in the primary clarifiers. The co-thickened primary sludge and WAS are pumped to common solids handling processes, which include anaerobic digestion, sludge blending, dewatering and fluidized bed incineration. The biogas produced from the anaerobic digesters is used in gas-fuelled hot-water boilers for digester process heating. Biogas in excess of the demand from these boilers is flared. The plant also receives hauled septage, liquid sludge and liquid-digested biosolids from wastewater treatment plants in York Region and Durham Region. The residual ash from the incineration process is dewatered and recycled in the cement-making process at St. Marys Cement Plant (Bowmanville, Ontario). A process flow diagram of the plant is shown in Figure 9.2.

To service the projected sewershed population and maintain the system's operational flexibility, additional treatment capacity will be required to accommodate the estimated wastewater flows and loads. Chapter 9 provides a conceptual level description of the expansion requirements at the Duffin Creek WPCP.

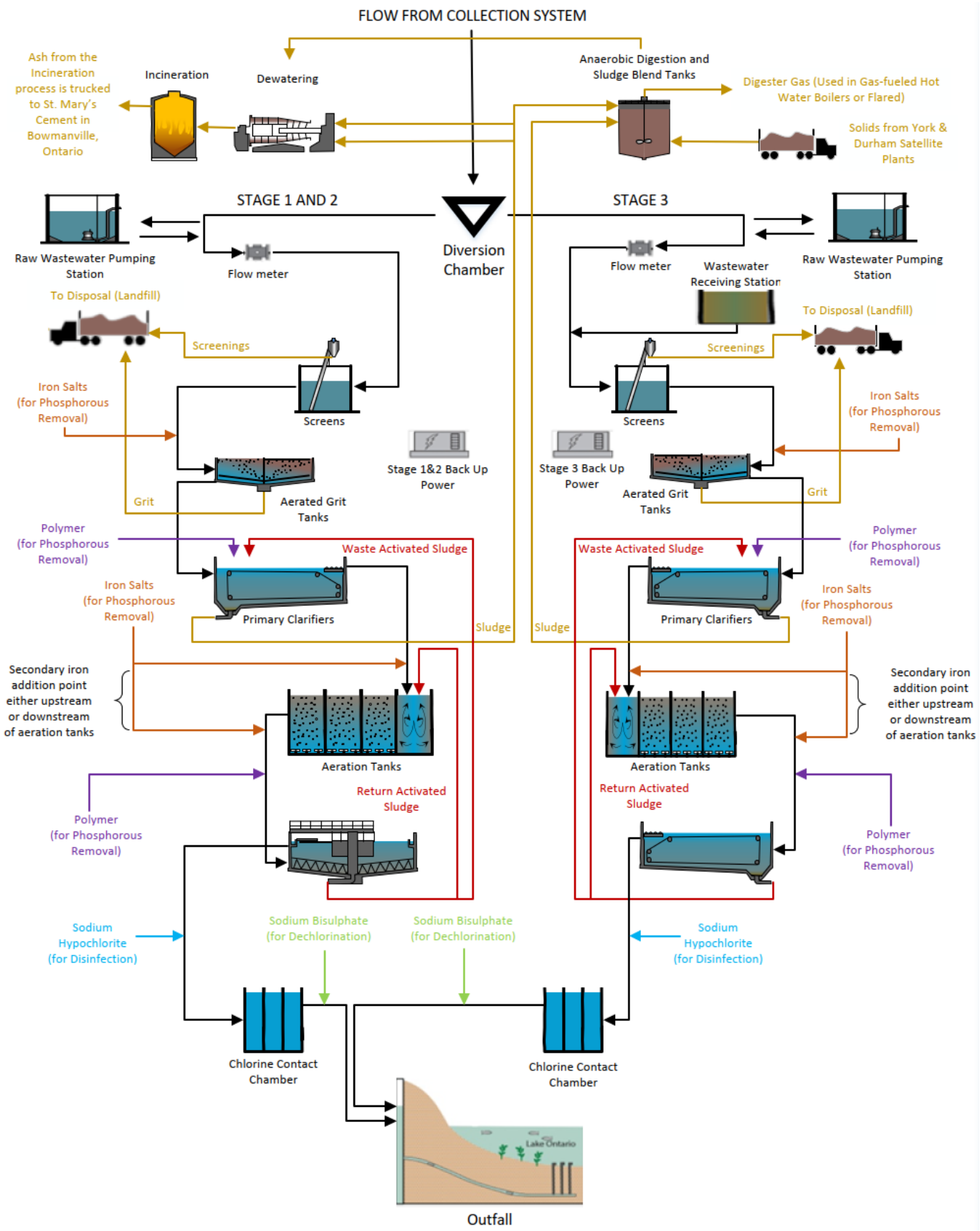

Figure 9.2 **Process Flow Diagram of Duffin Creek WPCP**

Chapter 9 includes the following sections:

– Study area
– Existing conditions, including social and built environment, natural environment and cultural environment
– Expansion conceptual planning
– Environmental impacts and mitigation strategies
– Capital cost estimates and implementation plan.

9.1.1 Study Area

This section summarizes the Duffin Creek WPCP site area boundaries relative to roadways and Lake Ontario.

9.1.2 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, surveys and consultation with stakeholders, 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 9.1.2.1 to 9.1.2.3.

9.1.2.1 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, capacity constraints and changes in land use patterns, recognizing the interplay between social and built elements in the project's environmental impact.

9.1.2.2 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.

9.1.2.3 Cultural Environment

This aspect examines known and potential cultural heritage resources, which includes archaeological resources, built heritage resources, and cultural heritage landscapes that may be affected by the proposed project. It considers the potential impacts on the cultural heritage resources within the project area.

9.1.3 Duffin Creek WPCP Expansion Conceptual Planning

This discussion outlines general design guidelines, expansion requirements and timelines for the Duffin Creek WPCP Expansion and Upgrades Project. General design guidelines and parameters have been identified in Chapter 3; site-specific conditions have been included within this chapter.

9.1.4 Environmental Impact and Mitigation Strategies

This section identifies potential environmental impacts and develops mitigation measures that will inform decision-making processes to promote sustainable development that minimizes negative environmental effects while maximizing positive outcomes. As the project moves from conceptual design through to the detailed design stage all practical efforts shall be made to avoid, minimize and mitigate impacts. When impacts cannot be avoided restoration measures will be provided as well as any required compensation.

9.1.5 Capital Cost Estimates and Implementation Plan

These sections discuss the capital cost estimate, future field investigations and permits, and approvals required for design and construction of the project. These components will be further reviewed and refined during the preliminary design stage.

9.2 Study Area

The Duffin Creek WPCP is located in the City of Pickering. The site is approximately 80 hectares and is bordered by Montgomery Park on the west, McKay Road on the north, Jodrel Road and Frisco Road on the east. The southern boundary of the site is Lake Ontario, and the Waterfront Trail runs across the southern portion of the property. The site is on lands co-owned by York Region and Durham Region in the City of Pickering, and, in some instances, the work will occur on or adjacent to land regulated by the Toronto and Region Conservation Authority (TRCA), as shown in Figure 9.3.

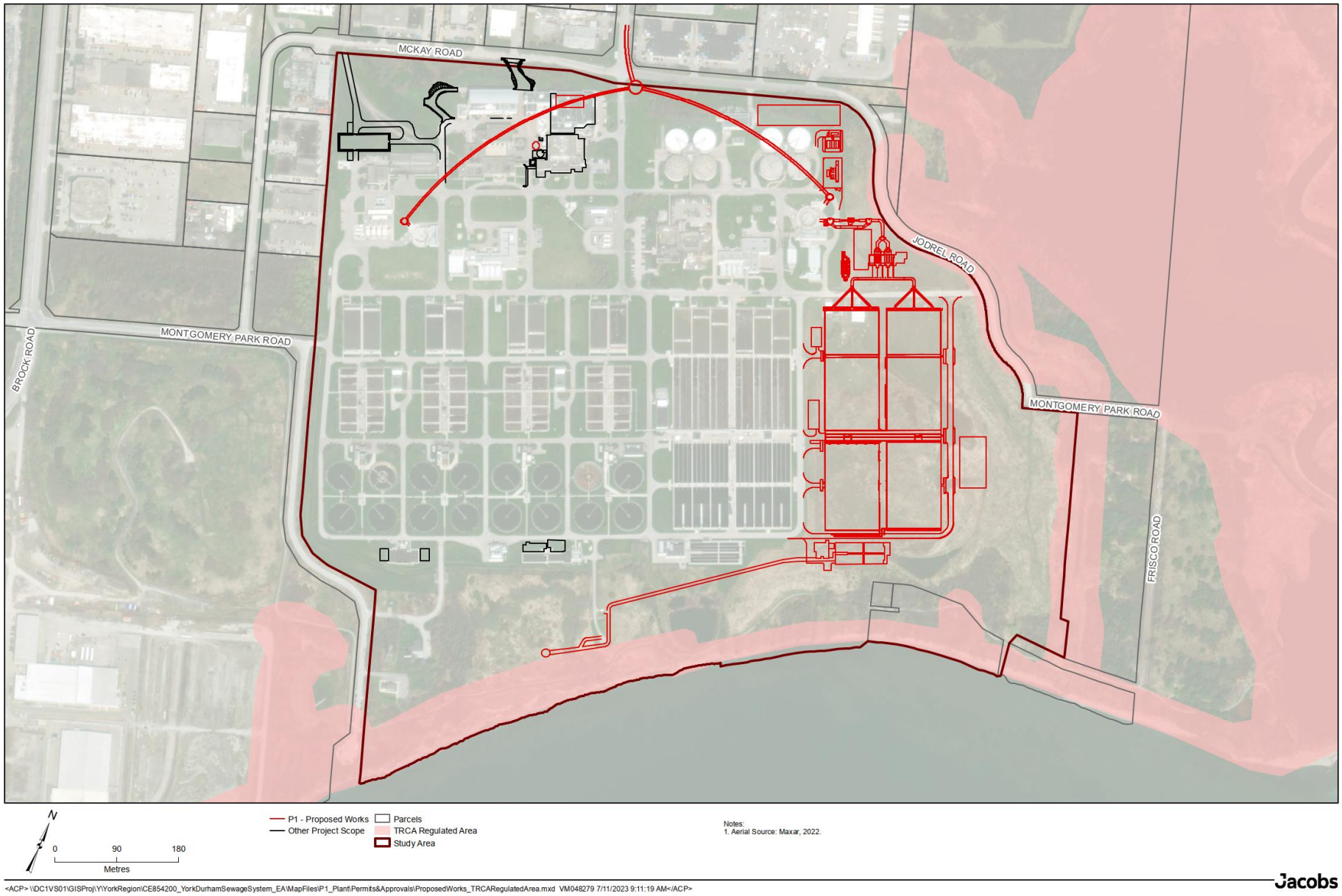

Figure 9.3 **Duffin Creek WPCP Conceptual Layout and TRCA-Regulated Area**

9.3 Existing Conditions

9.3.1 Climate and Meteorology

The Duffin Creek WPCP is located in Pickering on the northern shore of Lake Ontario. Over the course of the year, the temperature typically varies from -10 degrees Celsius (°C) to 26 °C and is seldom below -20 °C or above 30 °C (Weatherspark 2023). The warm season lasts for 3.6 months, from May 29 to September 17, with an average daily high temperature above 20 °C. The hottest month of the year in Pickering is July, with an average high of 25 °C and low of 16 °C. The cold season lasts for 3.4 months, from December 3 to March 15, with an average daily high temperature below 3 °C. The coldest month of the year in Pickering is January, with an average low of -9 °C and a high of -2 °C.

The average hourly wind speed in Pickering varies significantly with the seasons over the course of the year. The windier part of the year lasts for 5.8 months, from October 25 to April 20, with average wind speeds of more than 18.0 kilometres per hour. The windiest month of the year in Pickering is January, with an average hourly wind speed of 22.2 kilometres per hour. The calmer time of year lasts for 6.2 months, from April 20 to October 25. The calmest month of the year in Pickering is August, with an average hourly wind speed of 13.8 kilometres per hour.

The predominant average hourly wind direction in Pickering is from the west. Figure 9.4 illustrates the wind rose based on 2013 to 2017, five-year surface meteorological data processed for the Duffin Creek WPCP by the Ministry of the Environment, Conservation and Parks (MECP). This wind rose is consistent with the meteorological dataset used in previous modelling done for the site.

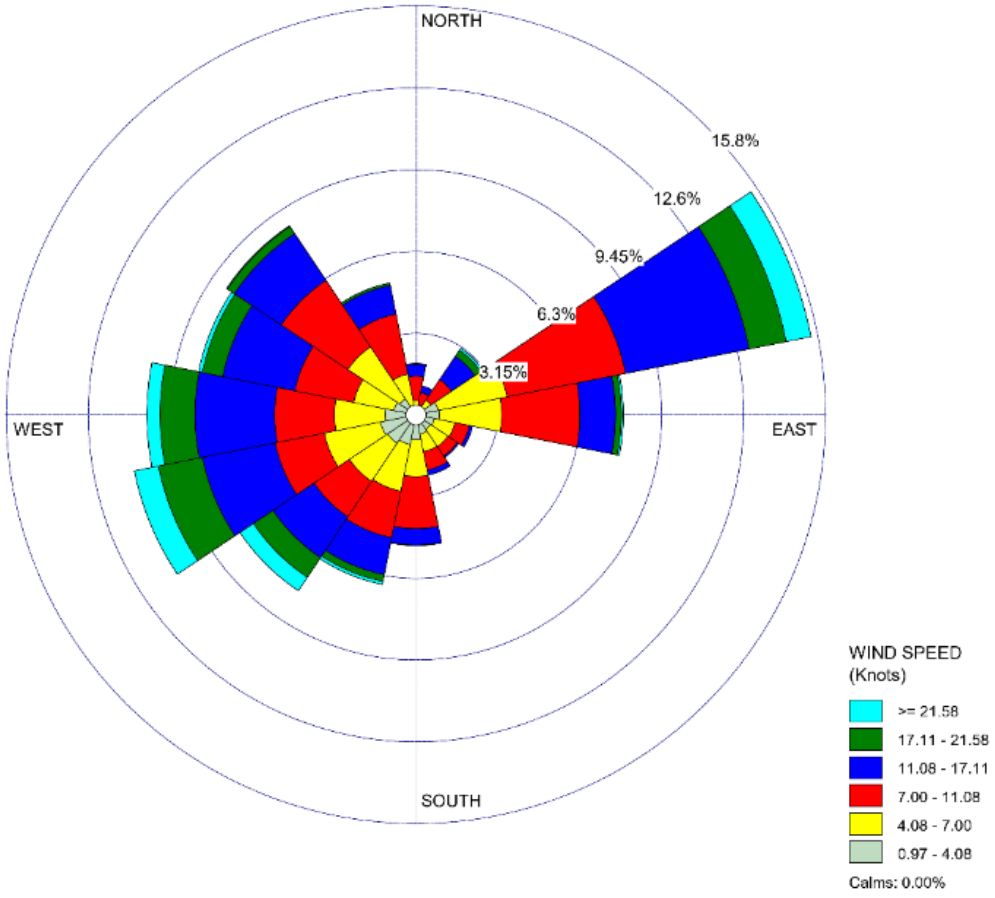

Figure 9.4 Wind Rose for Duffin Creek Water Pollution Control Plant

York Region and Durham Region have already experienced the effects of climate change with higher average temperatures, increased extreme heat and rainfall and more extreme weather events that bring high winds and intense precipitation (WSP 2020). Climate Hazards can be grouped into the following categories:

– Temperature (extreme heat, heat wave, extreme cold).
– Precipitation (heavy rainfall, heavy snowfall).
– Natural hazards affected by climate change (seismic, drought). There are studies looking at the potential impact that changing water levels in the lake could have on the frequency of earthquakes in the area.
– Mixed climate events (extreme storms causing severe wind, snow and ice, or a combination of climate and natural hazards).

9.3.2 Ambient Air Quality Background Levels

Background concentrations of contaminants of concern (COCs) in the study area were assessed to represent the effect of existing emissions sources (both anthropogenic and biogenic) in the area.

Ambient air quality monitoring data were obtained from available Environment Canada and Climate Change (ECCC) National Air Pollution Surveillance (NAPS) monitoring stations located closest to or most representative of the project location. Where data from multiple stations was analyzed, levels from the most representative station were used as the background concentration.

The background levels for particles with a diameter of 10 microns or less (PM10) and total suspended particles (TSP) were estimated by assuming a ratio of PM2.5/PM10 = 0.54 and PM2.5/TSP = 0.30 (Lall et al. 2004). The background ambient air quality concentrations were used to compare against air quality criteria applicable to Ontario, as well as any more stringent federal criteria. It was determined that all existing air quality contaminants present are below applicable air quality criteria. Fine particulate matter (PM2.5) has the highest ambient concentration relative to the applicable criterion, at 65% (24-hour average) and 68% (annual average) of the total criteria.

9.3.3 Social and Built Environment

The Duffin Creek WPCP site is located within a zoned Employment General (E1) land as a Controlled Access Area. A Controlled Access Area is where unauthorized persons are denied unrestricted access and are either escorted by authorized personnel or are under surveillance. According to the City of Pickering zoning by-law, the E1 zone permits a wide range of uses, including manufacturing, assembly and limited personal service uses. Lands immediately surrounding the plant are E1 land use to the north and west, natural areas to the east and Lake Ontario to the south. Land use designations from the Pickering Official Plan (March 2022, Edition 9) are shown in Figure 9.5.

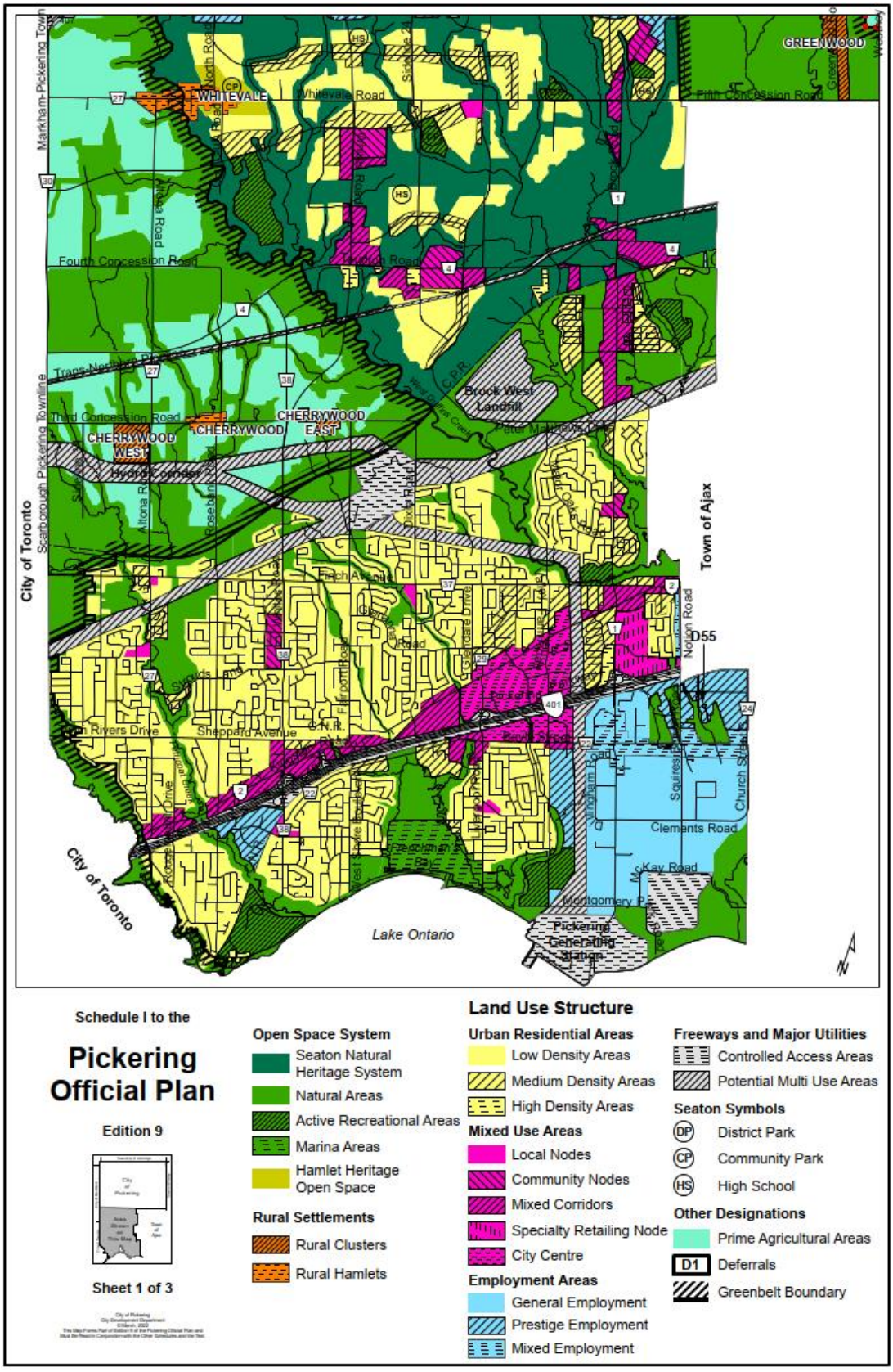

Figure 9.5 City of Pickering Official Plan Land Use Structure

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

9.3.4 Natural Environment

The project was assessed to determine the existing conditions and the potential impact to the natural environment. This assessment included a desktop geotechnical review, a desktop hydrogeological review, natural heritage characterization and a review of existing meteorological conditions and climate.

9.3.4.1 Geotechnical Desktop Review

A geotechnical desktop review was undertaken by using available background information and researching existing subsurface information on publicly available platforms and databases. Reviewed geotechnical information considered information on the area near the proposed work (that is, 100 metres [m] from the property boundary).

As part of a geotechnical investigation carried out by Alston in 2007, 18 boreholes (BH07-1 to BH07-18) were advanced, ten of which (BH-07-04, BH-07-05, BH-07-08, BH-07-10, BH-07-11, BH-07-13, BH-07-14 and BH-07-16 to BH-07-18) were advanced on or near the site to depths ranging from 2.1 to 12.5 metres below ground surface (mbgs). These boreholes were drilled as part of the Duffin Creek Stage 3 Improvement and Upgrades Project. The overall stratigraphy was reported as topsoil and fill underlain by a firm to hard silty clay deposit intersected by lenses and pockets of silty sand material.

In addition, Alston conducted another round of investigations in 2010, wherein 21 boreholes (BH10-01 to BH10-21) were drilled, with five boreholes (BH10-17 to BH10-21) in proximity to the proposed electrical substation and Stage 4 headworks facility. The purpose of the geotechnical investigation was to determine subsurface conditions pertaining to Stage 3 sewage pumping station (SPS) substructures. These boreholes were advanced to depths ranging from 15.5 to 35 mbgs. The overall subsurface stratigraphy consists of topsoil and fill (up to 4.5 metres thick). The fill/topsoil layer overlaid a stiff to hard silty clay deposit. The silty clay layer overlaid a very dense silty sand to sandy silt with some gravel layer (except in BH10-18). Under the sand layer, a shaly clay layer or shale was observed at the bottom of the borehole.

Selected representative soil samples from the boreholes were collected during the 2007 and 2010 investigations and subjected to the following index geotechnical laboratory tests: (1) natural moisture content analysis, (2) grain-size distribution analysis and (3) Atterberg limit analysis. The moisture content results ranged from 2 to 31 percent (%) and were typically classified as damp to wet. According to the results of the Atterberg tests, the soils were generally classified as CL-ML, or CL, with a Plasticity Index between 7 and 10. Sulphate content tests were conducted on three soil samples outside the study area. The results showed the soil's sulphate content to be generally low. Laboratory one-dimensional consolidation test analysis completed on one sample collected within the study area showed a coefficient of consolidation values in the range between 0.16 and 0.85 centimetres squared per second.

9.3.4.2 Hydrogeological Desktop Review

A hydrogeological desktop review was undertaken by using water well records from MECP, Oak Ridges Moraine Groundwater Program, Ontario Geological Survey Geotechnical Borehole Database and historical reports. Data were analyzed for areas within 500 m of the work area.

9.3.4.2.1 Hydrostratigraphy

The regional and site hydrogeology includes the following major units, as shown in Figure 9.6:

- Undifferentiated Upper Sediments (Aquifer)
- Lower Oak Ridges Moraine Aquifer Complex (Aquifer)
- Lower Newmarket Till (Aquitard)
- Thorncliffe Formation (Aquifer)
- Sunnybrook Formation (Aquitard)
- Scarborough Formation (Aquifer)
- Bedrock – Georgian Bay-Blue Mountain Formation (Aquitard)

The hydrogeological characteristics of the upper shallow aquifers will be assessed during Stage 4 subsurface investigations to estimate groundwater control and dewatering requirements during construction.

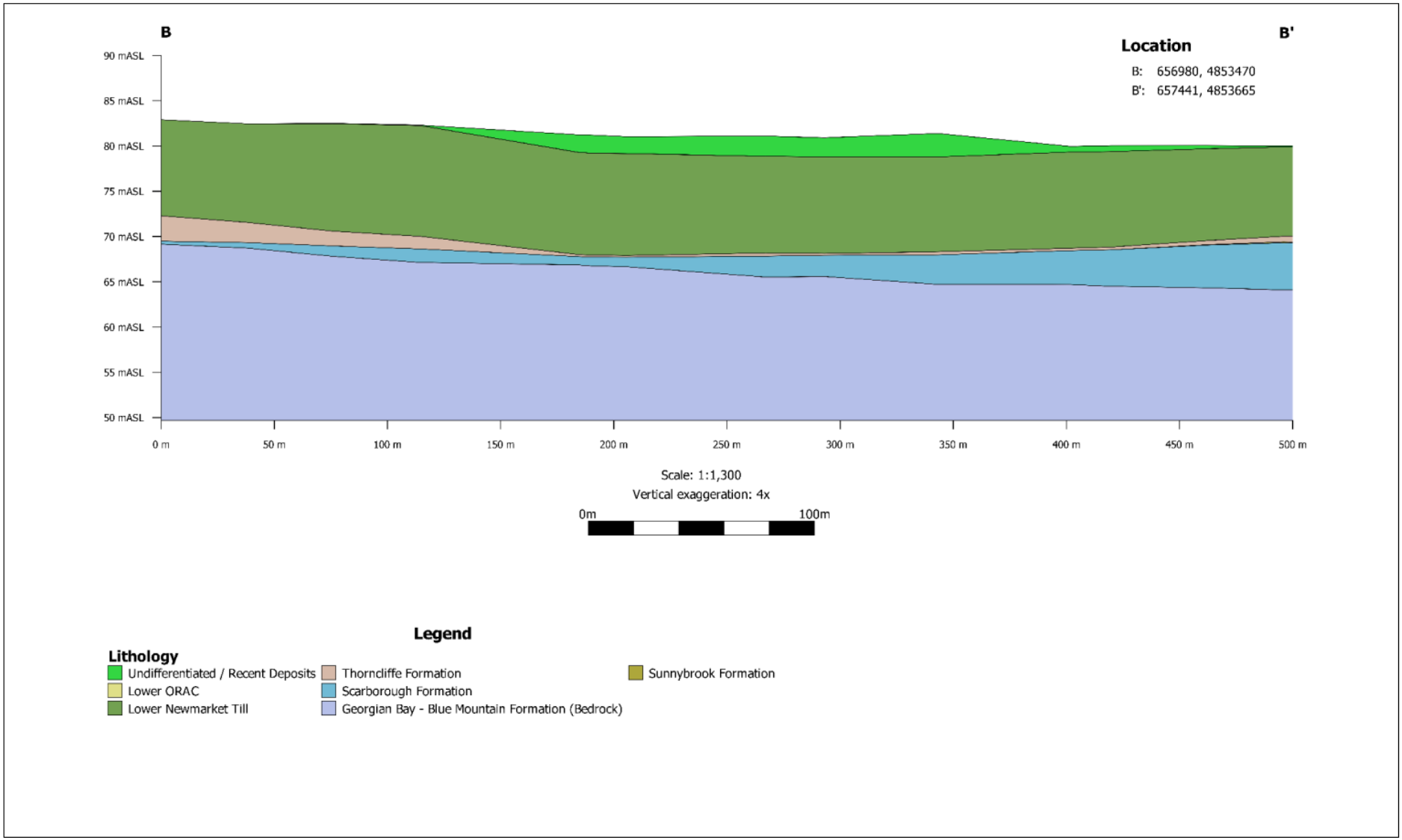

Figure 9.6 **Geological Cross Section at the Duffin Creek WPCP**

9.3.4.2.2 Groundwater Elevation and Quality

Between 2007 and 2011, groundwater levels were present at depths ranging between 3.1 to 9.0 mbgs, and static water levels noted in well records ranged between 2.3 and 11.3 mbgs, averaging 4.9 mbgs.

No groundwater quality data for the bedrock were available for review, and data for the overburden within the Stage 4 expansion area were limited. The Stage 4 subsurface investigation will include groundwater samples collected from the monitoring wells constructed in the overburden.

9.3.4.3 Preliminary Assessment of Hydraulic Gradients

Groundwater flow direction is consistent with the surface topography of the work area and surrounding area, which slopes downward from northwest to southeast.

According to the Oak Ridges Moraine Groundwater Program mapping, the Stage 4 expansion and immediate area are characterized by downward hydraulic gradients between the water table and the potentiometric surface. The Stage 4 subsurface investigation will assess the vertical gradient within the upper aquifers and the Newmarket Till aquitard using nested groundwater monitoring wells screened within each of the hydrostratigraphic units. This assessment is required to understand groundwater flow and associated pressure between the units and to evaluate potential effects on construction and dewatering requirements.

9.4 Natural Heritage Characterization

9.4.1 Methodology

Natural heritage in the study area was characterized through an initial desktop background review followed by a reconnaissance survey to confirm and identify existing natural environment conditions.

Available online natural heritage background data were accessed in June 2023, along with available mapping from the Ministry of Natural Resources and Forestry (MNRF), TRCA Regulation Mapping, Natural Heritage Information Centre (NHIC), Fisheries and Oceans Canada (DFO), *Ontario Breeding Bird Atlas* and iNaturalist. 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 buffer distance from the alignment for evaluation of potential negative impacts on natural heritage features.

Using the results of the background review, coupled with air photographic interpretation and available agency data, a one-day site reconnaissance survey was also completed to obtain additional information about terrestrial resources and natural features.

Table 9.1 details the natural heritage characterization within or adjacent to the study area, and Figure 9.7 depicts the ecological land classification.

Table 9.1 Natural Heritage Characterization Within and Adjacent to the Study Area

Feature	Description
Areas of Natural and Scientific Interest	Duffins Creek Coastal Marsh (Life Sciences) was identified approximately 200 m east of the study area.
Vegetation and Vegetative Communities	Seven ecological communities were identified (as shown in Figure 9.7), including: 1. FOD4-2: Dry-Fresh White Ash Deciduous Forest Type 2. CUM1: Mineral cultural meadow ecosite 3. CUT1: Mineral Cultural Thicket Ecosite 4. FOD4: Dry-Fresh Deciduous Forest Ecosite 5. FOM4: Fresh White Cedar Mixed Forest Ecosite 6. BLO: Open Bluff 7. SWM: Mixed Swamp.
Wildlife	Three wildlife species were identified by direct observations (sight and sound), tracks, scat or droppings (or a combination thereof), including: 1. Monarch (Danaus plexippus) 2. Eastern Cottontail (Sylvilagus floridanus) 3. American Bumble Bee (Bombus pensylvanicus).
Birds	Twenty-six species were observed by sight, song or a combination thereof, including: 1. American Crow (Corvus brachyrhynchos) 2. American Goldfinch (Spinus tristis) 3. American Redstart (Setophaga ruticilla) 4. American Robin (Turdus migratorius) 5. Black-capped Chickadee (Poecile atricapillus) 6. Brown-headed Cowbird (Molothrus ater) 7. Cedar Waxwing (Bombycilla cedrorum) 8. Common Grackle (Quiscalus quiscula) 9. Common Yellowthroat (Geothlypis trichas) 10. Eastern Kingbird (Tyrannus tyrannus) 11. European Starling (Sturnus vulgaris) 12. Gray Catbird (Dumetella carolinensis) 13. House Finch (Haemorhous mexicanus) 14. House Wren (Troglodytes aedon) 15. Indigo Bunting (Passerina cyanea) 16. Mourning Dave (Zenaida macroura) 17. Northern Cardinal (Cardinalis cardinalis) 18. Northern Flicker (Colaptes auratus) 19. Northern Mockingbird (Mimus polyglottos) 20. Northern Rough-winged Swallow (Stelgidopteryx serripennis) 21. Red-eye Vireo (Vireo olivaceus) 22. Red-wingded Blackbird (Agelaius phoeniceus) 23. Song Sparrow (Melospiza melodia) 24. Swamp Sparrow (Melospiza georgiana) 25. Warbling Vireo (Vireo gilvus) 26. Yellow Warbler (Setophaga petechia)

Feature	Description
Bats	At the time of the field survey, no bat habitat was identified within or adjacent to the study area; however, in previous assessment conducted around the study area, 11 potential bat snag trees were observed along the Waterfront Trail and Frisco Road. The Bat Habitat Assessment will be reviewed during the preliminary design stage, when additional field surveys can be conducted if required.
Significant Wildlife Habitat	The study area included many anthropogenically disturbed areas (i.e., disturbed through human activity, such as CUM1 and industrial), with high foot traffic and poor-quality forested areas with many dead white ash trees; however, some areas may support wildlife, including: – Migratory butterfly stopover areas – Landbird Migratory Stopover Areas – Reptile Hibernaculum.
Seasonal Concentration Areas	A colonial waterbird nesting area was identified in the Lower Duffins Creek Wetland Complex, within 120 m of the study area.
Rare Vegetation Communities or Specialized Habitats for Wildlife	Based on the results of the ELC inventory, rare vegetation communities do not occur within the study area.
Habitat for Species of Conservation Concern	Numerous special concern avifauna (bird) species may be present based on the background investigation. No SAR or special concern species were identified during the field survey. However, the survey was limited to a single survey within a single season, and additional field investigations may be required to confirm the presence or absence of SAR or Special Concern species to identify any potential impacts.
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 (MNRF 2015) during the single 2023 field survey visit. Monitoring from camera trapping carried out by York Region for Wildlife Habitat Council Certification has shown the area is likely a corridor for deer, coyote, wild turkey and migratory species during the migratory window.

Feature	Description
Species at Risk SAR	Thirty-one potential SARs were identified, including: Birds: 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 vociferous) 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. American Coot (*Fulica americana)* 22. Blue-winged Teal (*Spatula discors)* 23. Common Gallinule (*Gallinula galeata).* Insect: 1. Monarch (Danaus plexippus) Reptiles and Amphibians: 1. Northern Map Turtle (Graptemys geographica) 2. Snapping Turtle (Chelydra serpentina) 3. Western Chorus Frog (Pseudacris 15aculate pop. 1) Aquatic: 1. Redside Dace (Clinostomus elongatus) 2. Shortnose Cisco (*Coregonus reighardi)* 3. American Brook Lamprey (*Lethenteron appendix)* Vegetation: 1. Butternut (Juglans cinerea).

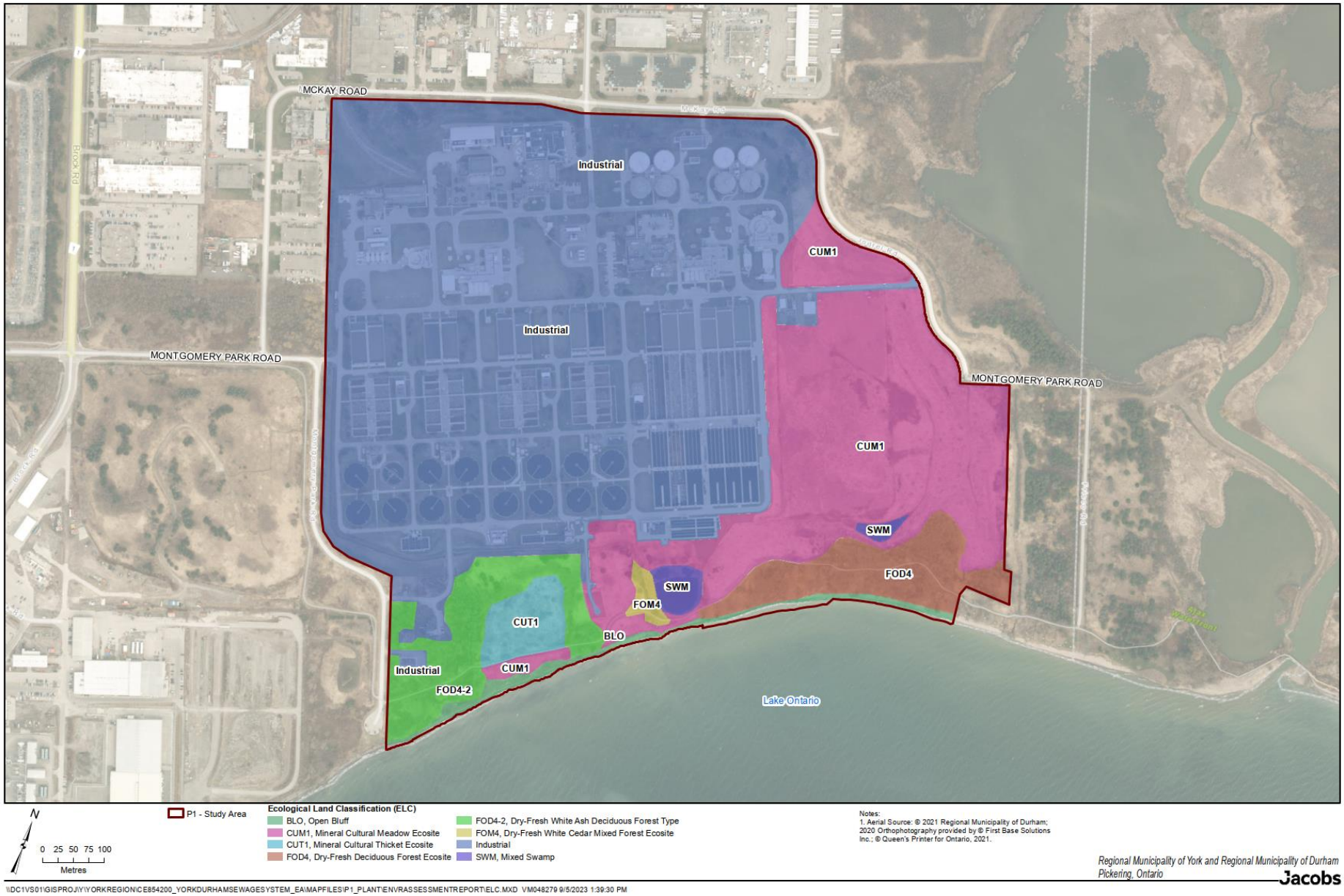

Figure 9.7 **Duffin Creek WPCP Study Area Ecological Land Classification**

9.4.2 Greening Strategy

As part of the Stage 3 Class Environmental Assessment process, a Greening Plan was developed by the City of Pickering, York Region and TRCA to provide natural enhancement, screening and restoration for the proposed Stage 3 expansion at the Duffin Creek WPCP. During preliminary design, an evaluation of the existing Greening Strategy Funding Agreement (York Region and TRCA 2007) consistent with the currently proposed upgrades to the Duffin Creek WPCP will be completed along with consultation to achieve the required environmental enhancement and biodiversity goals.

9.4.3 Assessment of Past Uses

An assessment of past uses (APU) was conducted within the study area. The APU study area also includes any other property located wholly or partly within 250 m of the nearest point on a boundary of the study area or any property that the qualified person determines should be included as part of the assessment. For the APU, the study area consists of the majority of the property located at 901 McKay Road, Pickering, Ontario, which is currently owned by York Region and Durham Region. Current use of the project area has been industrial land since 1978; before 1978, past use of the project area was agricultural or other land use.

Potentially contaminating areas (PCAs) identified within the study area (as shown in Figure 9.8) were considered to directly result in corresponding areas of potential environmental concern (APECs), whereas PCAs identified in the APU study area were evaluated as possible APEC contributors based on information gathered by the records review, interviews and site reconnaissance.

A total of 32 APECs were identified for the study area (as shown in Figure 9.9). All 32 APECs have at least one associated contaminant of potential of concern (COPC) where there is potential that one or more contaminants have affected the soil to be excavated within the project area. However, of the 32 APECs, only five locations are within or in close proximity to the area proposed for the Duffin Creek WPCP expansion and upgrades as follows:

– APEC-9: Fuel tanks
– APEC-10: Salt tent
– APEC-29: Fire
– APEC-32: Off-site PCAs to the north
– APEC-33: Stormwater pond.

Table 9.2 summarizes the COPCs identified for each APEC.

Figure 9.8 **PCA Activity Within Project Area and APU Study Area**

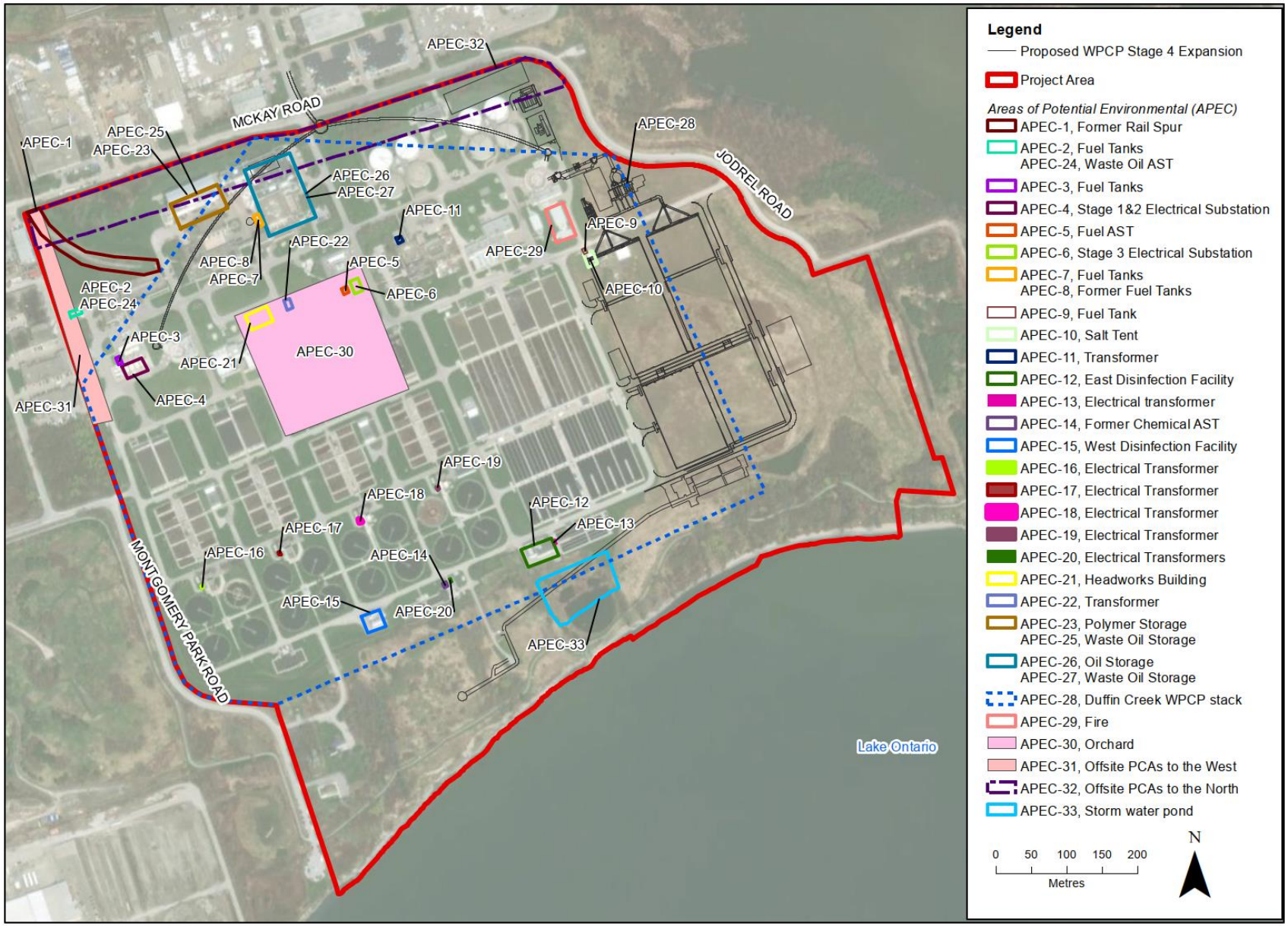

Figure 9.9 **APEC Within Study Area**

Table 9.2 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 (On-site or Off-site)	Contaminants of Potential Concern[3]	Media Potentially Impacted (Groundwater, soil or sediment)
APEC-09	**Fuel tank:** – A diesel fuel aboveground storage tank was observed during the site reconnaissance on the northern side of the salt shed. The aboveground storage tank is approximately 1,345 litres (L) in volume and contains diesel fuel.	Eastern portion of project area	28 - Gasoline and Associated Products Storage in Fixed Tanks	On-site	PHC, BTEX	Soil
APEC-10	**Salt tent:** – A salt tent used for a salt storage building was observed on the eastern side of Stage 3 primary clarifiers during the site reconnaissance. The salt is applied to the roadways and sidewalks for the purpose of vehicle and pedestrian safety.	Eastern portion of project area	48 - Salt Manufacturing, Processing and Bulk Storage	On-site	EC, sodium adsorption ratio	Soil
APEC-29	**Fire:** – An explosion and fire in the biofilter H_2S gas building was reported to have occurred on January 12, 2014. The fuel type was "other hydrocarbon fuel."	Northeastern portion of project area	Other - Activity not defined in O. Reg. 153/04 Table 2 of Schedule D	On-site	Dioxins and furans	Soil
APEC-32	**Off-site PCAs from the north:** – Chemical product manufacturing – Donalco Inc. was listed at 1135 Squires Beach Road as a chemical product manufacturer. The company was also listed as a waste generator (ON4432971) of polymeric resins, paint/pigment/coating residues, organic laboratory chemicals and waste oils and lubricants.	Northern portion of the project area	8 - Chemical Manufacturing, Processing and Bulk Storage	Off-site	Metals, ORP Hg, ORP, CrVI, ORP CN, PAH, PHC, BTEX, VOC, dioxins and furans	Soil
	– Commercial trucking - Dicom Transportation Group and Ryder Logistics and Transportation Solutions, both commercial trucking companies, have been listed at 910 McKay Road. Dicom was also listed as a waste generator (ON7654800) of aliphatic solvents, alkaline solutions and miscellaneous organic chemicals.		11 - Commercial Trucking and Container Terminals			
	– Semiconductor and electrical component manufacturing - JPM Antrum was listed in Scotts Manufacturing Directory at 1125 Squires Beach Road as a semiconductor and other electronic component manufacturer. The company was also listed as a waste generator (ON2356400) of oil skimmings and sludges, waste oils and lubricants, waste compressed gases, inorganic laboratory chemicals and aliphatic solvents. A similar business was also listed at 1125 Squires Beach Road under David Brown Radicon Inc.		19 - Electronic and Computer Equipment Manufacturing			
	– Fuel tanks - Interlink Freight Systems was listed with four delisted fuel tank records at 910 McKay Road. According to fuel tank storage records, there were four 45,460 L capacity diesel fuel UST (1992) at the property. Ryder was also listed as spilling 20 L of diesel oil to the ground on two occasions.		28 - Gasoline and Associated Products Storage in Fixed Tanks			
	– Fuel tanks - Albis Canada Limited was listed with a delisted fuel tank at 850 McKay Road. Albis was also listed with a liquid gasoline fuel tank (USY capacity of 27,200 and UST capacity of 4,500) in 1990.		28 - Gasoline and Associated Products Storage in Fixed Tanks			
	– Metals and dye fabrication - Canadian Progressive Tool and Transfer Ltd. was listed at 1080 Squires Beach Road as a metalworking machinery manufacturer in Scotts Manufacturing Directory. The company was also listed as a waste generator (ON0749501) of petroleum distillates, waste oils and lubricants and emulsified oils.		34 - Metal Fabrication			
	– Machine shop - Metro Pattern & Model Ltd. was listed as a machine shop at 900 McKay Road. The company was listed as a waste generator (ON8489552) of emulsified oils.		34 - Metal Fabrication			
	– Industrial mould manufacturing - MSB Industries was listed as an industrial mould manufacturer at 902 McKay Road. The company was also listed as a waste generator (ON2152900) of oil skimmings and sludges, petroleum distillates, light fuels and waste oils and lubricants.		34 - Metal Fabrication			

[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 One ESA, 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] COPCs 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. Metals include the following analytical.

APEC ID[1]	APEC Description	Location of area of potential environmental concern on Phase One Property	Potentially contaminating activity[2]	Location of PCA (On-site or Off-site)	Contaminants of Potential Concern[3]	Media Potentially Impacted (Groundwater, soil or sediment)
	– Ennis Paint Canada ULC - A paint manufacturer was listed at 850 McKay Road with various ECAs. Ennis (as Ennis-Lint) was also listed as a waste generator (ON8567440) of wastes from pigments/coatings and paints, amines, waste oil and sludges, aliphatic solvents and residues, petroleum distillates, polymeric resins and miscellaneous waste organic chemicals. Ennis was also listed with the National Pollutant Release Inventory for releases of methanol, xylenes, ethylbenzene, n-hexane, methyl methacrylate and toluene.		39 - Paints Manufacturing, Processing and Bulk Storage			
	– Albis Canada Limited - A plastic and synthetic resin manufacturer was listed at 850 McKay Road as a waste generator (ON0806800) of inorganic laboratory solvents, aliphatic solvents, petroleum distillates, halogenated solvents, oil skimmings and sludges, waste oils and lubricants and organic laboratory chemicals. Albis also reported a fire/explosion at the site in 1995.		43 - Plastics (including Fibreglass) Manufacturing and Processing			
	– K & K Recycling Services – An automobile wrecking and supply business, scrap metals, was located at 870 McKay Road. K & K Recycling was also listed as a waste generator (ON7955124) of waste oils and lubricants, light fuels and oil skimmings and sludges.		49 - Salvage Yard, including automobile wrecking			
	– Motor vehicle parts and accessories manufacturing – Robertson and Dawson Ltd. was listed at 1050 Squires Beach Road in the National Pollutant Release Inventory with releases of styrene. Also listed as a resin manufacturer in regard to truck and bus bodies.		57 - Vehicles and Associated Parts Manufacturing			
	– Waste facility – Veolia ES Canada Industrial Services is listed as a waste transfer station and processing facility. It is listed as a receiver of waste oils and lubricants, leachate toxic, aliphatic solvents, light fuels, oil skimmings and sludges, paints/pigment/coating residues and petroleum distillates. SARP Toronto Inc. was also listed at this address as a waste management facility.		58 - Waste Disposal and Waste Management, including thermal treatment, landfilling and transfer of waste, other than use of biosoils as soil conditioners			
	– Oil spill – 1052 L of gear oil spilled to the ground was reported at K & K Recycling in 2010.		Other - Activity not defined in O. Reg. 153/04 Table 2 of Schedule D (spill)			
APEC-33	**Stormwater pond:** – Stormwater pond that may have received surface soil impacts from the facility during overland flow events.	Southern edge of site	Other - Activity not defined in O. Reg. 153/04 Table 2 of Schedule D (spill)	On-site	Metals, ORP, PAH, PHC, VOC, dioxin and furans	Soil

BTEX = benzene, toluene, ethylbenzene and xylene
CN- = Cyanide
CrVI = Hexavalent chromium
EC = Electrical conductivity
ECA = Environmental Compliance Approval
L = Litre(s)
O. Reg.= Ontario Regulation
ORP = Oxidation reduction potential
ORP Hg = Oxidation reduction potential of mercury
ORP PAH = Oxidation reduction potential of polycyclic aromatic hydrocarbons
PAH = Polycyclic aromatic hydrocarbons
PHC = Petroleum hydrocarbons
UST = Underground storage tank
VOC = Volatile organic compound

9.4.4 Cultural Environment

9.4.4.1 Archaeological Resources

A Stage 1 Archaeological Assessment was conducted to provide a review of geographic, land use and historical information for the properties and the relevant surrounding area, and contacting MCM to find out whether, or not, there are any known archaeological sites on or near the properties. The purpose of an archaeological assessment is to identify areas of archaeological potential and further archaeological assessment (e.g., Stage 2-4) as necessary. The Stage 1 archaeological assessment (under Project Information Form number P094-0357-2023) was undertaken by ASI and has been entered into the Ontario Public Register of Archaeological Reports. All activities carried out during this assessment were completed in accordance with the Ontario Heritage Act (1990, as amended in 2023) and the 2011 Standards and Guidelines for Consultant Archaeologists (S&G) administered by the Ministry of Citizenship and Multiculturalism (MCM 2011). A brief overview of the developmental, historical and archaeological context revealed the following:

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).

Between 1801 and 1807, a settlement founded by early Quaker families was developed along the Danforth Road (Kingston Road/Highway 2), where it crossed Duffins Creek. A 4,800-acre block around the village was first granted to Major John Smith in 1793, who willed it to his son David W. Smith, Surveyor-General of Upper Canada. Irish traders named Duffin and Peak were the first documented European settlers in this area.

Historical aerial imagery from 1961 and 1975 shows the study area on the northern shore of Lake Ontario. The study area consists of open agricultural fields and some treed lands. To the northwest, northeast and southwest of Montgomery Park Road and Squires Beach Road, there are few houses, which are spaced far apart from each other and set back from the roadways. Southeast of Montgomery Park Road and Squires Beach Road, two parallel roads extend south from Montgomery Park Road to a road that generally follows the lakeshore. In the 1961 aerial image, the eastern of the two parallel roads and the lakeshore road are dense residential roads with houses set close to the roadway. In the 1975 image, the western of the two parallel roads is also a dense residential road.

According to the Ontario Archaeological Sites Database, 13 previously registered archaeological sites are located within 1 kilometre of the study area (MCM 2023). Cultural heritage value or interest is only indicated for sites within 50 m of the study area based on information from the original assessment reports and the site records in the Ontario Archaeological Sites Database. One site, referred to as the Squires Beach Site (AkGs-1), is within the study area and has been noted to have further cultural heritage value or interest. The Squires Beach site was excavated in the 1950s by Hugh Squires; the Site Record Form was filled out by Victor Konrad in 1972 and notes the collection to consist of lithic projectile points, stone knives and axes affiliated with the Archaic period.

The Stage 1 background study determined that parts of the study area exhibit archaeological potential, and therefore, a Stage 2 archaeological assessment by test pit survey at 5 m intervals was recommended.

9.5 Duffin Creek WPCP Expansion Conceptual Planning

9.5.1 Design Basis

9.5.1.1 Raw Wastewater Flow and Load Projections

The population projections for the Duffin Creek WPCP sewershed and design wastewater generation rates for the 2051 planning period are summarized in Chapter 3. Population and flow projections beyond the planning period were developed, assuming a linear growth rate that is consistent with the growth rate from 2041 to 2051.

Figure 9.10 shows the historical (2007 to 2022) and projected populations and ADF for the 2051 planning period and beyond. The projections indicate that the plant's current design sewershed population (1.55 million people) will be met around 2030, and the plant's current rated ADF (630 ML/d) will be met around 2036.

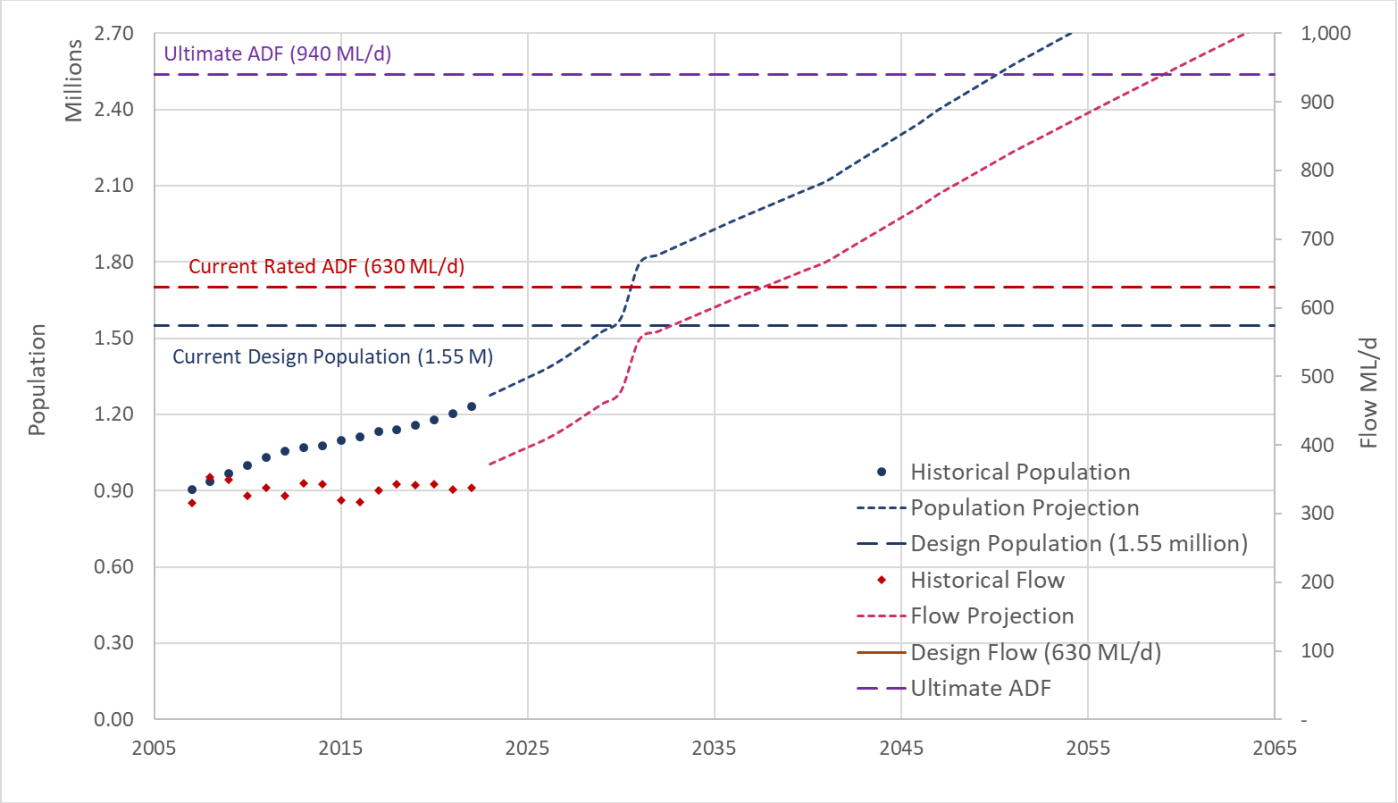

Figure 9.10 Population and Flow Projections for Duffin Creek WPCP

The expansion of the Duffin Creek WPCP capacity is limited by the total firm pumping capacity of the existing Stages 1 and 2 and Stages 3 and 4 influent pumping stations, which have a total firm pumping capacity of 3,290 ML/d.

The hydraulic capacity that is required to service the sewershed population projection for the 2051 planning period is near the firm capacity that can be accommodated by the existing influent pumping stations (IPS).

Therefore, the proposed infrastructure for the plant expansion is based on a hydraulic capacity of 3,290 ML/d and a design peak instantaneous flow (PIF) peak factor of 3.5, providing an expanded ADF capacity of 940 ML/d. Based on the sewershed population projections, this design flow rate is expected to be reached around 2060.

Historical raw wastewater flow and load data were statistically analyzed to determine design per capita flows and loads and peak factors. The design per capita values are consistent with typical municipal wastewater and design bases developed for past capacity expansions at the Duffin Creek WPCP. Table 9.3 summarizes the design basis used to define the infrastructure requirements for the capacity expansion at Duffin Creek WPCP.

Table 9.3 Summary of Design Basis for Duffin Creek WPCP Expansion

Description	Parameter	Design wastewater generation rates and peak factors	Capacity expansion design basis
Population and raw wastewater flow	Population	Sewershed population projections for 2060	2,686,000
	ADF	350 L/cap/d	940 ML/d
	PDF	Peak factor of 1.6	1,500 ML/d
	PHF	Peak factor of 2.5	2,350 ML/d
	PIF	Peak factor of 3.5	3,290 ML/d
Average raw wastewater loads	TSS	90 g/cap/d	241,710 kg/d
	BOD_5	60 g/cap/d	161,140 kg/d
	TKN	13.7 g/cap/d	36,790 kg/d
	TP	1.7 g/cap/d	4,570 kg/d
Maximum month raw wastewater loads	TSS	Peak factor of 1.2	338,390 kg/d
	BOD_5	Peak factor of 1.4	193,370 kg/d
	TKN	Peak factor of 1.1	41,570 kg/d
	TP	Peak factor of 1.1	5,120 kg/d
Raw sludge generation plus imported solids	Annual average	100 g/cap/d plus imported solids	314 dt/d
	Maximum month	Peak factor of 1.2	377 dt/d

ADF = Average daily flow
BOD_5 = 5-day biochemical oxygen demand
dt/d = Decitonne/day
g/cap/d = Grams per capita per day
kg/d = Kilograms per day
ML/d = Megalitres per day
PDF = Peak daily flow
PHF = Peak hourly flow
PIF = Peak instantaneous flow
TKN = Total kjeldahl nitrogen
TP = Total phosphorus
TSS = Total suspended solids

9.5.2 Effluent Quality

The current operation of the Duffin Creek WPCP is governed by ECA No. 5547-C43QV9, dated October 26, 2021. The ECA includes phased limits for TP related to the completion of the Phosphorus Reduction Action Plan (PRAP) Upgrades (expected in 2024) and the Biosolids Treatment Replacement Project (expected in 2032).

An ECA Sewage amendment application was submitted in April 2023 to include the process upgrades proposed as part of the Duffin Creek Rehabilitation of Plant Stage 3 Liquids and Miscellaneous Remedial Works, Contract D2023-24. The amended ECA Sewage is expected to be issued by November 2023. The ECA amendment will not have changes on the TP effluent limits.

Table 9.4 summarizes the effluent objectives and limits for the plant per the current ECA. Table 9.5 summarizes the proposed effluent objectives and limits for the plant expansion.

Table 9.4 Current Effluent Objectives and Limits for Duffin Creek WPCP

Parameter	Monthly average objectives and limits	Seasonal average objectives (Apr 1 to Aug 31)	Annual average objectives and limits
$cBOD_5$	Objective: 15.0 mg/L Limit: 25.0 mg/L	Not applicable	Not applicable
TSS	Objective: 15.0 mg/L Limit: 25.0 mg/L	Not applicable	Not applicable
TP (current limits)	Objective: 0.6 mg/L Limit: 0.8 mg/L	Not applicable	Limit: 311 kg/d
TP (limits upon completion of PRAP Upgrades)	Not applicable	Objective: 0.35 mg/L Limit: 0.50 mg/L	Objective: 0.35 mg/L Limit: 0.45 mg/L and 284 kg/d
TP (limits upon completion of Biosolids Treatment Replacement Project)	Not applicable	Objective: 0.35 mg/L Limit: 0.45 mg/L	Objective: 0.35 mg/L Limit: 0.45 mg/L and 284 kg/d
Total ammonia nitrogen	Objective: 5.0 mg/L Limit: 6.0 mg/L (May 1 to Oct 31) or 10.0 mg/L (Nov 1 to Apr 30)	Not applicable	Not applicable
Un-ionized ammonia nitrogen	Objective: 0.1 mg/L Limit: 0.2 mg/L	Not applicable	Not applicable
Total residual chlorine	Objective: Non-detectable Limit: 0.02 mg/L	Not applicable	Not applicable
E. coli	Objective: 100 organisms per 100 mL monthly geometric mean density Limit: 200 organisms per 100 mL monthly geometric mean density	Not applicable	Not applicable
pH	Objective: 6.5 to 8.5 inclusive, at all times Limit: 6.0 to 9.5 inclusive, at all times	Not applicable	Not applicable

Table 9.5. Proposed Effluent Objectives and Limits for Duffin Creek WPCP Expansion

Parameter	Monthly average objectives and limits	Seasonal average objectives (Apr 1 to Aug 31)	Annual average objectives and limits
$cBOD_5$	Objective: 15.0 mg/L Limit: 25.0 mg/L	Not applicable	Not applicable
TSS	Objective: 15.0 mg/L Limit: 25.0 mg/L	Not applicable	Not applicable
TP	Not applicable	Objective: 0.35 mg/L Limit: 0.45 mg/L	Objective: 0.35 mg/L Limit: 0.45 mg/L and 423 kg/d
Total ammonia nitrogen	Objective: 5.0 mg/L Limit: 6.0 mg/L (May 1 to Oct 31) or 10.0 mg/L (Nov 1 to Apr 30)	Not applicable	Not applicable
Un-ionized ammonia nitrogen	Objective: 0.1 mg/L Limit: 0.2 mg/L	Not applicable	Not applicable

Parameter	Monthly average objectives and limits	Seasonal average objectives (Apr 1 to Aug 31)	Annual average objectives and limits
Total residual chlorine	Objective: Non-detectable Limit: 0.02 mg/L	Not applicable	Not applicable
E. coli	Objective: 100 organisms per 100 mL monthly geometric mean density Limit: 200 organisms per 100 mL monthly geometric mean density	Not applicable	Not applicable
pH	Objective: 6.5 to 8.5 inclusive, at all times Limit: 6.0 to 9.5 inclusive, at all times	Not applicable	Not applicable

$cBOD_5$ = five-day carbonaceous biochemical oxygen demand

kg/d = Kilograms per day

mg/L = Milligram per litre

mL = Millilitre

PRAP = Phosphorus Reduction Action Plan

TSS = Total suspended solids

TP = Total phosphorus

The effluent limits for the expanded Duffin Creek WPCP will be consistent with the limits shown in Table 9.4, with the exception of the annual TP load limit, which will increase in alignment with the plant capacity expansion. The TP load limit in the current ECA (284 kg/d) is based on a TP concentration of 0.45 mg/L and the current rated ADF capacity (630 ML/d). For the expanded plant capacity, the TP load limit will increase to approximately 423 kg/d (0.45 mg/L at 940 ML/d).

A Receiving Water Impact Assessment (RWIA) for the Duffin Creek WPCP expansion and new outfall was completed to determine water quality impacts in Lake Ontario at several areas of interest along the shoreline and at the Ajax Water Supply Plant (WSP). The RWIA considered the expanded plant capacity (940 ML/d) and the future effluent concentration limits outlined in Table 9.5 (effluent TP concentration of 0.45 mg/L and effluent total ammonia nitrogen concentration of 6.0 to 10.0 mg/L). The results of the RWIA demonstrate that the expanded plant and new outfall meet applicable regulatory requirements at these effluent concentrations. The RWIA methodology, results and conclusions are described in Chapter 10.

9.5.3 Infrastructure Requirements

The expansion requirements address all major liquid treatment processes (influent pumping, headworks, primary treatment, secondary treatment and disinfection), solids treatment processes (digestion, dewatering, incineration and ash thickening), site services (odour control, electrical substation, standby power and utilities) and a new renewable natural gas purification facility.

For planning purposes, future capacity expansions for liquid treatment are based on conventional treatment technologies consistent with those in Stage 3 (screening and grit removal, primary clarification, conventional activated sludge secondary treatment, chemical phosphorus removal and chlorine disinfection). Similarly, future capacity expansions for solids treatment are based on the current solids handling processes (anaerobic digestion, dewatering and incineration). Therefore, the infrastructure requirements outlined in this report do not consider an evaluation of alternative treatment processes and technologies. An evaluation to refine the preferred solutions for expanding the Duffin Creek WPCP will be completed in the next design phase and will consider factors such as constructability, operations and maintenance (O&M) considerations, energy consumption, greenhouse gas (GHG) emissions and capital and life cycle costs.

The conceptual plant infrastructure requirements are summarized in Table 9.6. Sizing for new equipment and tanks is consistent with the existing units used in Stage 3. Design details will be reviewed and confirmed during future design stages.

Table 9.6 Summary of Expansion Requirements for Duffin Creek WPCP

Treatment type	Treatment system	Expansion requirements	Notes and design considerations
Liquids treatment	Stage 3&4 IPS	– 6 new pumps, each with a nominal hydraulic capacity of 181 ML/d, installed in existing Stages 3&4 IPS.	– Firm pumping capacity for design PIF.
	Headworks	– New Stage 4 headworks facility, including: • 4 new screen channels, each with a hydraulic capacity of 258.3 ML/d. • 4 new grit tanks, 536 m^3 each.	– Screening: Firm pumping capacity for design PIF. – Grit tanks: Minimum HRT of 4 minutes at design PHF.
	Primary treatment	– 6 new rectangular primary clarifiers, each 65 m long by 24 m wide, providing a total surface area of 9,360 m^2.	– SOR of 50 to 60 $m^3/m^2/d$ for design PDF.
	Secondary treatment	– 6 new rectangular bioreactors, each 105 m long by 24.9 m wide, providing a total volume of 90,200 m^3. – 6 new rectangular clarifiers, each 124 m long by 25.8 m wide, providing a total surface area of 19,195 m^3. – 4 new blowers, each with a capacity of 37,400 m^3/h.	– Bioreactors: 9-day SRT and MLSS concentration in the range of 2,000 mg/L to 4,000 mg/L. – Secondary Clarifiers: SOR of 37 to 40 $m^3/m^2/d$ at design PHF and SLR of 170 to 180 $kg/m^2/d$ at design PDF. – Blowers: Firm blower capacity for maximum day load while maintaining DO concentration of 2.0 mg/L in aerated zones.
	Phosphorus removal	– New storage and metering system to supply iron salts, located in Stage 4 headworks facility. – New polymer makedown and metering building.	– Firm chemical pumping capacity to provide 15 mgFe/L at design ADF (using ferric sulphate). – Chemical storage capacity of 15 d at design ADF.
	Disinfection	– A total of 8,900 m^3 of additional tank volume, including a new disinfection facility for sodium hypochlorite and sodium bisulphite chemical storage and metering.	– The chlorine contact tanks are sized to maintain a minimum contact time of 30 minutes at the design ADF and 15 minutes at the design PHF.
	Outfall	– A new outfall designed to provide a hydraulic capacity equivalent to the firm capacity of the IPS (3,290 ML/d).	– Further details on the outfall design are provided in Chapter 10 of the Project Report.
Solids treatment	Anaerobic digestion	– No expansion. All sludge at the Duffin Creek WPCP is ultimately dewatered and incinerated; therefore, achieving sludge stabilization through digestion is not required. The digesters and sludge blending tanks are primarily used to store and mix solids prior to incineration.	– Minimum HRT of 15 d in primary digesters and volatile solids loading of 1.6 $kgVS/m^3/d$ at the maximum month sludge production rate.
	Dewatering	– Two new centrifuges and associated cake pumping systems.	– Firm dewatering capacity for maximum month sludge production rate.

Treatment type	Treatment system	Expansion requirements	Notes and design considerations
	FBI system	– A fifth FBI system with a nominal capacity of 105 dt/d.	– Firm incineration capacity for maximum month sludge production rate. – Each incinerator is equipped with a heat exchanger, waste heat boiler and an air pollution control train.
RNG purification facility	RNG	– New RNG facility, including biogas storage, gas booster fans, an RNG purification unit and a transfer station for grid connection	– Sized to accommodate the maximum biogas generation rate from the anaerobic digesters.
Site services	Electrical services	– New electrical substation with two 10 MVA transformers with a 4.16-kilovolt switchgear main-tie-main configuration. – New standby power providing a power capacity of 3.1 MVA.	– The proposed new substation's main-tie-main configuration and transformer rating are equivalent to the existing TS101 and TS-201 electrical substations. – The main-tie-main with dual transformer will provide power redundancies and ease of maintenance.
	Stormwater management	– A new stormwater drainage system for newly built areas on the project site.	– Enhanced quality control system to achieve 80% removal of TSS on an annual average basis.

ADF = Average daily flow
CCT = Chlorine contact tank
FBI = Fluidized bed incineration
HRT = Hydraulic retention time
IPS = Influent pumping station
$kg/m^2/d$ = Kilogram(s) per square metre per day
$kgVS/m^3/d$ = Kilogram(s) of volatile solids per cubic metre per day
m^2 = Square metre(s)
m^3 = Cubic metre(s)
m^3/h = Cubic metre(s) per hour
$m^3/m^2/d$ = Cubic metre(s) per square metre per day
mg/L = Milligram(s) per litre
MLSS = Mixed liquor suspended solids
MVA = Megavolt ampere(s)
PDF = Peak daily flow
PIF = Peak instantaneous flow
RNG = Renewable natural gas
SLR = Solids loading rate
SOR = Surface overflow rate.
SRT = Solids retention time

9.5.4 Site Layout

Figure 9.11 shows the site layout for the capacity expansion based on the expansion requirements described in Table 9.6, including the following new facilities:

- Raw wastewater inlet distribution chamber and conveyance channels from the York Durham Sewage System (YDSS) to Stages 1&2 and Stages 3&4 IPS
- Stage 4 liquid treatment works, including headworks and odour control, primary clarifiers, secondary treatment bioreactors and clarifiers, blower building, polymer building, chlorine contact chambers and disinfection chemical facility
- Stages 1&2 chlorine contact chamber expansions
- Solids handling facilities, including fifth incinerator and ancillary ash handling systems
- Electrical substation and standby power facilities
- Biogas storage and purification facility for renewable natural gas (RNG) grid injection
- Space allocation for Durham Region storage area
- Final effluent conveyance, including effluent channels and a drop shaft to the future outfall

Because of the increase in infrastructure, equipment and site utilization, capacity expansions are expected to require a larger staff team and a new facility for administration, O&M, workshops and storage. For planning purposes, allowance for a new administration/O&M facility is included in the overall cost estimate for the Stage 4 liquid treatment plant expansion; however, this facility has not been included on the site layout.

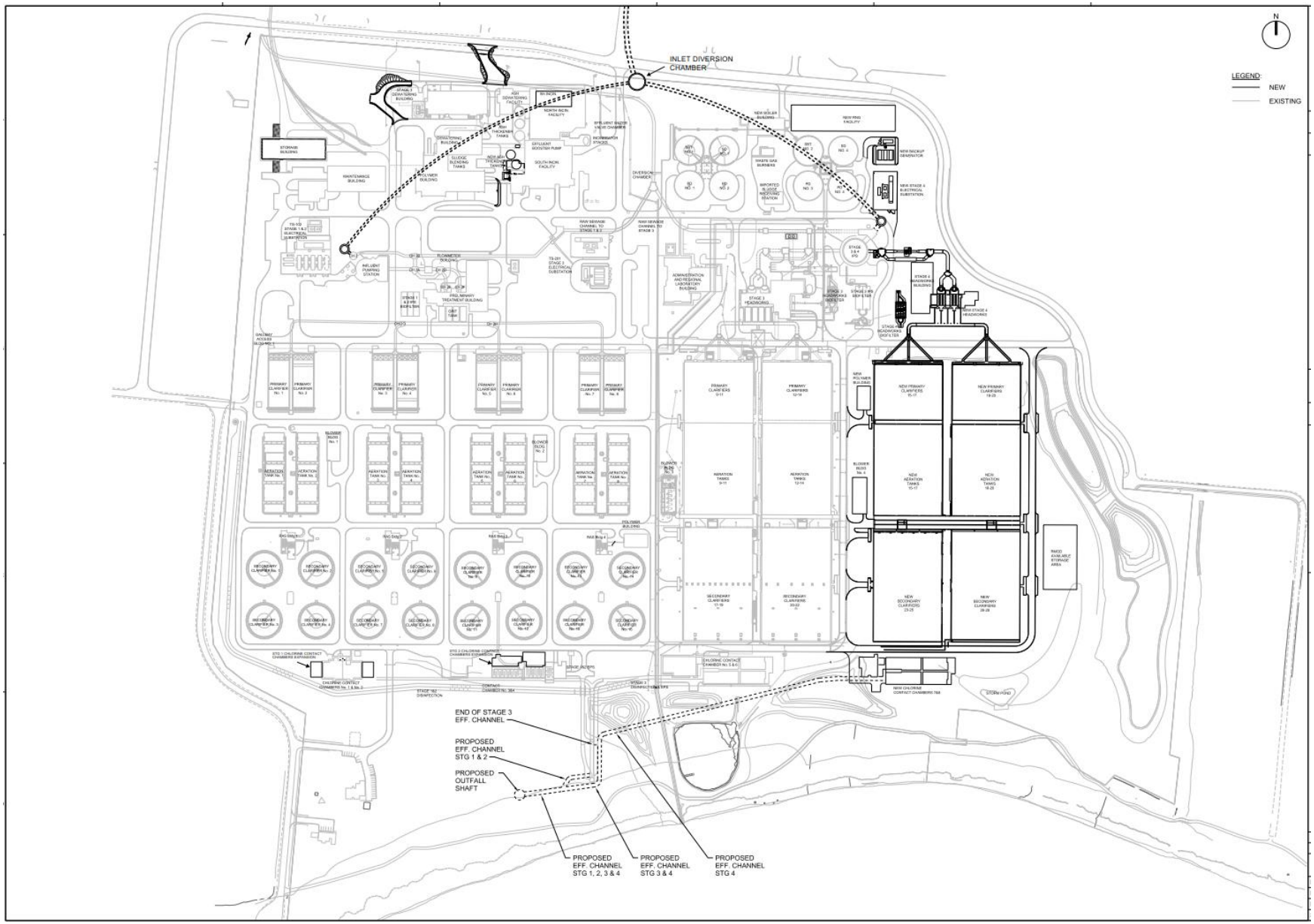

Figure 9.11 Duffin Creek WPCP Site Layout for the Plant Capacity Expansion

9.6 Environmental and Community Impacts and Mitigation

The construction and operation of the expanded Duffin Creek WPCP will potentially have impacts on the social, built, natural and cultural environments. Desktop studies were done to determine the extent of these impacts and to propose mitigation measures that would reduce the likelihood and the consequences should they occur. A summary of the noise, air and odour impact assessment methodology and results is provided below.

9.6.1 Noise Impact Assessment

9.6.1.1 Regulatory Framework

9.6.1.1.1 Construction

The City of Pickering Noise Control By-law number (No.) 6834/08 prohibits the operation of construction equipment from 7:00 pm to 7:00 am and all day on Sundays and statutory holidays if the construction noise is audible at a point of reception.

The Ontario Environmental Noise Guideline NPC-300 provides sound level limits that are applied by MECP to stationary sources according to land use surrounding the noise sources. This guideline considers construction activity to be temporary and is not considered a stationary source of noise. Therefore, there are no provincially required receptor-based noise criteria for construction activities.

MECP NPC-115 and NPC-118 set out noise emission standards for various types of construction equipment based on their date of manufacture and power rating. Both NPC-115 and NPC-118 stipulate noise limits on individual pieces of construction equipment rather than site-wide combined performance limits or sound levels at nearby receptors.

The United States Federal Transit Administration (FTA) Noise and Vibration Assessment Manual (2018) provides noise screening levels for a general construction noise screening assessment. The screening levels for different land uses established in this manual were used to assess overall noise construction impacts.

For the purpose of this study, noise impacts were compared with the residential day and nighttime values listed in Table 9.7 to gauge potential impacts (that is, 80 and 70 dBA 8-hour energy equivalent sound level [L_{eq}] for day and night, respectively). Nighttime construction is not currently anticipated but is included in the table for information purposes.

Table 9.7 FTA Noise Assessment Manual Noise Levels at Receptors

Land use	8-hour L_{eq} (dBA) day	8-hour L_{eq} (dBA) night
Residential	80	70
Commercial	85	85
Industrial	90	90

dBA = A-weighted decibel

9.6.1.1.2 Operation

The project study area around the Duffin Creek WPCP stationary noise sources is defined as a Class 2 area, according to the MECP guideline, which is typically “an area with an acoustical environment that has qualities representative of both Class 1 (typically urban) and Class 3 (typically rural) areas” (MECP 2013).

In accordance with NPC-300, the sound level limit is assessed at noise-sensitive points of reception (PORs) and expressed in terms of a 1-hour energy equivalent sound level ($L_{eq(1h)}$). The $L_{eq(1h)}$ limit is defined as the higher of the applicable MECP exclusion level or the minimum existing background sound level for that POR.

The NPC-300 1-hour equivalent sound level limits (L_{eq}) for outdoor POR and plane of window (POW) of noise-sensitive spaces in a Class 2 area are summarized in Table 9.8.

Table 9.8 MECP Operation Sound Level Limits

Operation condition	Time period	MECP exclusion sound level limit (dBA) – Outdoor POR	MECP exclusion sound level limit (dBA) – POW of noise-sensitive spaces
Normal operation (Steady noise, excluding emergency generators)	Daytime (07:00 – 19:00)	50	50
	Evening (19:00 – 23:00)	45	50
	Nighttime (23:00 – 07:00)	NA	45
Emergency generator testing	Daytime (07:00 – 19:00)	55	55

9.6.2 Noise-Sensitive Receptors

Noise-sensitive land uses, including residential, commercial (such as hotels) and institutional (such as schools and hospitals), were investigated within 1,000 m of the Duffin Creek WPCP property line. There are no noise-sensitive commercial or institutional receptors within this area. The only residential area within 1,000 m is the Duffins Bay residential area east of the plant in Ajax. The shortest distance between the plant and the residential area is 680 m from the plant's eastern property line to the property line of Hamptons Apartment located at 195 Lake Driveway West.

Three representative noise receptors, which were historically used in the Duffin Creek WPCP's Acoustic Assessment Reports supporting the facility's ECA Air and Noise amendment applications, are listed in Table 9.9 and used for this assessment.

Table 9.9 Identified Noise Points of Reception

House ID	Address	POR ID	Description	Height above grade (m)
R1	195 Lake Driveway West	R1_o	4-storey Hamptons Apartment, Outdoor POR	1.5
		R1-w	4-storey Hamptons Apartment – 4th-floor window	10.5
R2	182 Lake Driveway West	R2-o	2-storey detached house, front yard	1.5
		R2-w	2-storey detached house; 2nd floor window	4.5
R3	146 Lake Driveway West	R3-o	2-storey detached house, front yard	1.5
		R3-w	2-storey detached house; 2nd floor window	4.5

9.6.3 Noise Impact Assessment – Construction

This section discusses the impacts of construction noise that may lead to elevated nuisance noise levels based on a conservative assumption of potential noise sources from construction activities. Construction activities are expected to be temporary in nature and will generally result in noise impacts on-site and in the immediately adjacent areas.

Table 9.10 lists the typical sound pressure levels for construction equipment expected for the project construction.

Table 9.10 Typical Construction Equipment Sound Levels

Construction activity	Equipment name	Noise level (dBA) at 15 meters[14]
Earthmoving	Backhoes	80
	Dozer	85
	Compactor (ground)	80
	Excavators	85
	Front Loaders	80
	Graders/Scrapers/Gradall	85
	Paver	85
Material handling equipment	Crane	85
	Concrete Mixer Truck	85
	Concrete Pump	82
	Dumper/Flat Bed Truck	84
Stationary equipment	Generator	82
	Pumps	77
	Compressors (air)	80
Impact Equipment	Jack Hammers and Rock Drills	85
Other	Pneumatic Tools	85
	Bar Bender	85

A noise screening analysis was conducted based on a conservative assumption of simultaneous and extended equipment usage. As stated in the FTA screening method, the two noisiest sources operating simultaneously are both approximately 85 dBA (shown in Table 9.10), and therefore, the sound pressure level (SPL) at 15 m away from the noise source would be about 88 dBA in total. Approximate sound levels associated with the construction of the proposed project, estimated at 50 to 680 m from the construction site boundary, are provided in Table 9.11, assuming the two nosiest construction sources are located at the plant property line. Atmospheric absorption attenuation was not considered.

Table 9.11 Expected Construction Noise Levels from the Duffin Creek WPCP Boundary at different distances

Parameter	15 metres	50 metres	100 metres	250 metres	500 metres	680 metres
SPL (Equipment usage factor:1) (dBA)	88	78	72	64	58	55
SPL (Equipment usage factor: 0.2) (dBA)	81	71	65	57	51	48
Land use in areas surrounding the WPCP	Industrial	Industrial Environmental Protection	Industrial Open space	Industrial Open space	Industrial Commercial Open space	Residential Industrial Commercial

[4] Sound levels adopted from US Federal Highway Administration (FHWA) – Highway Construction Noise Handbook (August 2006).

9.6.3.1 Noise Impact Assessment – Operation

9.6.3.1.1 Individual Noise Impacts

The modelled contribution of each noise source to the overall plant sound levels at the noise receptors was assessed.

The assessment shows that the blowers (Stage 4 and Stage 3) and processing air piping are the most significant noise contributors to the sensitive receptors to the east. The highest noise impact source would be the Stage 4 blower main air pipe with 34.2 dBA at receptors. The next significant contributors are the two heating, ventilation and air conditioning (HVAC) louvers with a relatively large opening area (that is, the Stage 4 Headworks Exhaust Louver and the New Dewatering Building HVAC louver).

9.6.3.1.2 Cumulative Noise Impacts

The overall Duffin Creek WPCP noise impacts during daytime at identified noise receptors range from 38.9 dBA at R3 outdoor POR to 42.7 dBA at R1 POW. The plant's noise impacts in the evening and during night range from 38.8 dBA to 42.6 dBA, slightly lower than the daytime.

9.6.3.1.3 Most Impacted Point of Receptor Assessment

The most impacted Point of Receptor is the POW on the 4th-floor window in the four-storey Hamptons Apartment located at 195 Lake Driveway West.

During normal operation, the existing plant's noise impact at this receptor is 40.9 dBA during the day and 40.7 dBA in the evening and during night. With the Stage 4 expansion, the daytime sound level will slightly increase to 42.7 during the day and to 42.6 in the evening and during night. The Stage 4 expansion will result in a 1.8-decibel (dB) increase during the day and a 1.9 dB increase during the night. In general, the human ear cannot perceive a sound level increase of 1 to 2 dB. Regardless, in any time period, the overall impacts are less than the applicable MECP Class 2 noise criteria of 50 dBA during the day and 45 dBA during the night.

9.6.4 Air Quality Impact Assessment

9.6.4.1 Regulatory Framework

9.6.4.1.1 Ambient Air Quality Standards and Objectives

The following applicable air contaminant guidelines were used to assess ambient air quality conditions for relevant COCs in the study area:

– Ontario Ambient Air Quality Criteria (AAQC) (MECP 2019)
– Canadian Ambient Air Quality Standards (CAAQS) (CCME 2020).

The CAAQS are health and environmental-based outdoor air quality objectives for pollutant concentrations in the air.

9.6.4.1.2 MECP Point of Impingement Limits

In Ontario, the Air Contaminants Benchmarks List: Standards, guidelines and screening levels for assessing point of impingement concentrations of air contaminants" (version 3.0 - April 2023) was developed by the MECP to assess the point of impingement concentrations predicted by air dispersion modelling.

9.6.4.2 Air-Sensitive Receptors

Receptors were chosen based on recommendations provided in Section 7.1 of the Air Dispersion Modelling Guideline for Ontario, which is in accordance with Section 14 of O. Reg. 419/05; specifically, a nested receptor grid was placed approximately centred of the Duffin Creek WPCP air emissions sources, covering an area of 10 kilometre by 10 kilometre. In addition, receptors were also placed every 10 m along the property line.

9.6.4.3 Air Emission Sources – Construction

Air emission sources from construction activities include:

– Truck and construction equipment diesel engine exhausts. Contaminants such as nitrogen oxides, smaller/fine particulate matter, VOCs, SO_2 and CO are expected to be emitted from the operation of construction equipment, increased traffic in the area from workers and delivery and maintenance vehicles.
– Construction activity fugitive dust emissions from earthwork, such as removal of overburden, hauling, general material handling, grading and so forth.

9.6.4.4 Air Quality Impact Assessment – Construction

The contaminants that arise from diesel engine combustion will be highly localized to the work area because of short emission discharge height and the sources' mobility. Construction equipment varies in different construction phases for relatively short durations and is not likely to have a long-term ecological effect beyond the plant site.

The fugitive particles created by construction activities will be of larger aerodynamic diameters that tend to settle out of the atmosphere rapidly. The potential impacts are likely to be in relation to possible dust nuisance in the immediate vicinity of the site rather than ambient air quality concerns.

9.6.4.5 Air Quality Impact Assessment – Operations

Dispersion modelling was completed to estimate the existing (baseline) impacts, impacts from the proposed project and the overall post-project impacts to determine the project's contribution to the plant's overall impacts. The following operation scenarios were modelled:

– Baseline scenario – Includes existing sources from Stages 1&2 liquids treatment, Stage 3 liquids treatment and solids handling processes and associated infrastructure.
– Expansion scenario – Includes Stage 4 project components only.
– Cumulative scenario – Includes baseline and Stage 4 project components.

The POI concentrations were compared against the applicable standards and guidelines listed in the ACB List, dated April 2023. The predicted concentrations of all contaminants are less than the applicable MECP standard and/or guideline listed in the ACB list.

Comparing the overall cumulative post-project impacts to the existing baseline, the increase ratio ranges from 0.0001% (half-hour average carbon monoxide) to 26.4% (10-minute VOC from incinerators) for the 71 contaminants identified and modelled. The cumulative POI concentrations of all contaminants are predicted to be less than the applicable MECP standard, guideline, or screening level listed in the ACB list.

The predicted cumulative concentrations of trace VOCs and metals from the incinerator system account for less than 0.001% to 3.70% of the associated MECP POI limits. The predicted cumulative concentrations of products of combustion account for 1.44% half-hour CO) to 57.95% (1-hour SO_2) of the associated standard listed in the ACB list. Total reduced sulphur compounds account for 35.4% of the MECP health-based 24-hour standard.

9.6.5 Odour Impact Assessment

9.6.5.1 Regulatory Framework

The Duffin Creek WPCP odour assessment was conducted in accordance with the following guidance documents provided by MECP:

– Guideline A-10: Procedure for Preparing an Emission Summary Dispersion Modelling Report, March 2018 (Guideline A-10).
– Methodology for completing an Odour Assessment for Odour Mixtures, Technical Bulletin, Technical Assessment and Standards Development Branch, March 2021.

– Guideline A-11: Air Dispersion Modelling Guideline for Ontario (Guideline A-11) February 2017.
– Methodology for Modelling Assessments of Contaminants with 10-Minute Average Standards and Guidelines for Odour under O. Reg. 419/05 Technical Bulletin, September 2016 (Methodology for 10-Minute Average Modelling Assessments).

MECP uses a screening level of 1 odour unit (OU) at the 99.5 percentile but considers factors such as frequency, intensity, duration, offensiveness of the odours and location (collectively known as FIDOL) of impacts at sensitive receptors in the evaluation of odour impacts.

In 2009, an Odour Management Plan (OMP) was developed by the Regions to address the conditions contained in the MECP letter of approval, ENV1283 MC-2007-364, for the Duffin Creek WPCP Stage 3 Expansion Project. The OMP included an assessment of odour impacts with the baseline conditions and the expanded facility operations (that is, with Stage 3). Odour impacts were evaluated against the ambient background concentration levels, and then a secondary performance measure referred to as the "complaint trigger level." Based on a literature review conducted at the time, it was determined that any receptor that experiences odour concentrations below 4.2 OU/m^3 was not likely to register complaints, while odour concentrations between 4.2 OU/m^3 and 20 OU/m^3 may cause complaints. The 2009 OMP established 4.2 OU/m^3 as a secondary trigger level to assess potential odour impacts from the operation of the plant. Subsequent odour assessment conducted in support of the odour monitoring program included an analysis of the frequency of exceedance with the ranges as greater than 1 OU to 4.2 OU, greater than 4.2 OU to 8.8 OU, greater than 8.8 OU to 10.2 and greater than 10.2 OU

9.6.5.2 Odour-Sensitive Receptors

Areas within 2,500 m of the property line are identified as the study area for odour impacts. The MECP's odour assessment guidelines recommend impact assessment at sensitive receptors. Previous odour modelling studies completed for the site in support of ECA Air and Noise amendment applications identified 27 receptors and the farthest of these is 2,400 m to the north of the plant property. Therefore, a study area of 2,500 m surrounding the Duffin Creek WPCP is deemed adequate to assess the overall odour impacts.

9.6.5.3 Odour Impact Assessment – Construction

There may be some limited odorous emissions of VOCs caused by diesel combustion and potential release of reduced sulphides from existing conveyance and WPCP system tie-ins, but this effect can be managed using standard construction mitigation techniques. Odour emissions are not expected to be significant as a result of project construction activities.

9.6.5.4 Odour Impact Assessment – Operation

Three scenarios were modelled to compare odour impacts of new project components emissions with existing odour sources:

– Baseline scenario – Includes existing sources from Stages 1&2 liquids treatment, Stage 3 liquids treatment and solids handling processes and associated infrastructure.
– Expansion scenario – Includes Stage 4 project components only.
– Cumulative scenario – Includes baseline and Stage 4 project components.

The baseline scenario resulted in receptor impacts at the 99.5 percentile that ranged from 4.4 to 24.7 OU for the sensitive receptors. The expansion scenario resulted in receptor impacts at the 99.5 percentile that ranged from 0.6 to 15.3 OU for the sensitive receptors. Finally, the cumulative scenario had receptor impacts at the 99.5 percentile, ranging from 7.4 to 37.3 OU at the sensitive receptors.

Table 9.12 summarizes the impacts for receptors to the east (P1), west (P3), north (R5) and immediately adjacent to the southeast along the Waterfront Trail (T7) for each of the modelled scenarios. These results account for the hours of likely occupancy at each of the receptors, and they were factored into the overall exceedance count. Receptors P1, P3 and T7 are park and trail path receptors, and exposure to odour is likely to occur during the months of April to

November inclusive and between the daytime hours of 6 am to 9 pm. The R5 “Youth Residence” is occupied 24 hours a day all year around.

Receptors T7 (south, along the Shoreline Trail) and P1 (542 m east) are the ones with the highest impacts, and receptors P3 (1.03 kilometre west) and R5 (1.1 kilometre north) were selected to show the impacts on the western and northern directions.

When these time periods were factored into the exceedance count, for the cumulative scenario, receptor site T7 (a location along the Waterfront Trail) was only affected above 10 OUs 0.4 percent of the time and 0.9 percent above 5 OU. Overall, cumulatively, receptors P1 and P3 are affected to a lesser degree than receptor T7.

York Region and Durham Region, in consultation with MECP, have developed an odour management plan for the facility that provides details on mitigations to be constructed or applied, operational controls and practices, anticipated schedule, quantification and discussion of future odour reduction strategies.

It is worth noting that, although under the existing conditions, some receptors show modelled occasional exceedances over the 1 OU screening level, over the past five years, the plant, Ajax or Pickering have not recorded any odour complaints.

9.6.6 Summary of Project Impacts and Mitigation Strategies

Table 9.13, Table 9.14, Table 9.15 and Table 9.16 provide a summary of potential social, natural and cultural impacts and recommended mitigation measures.

Table 9.12 Frequency of Exceedance at Select Receptors over a 5-Year Period Accounting for Expected Seasonal and Diurnal Occupancy Only

Odour intensity (OU/m^3)	P1 Stage 4 %	P1 Exist %	P1 All %	P3 Stage 4 %	P3 Exist %	P3 All %	R5 Stage 4 %	R5 Exist %	R5 All %	T7 Stage 4, %	T7 Exist %	T7 All %
1	1.1	1.5	2.6	0.2	1.1	1.4	1.0	2.5	3.1	3.4	4.6	8.4
3	0.5	0.6	0.9	0.0	0.4	0.5	0.7	1.5	2.0	0.5	1.2	1.9
5	0.4	0.4	0.6	0.0	0.2	0.3	0.5	1.1	1.5	0.2	0.6	0.9
7	0.3	0.4	0.5	0.0	0.2	0.2	0.4	0.9	1.3	0.1	0.4	0.6
10	0.2	0.2	0.4	0.0	0.1	0.1	0.3	0.7	1.1	0.1	0.3	0.4

Receptor P1 = 542 metres east

Receptor P3 = 1.03 kilometres west

Receptor R5 = 1.1 kilometres north

Receptor T7 = along Waterfront Trail 100 metres southeast

Table 9.13 Social and Built Environment – Potential Impacts and Mitigation

Item #	Criteria	Indicators	Potential Effects (Positive/Negative)	Avoidance/Mitigation/Compensation
SB-1	Effect of noise on sensitive receptors – construction	– Number of sensitive receptors affected and extent and duration of adverse effects during construction	– Environmental noise may cause sleep disturbance and general annoyance. The magnitude of the noise disturbance depends on the number of pieces of equipment, their proximity to each other and to sensitive receptors, construction methods, equipment deployed, construction hours and duration of exposure to sensitive receptors. – Construction noise levels at sensitive receptors are expected to be within acceptable limits defined by the FTA Noise and Vibration Assessment Manual.	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. – Use acoustic enclosures for equipment such as generators and compressors. – Use localized, movable noise barriers/screens for specific equipment and operations. – Minimize simultaneous operation of equipment where possible, particularly noisy sources. – Implement a no-idling policy on-site (unless necessary for equipment operation). – Restrict construction hours where possible: • Perform construction during daytime hours when possible. If nighttime construction is necessary, high-noise activities should be restricted to daytime when possible. • Provide suggested construction staging to help mitigate noise generation. – Inform local residents before construction of the type of construction and expected duration if occurring outside of typical daytime hours (7 am to 7 pm). – Limit the number of heavy trucks on-site to the minimum required, where possible. – Stage construction vehicles away from noise-sensitive locations, where possible. – When construction location and design are better known, establish and apply project-specific construction noise criteria/exposure limits. – Undertake noise monitoring throughout the construction phase. Where noise level limits are exceeded, additional noise mitigation measures will be considered. – Consider developing a communications protocol that includes timely resolution of complaints. – Consider additional mitigation measures not listed herein as construction progresses.
	Effect of noise on sensitive receptors – operation	– Number of sensitive receptors affected and extent and duration of adverse effects during operation	– Overall noise impacts are not expected to be significant as a result of project operation activities.	The following best noise management practices should always be considered to minimize the environmental noise impacts: – Implement 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. – Procure equipment with low noise emissions. – Keep the entry doors closed and open for access only to buildings containing noisy equipment, such as the blower building and incinerator building. – Implement a no-idling policy on-site (unless necessary for equipment operation). – Follow the manufacturers' operation manual to operate and maintain equipment in good condition.

Item #	Criteria	Indicators	Potential Effects (Positive/Negative)	Avoidance/Mitigation/Compensation
SB-2	Effect of air quality on sensitive receptors – Construction	– Number of sensitive receptors affected and extent and duration of adverse effects during construction	– 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 as dust levels and are expected to quickly attenuate within a short distance of the activities. – Potential air quality impacts caused by dust and odour from diesel combustion and particulate emissions. – Exhaust emissions from construction vehicles may contribute to increased levels of criteria air contaminants (particulate matter, ozone, carbon monoxide, sulphur dioxide, nitrogen dioxide and lead). – 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.	Mitigation measures consistent with ECCC's Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities (Cheminfo Services Inc. 2005) and the MECP's Technical Bulletin Management Approaches for Industrial Fugitive Dust Sources will be followed. The following mitigation measures can be considered: – 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 on-site storage. – Minimize drop height of materials on-site. – Covering surface area of hauled bulk material. – Having methods and equipment for cleanup of accidental spills of dusty materials. – Implement a no-idling policy on-site (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. – Daily removal of accumulated mud, dirt and debris deposits on-site and regular truck washing. – 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. – Off-site 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 on-site to a maximum of 20 kilometre 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 so that harmful or volatile contaminants are not released. – Develop a communications protocol that includes timely resolution of complaints. – Site construction vehicle activity will be managed to control emissions of odorous contaminants and diesel exhaust. Mitigation measures that can be followed include: • Fuel-efficient vehicles • Proactive identification of emission sources • Equipment maintenance program.
	Effect of air quality on sensitive receptors – Operations	– Number of sensitive receptors affected and extent and duration of adverse effects during operation	– The proposed project will discharge air contaminants into the atmosphere, including products of combustion, reduced sulphur compounds, trace volatile organic compounds and trace metals.	– Air dispersion modelling was completed to compare the effects of the expanded plant against existing Ontario ambient air quality criteria. The analysis indicates that the cumulative concentration of all air pollutant assessed are below their respective MECP criteria. – The expanded facilities will be designed and operated such that emissions from various processes continue to be below the MECP air emission guidelines at all sensitive receptors. – Implement a no-idling policy on-site (unless necessary for equipment operation). – Follow the manufacturers' operation manual to operate and maintain equipment in good condition.

Item #	Criteria	Indicators	Potential Effects (Positive/Negative)	Avoidance/Mitigation/Compensation
SB-3	Effect of odours on sensitive receptors – Construction	– Number of sensitive receptors affected and extent and duration of adverse effects during construction	– Short-term odour emissions (reduced sulphides) from existing conveyance and system tie-ins. – Limited odour emissions of VOC from diesel fuel combustion. – Overall odour emissions are not expected to be significant as a result of project construction activities.	– Portable odour control devices as necessary, such as a misting device or portable activated carbon control unit. Choice to be determined based on details of the potential odour emissions. – Carefully manage fuel handling and filling to reduce spillage. – Site construction vehicle activity will be managed to control emissions of odorous contaminants and diesel exhaust. – Follow general air quality mitigation measures consistent with ECCC's *Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities* and the MECP' s *Technical Bulletin Management Approaches for Industrial Fugitive Dust Sources.*
	Effect of odours on sensitive receptors – Operations	– Number of sensitive receptors affected and extent and duration of adverse effects during operation	– There is potential for the expansion components to contribute to odours at the sensitive receptors.	The Regions have implemented the following mitigation measures in the event of an odour-related adverse effect: – Initiate the completion of ambient odour sampling at the location of any odour concerns, complaints and adverse effects, as well as source testing at the plant to identify key source contributors and potential contributing plant operating conditions. The information will be used to inform the source and characterization of the odour at the location of concern and at priority emission sources at the plant. The characterization of the odour will be considered FIDOL. – Note – Scoping and procuring odour sampling and analysis may take a number of months from the commencement of an adverse effect. Seasonal factors may also appropriately delay odour sampling. – Initiate stakeholder meetings similar to those held on a biannual basis for the Odour Impact Program, if considered necessary due to the length or extent of the adverse effect. – Based on identified key source contributors, review and revisit the Best-in-Class Odour Technology and Engineering Review Report, dated June 2011a (Jacobs, 2010). If the Best-in-Class Report contains dated information with respect to technology and engineering options available or the associated capital costs, the report will be updated to validate the options and provide updated information regarding odour control options. – Propose revised plant operational practices and ongoing monitoring required to assess resultant changes to off-site adverse impacts or proposed capital projects required to manage key odour source contributors.

Table 9.14 Natural Environment – Potential Impacts 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. – 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 pipe networks resulting from increased infiltration and inflow and/or preferential movement of groundwater within backfill materials.	– 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, 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.

Item #	Criteria	Indicators	Potential Effects (Positive/Negative)	Avoidance/Mitigation/Compensation
N-2	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 in catch basins 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.
N-3	Effect on aquatic habitat or functions	– Temporary or permanent loss of aquatic features or categorical loss of functions by type, including wetlands, watercourses by sensitivity type, and others	– Site preparation and construction activities, including equipment use, may cause disturbance and changes in soil compaction and site drainage and result in erosion, 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 and implement a sediment and erosion control plan. – Multibarrier sediment and erosion control measures (i.e., filter sock and heavy-duty silt fencing) can be erected to create a barrier between the wetland and construction if required. These measures and structures should 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. – Erect herptile exclusion fencing as necessary following the MNRF's Best Management Practices for Mitigating the Effects of Roads on Amphibian and Reptile Species at Risk in Ontario (MNRF 2016).
N-4	Effect on terrestrial habitat or functions	– Temporary and/or permanent loss of natural heritage features by type – Temporary and/or permanent vegetation removal and compensation	– 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 Ecological Land Classification communities. – Compensation for vegetation removed in the Naturized Area (as defined by the Greening Strategy) may be required 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.
N-5	Effect on terrestrial habitat or functions	– Number of trees removed during construction	– 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.

Item #	Criteria	Indicators	Potential Effects (Positive/Negative)	Avoidance/Mitigation/Compensation
N-6	Effect on terrestrial habitat or functions	– Temporary or permanent loss of SWH – Monarch	– Disturbance or destruction of habitat used by monarchs may occur.	– Plant or seed native flowering plants in temporarily disturbed areas 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.
		– Temporary or permanent loss of Significant Wildlife Habitat - Colonial waterbird nesting area (proximal to site)	– Avifauna species in the colonial waterbird nesting area are unlikely to be affected by noise, harassment, tree removals, incidental nest take, and habitat fragmentation because of the distance from the study area (200 m). – Avifauna are protected under the *Migratory Birds Convention Act* (MBCA) and ESA.	– All works must comply with the MBCA and ESA, 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 the type of nests observed according to the MBCA. – Implement appropriate buffers based on the type of nests observed per the MBCA.
		– Temporary or permanent loss of migratory breeding birds' habitat and nests	– Disturbance or destruction of migratory bird nests may occur during operational vegetation maintenance activities if applicable.	– All works must comply with the MBCA and ESA, including timing windows for the nesting period (April 1 to August 31). – Tree removal and 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 the type of nests observed according to the MBCA.
		– Temporary or permanent loss of SAR habitat	– Disturbance, displacement, or mortality of SAR or SAR habitat may occur.	– On-site 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, 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 ESA. – 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 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.

Table 9.15 Cultural Environment – Potential Impacts and Mitigation

Item #	Criteria	Indicators	Potential Effects (Positive/Negative)	Avoidance/Mitigation/Compensation
C-1	Effect on archeological resources	– Project components encroach on or are in the vicinity of archaeological sites or an area of archaeological potential	– Ground disturbance impacts to an area of archaeological potential or archaeological sites	– Comply with the recommendations of the Stage 1 archaeological assessment. Any further recommended assessment (e.g., Stage 2,3,4) shall be completed as early as possible in the detailed design phase and prior to any ground disturbing activities. – Should previously undocumented archaeological resources be discovered, they may indicate a new archaeological site and therefore subject to Section 48 (1) of the Ontario Heritage Act. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological assessment, in compliance with Section 48 (1) of the Ontario Heritage Act. – The Funeral, Burial and Cremation Services Act, 2002, S.O. 2002, c.33 requires that any person discovering human remains must cease all activities immediately and notify the police or coroner. If the coroner does not suspect foul play in the disposition of the remains, in accordance with Ontario Regulation 30/11, the coroner shall notify the Registrar, Ontario Ministry of Public and Business Service Delivery, which administers provisions of that Act related to burial sites. In situations where human remains are associated with archaeological resources, the Ministry of Citizenship and Multiculturalism (MCM) should also be notified (at archaeology@ontario.ca) to ensure that the archaeological site is not subject to unlicensed alterations which would be a contravention of the Ontario Heritage Act.

Table 9.16 Technical Environment – Potential Impacts and Mitigation

Item #	Criteria	Indicators	Potential Effects (Positive/Negative)	Avoidance/Mitigation/Compensation
T-1	Effects to the plant performance and operation	– Impacts to the effluent quality – Temporary shutdown of treatment processes/equipment in the existing Duffin Creek WPCP during construction	– Temporary shutdown of treatment systems at the plant.	– As the continual operation of the plant is of utmost importance, careful consideration will be given during the design and construction scheduling to avoid impacts on the plant operation and effluent quality.
T-2	Effects to the plant performance and operation	– Impacts to the effluent quality – Temporary shutdown of treatment processes/equipment in the existing Duffin Creek WPCP during operation	– Temporary shutdown of treatment systems at the plant.	– Design to include treatment process/equipment redundancy.

9.7 Capital Cost Estimates

The cost estimate was developed based on the Association for the Advancement of Cost Engineering International methodology and represents 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 and future investigations.

9.7.1 Cost Assumptions

The development of the cost estimate was based on general assumptions and allowances, which include, but are not limited to, the following:

1. Future capacity expansions for liquid treatment are based on conventional treatment technologies consistent with those in Stage 3. Similarly, future capacity expansions for solids treatment are based on the current solids handling processes.
2. Each cost item includes allowances for site electrical, site preparation, site civil, finish grading and landscaping and site supervisory control and data acquisition (SCADA) items, as applicable, based on previous construction projects at the plant.
3. An allowance of 15% design contingency is considered to cover design and pricing unknowns in preparing this estimate. The allowance is not meant to cover additional scope of work or quality modifications but rather to provide some flexibility as the design develops. The design allowance typically decreases as the design progresses.
4. An allowance of 10% construction contingency is considered to cover the unexpected increase in costs or unforeseen site conditions that result in design modifications during the construction phase.
5. An allowance of 2% is considered for the cost of future investigations listed in section 9.8.1 (field investigations).
6. All unit costs are inclusive of labour, materials, installation and restoration.
7. All unit prices were based on the best available information at the time the study was completed.

The cost estimate excludes the following costs:

1. Market contingency
2. Non-construction costs for the following items:
    a. Design
    b. Services during construction
    c. Legal
    d. Owner administration costs
3. Any unforeseen significant increase in material prices
4. Unavailability of materials and skilled labour
5. Accelerated or delayed schedule
6. Overtime premium
7. Applicable taxes
8. Escalation
9. Permits and approvals (summarized in section 9.8.2).

9.7.2 Cost Estimate

Table 9.17 summarizes the overall opinion of probable construction cost for the Duffin Creek WPCP Expansion and Upgrades Project. The estimate is classified as Class 5 as per AACE standard, with accuracy ranging from -50% to

+100%. The estimated construction cost is $585 M, with a probable cost ranging from $296 M (-50%) to $1,170 M (+100%).

Table 9.17 Estimated Construction Costs

Low range (-50%) (CAD 2023, excluding HST)	Estimated costs (CAD 2023, excluding HST)	High range (+100%) (CAD 2023, excluding HST)
292,512,000	585,023,000	1,170,046,000

Table 9.18 summarizes the total project cost, including construction, engineering, geotechnical investigations and allowance for future investigations (summarized in section 9.8.1). The total project cost is estimated at $686 M.

Table 9.18 Duffin Creek WPCP Expansion Estimated Capital Costs

Item	Description	Amount (CAD, 2023)
1	Stage 4 influent pumping, headworks, primary treatment, secondary treatment, disinfection, effluent channels and administration/O&M facility upgrades	338,000,000
2	Biogas RNG facility	18,000
3	Construction of fifth incinerator and dewatering upgrades	130,000,000
4	Design contingency (15% of Items 1-3)	70,202,700
5	Construction contingency (10% of Items 1-3)	46,801,800
	Total construction cost estimate	**585,022,500**
6	Engineering (15%)	87,753,375
7	Future investigations (2%) inclusive of $1.4 M for geotechnical investigations	13,100,450
	Total project cost estimate (rounded off to the nearest million)	**686,000,000**

9.8 Implementation Plan

9.8.1 Field Investigations

The conceptual planning of the Duffin Creek WPCP Expansion was based on a desktop review of available information. Field investigations are required prior to and during the design stage to ascertain factual data required for detailed design, which would either confirm or modify design concepts. Table 9.19 lists what is anticipated to be the required future investigations.

Table 9.19 Proposed Field Investigations

Field investigation	Comments
Geotechnical	– To confirm initial findings and provide geotechnical information for design: • 27 boreholes with monitoring wells. All geotechnical boreholes to be drilled to a minimum depth of at least 15 mbgs. • Soil and rock samples to be collected at each significant stratum and subjected to a careful visual examination in the field in order to determine the soil profile. – Planned tests for soils include the following: • Index properties tests moisture content and grain-size distribution, including sieve and hydrometer and Atterberg limits (if cohesive soil is encountered). • Chemical analyses: corrosivity package (minimum two samples per borehole) and toxicity characteristic leaching procedure on a minimum of one composite sample. • Advanced soil and rock testing. • Test pit to confirm whether permanent shoring was left in place along the existing effluent channels and the drop shaft.
Hydrogeological	– To confirm initial findings and provide hydrogeological information for design: • Install three mini piezometers and three staff gauges in the Duffins Creek wetlands to measure water levels in these surface water features. • Install four nested monitoring wells screening in each of the hydrostratigraphic units. • Hydraulic testing (slug tests or similar) will be conducted at all locations to calculate in situ hydraulic conductivities. • Soil samples to be collected from the screened intervals of selected monitoring wells and analyzed for grain-size analysis. • Groundwater samples to be collected and analyzed for general chemistry (all locations), Sewer Use Parameters (one deep and one shallow well), PHCs and VOCs (six locations chosen based on drilling observations).
Environmental investigation	– Soil bulk samples will be analyzed for the following parameters: • pH • Sodium adsorption ratio and EC • Metals and inorganics • PHC F1 through F4, including BTEX • PAHs • VOCs • Dioxins and furans (one sample per borehole) • Leachate analysis will be completed on at least 10% of the soil samples for certain contaminants in accordance with O. Reg. 406/19 requirements.
Topographic surveys	– To confirm ground levels in the areas proposed for the Stage 4 expansion in support of the plant hydraulic analysis.
Cultural Heritage	– None required.
Stage 1 Archaeology	– A Stage 1 Archaeological Assessment was completed in June 2023. The property inspection determined that parts of the study area exhibit archaeological potential and will require archaeological assessment.
Stage 2 Archaeology	– Parts of the study area exhibit archaeological potential. These lands require Stage 2 Archaeological Assessment by test pit survey at 5 m intervals. Stage 2 is required prior to any proposed construction activities on these lands.
Tree inventory and natural environment studies	– Additional breeding bird surveys and amphibian night surveys. – Arborist inventory and arborist report to determine required tree removal and compensation plantings. – Ecosystem compensation for vegetation removal in TRCA-regulated areas in accordance with TRCA's *Ecosystem Compensation Guidelines* (TRCA 2018).

9.8.2 Permits, Approvals and Other Legislative Requirements

Various federal and provincial legislation and policies and municipal by-laws govern the planning, design, construction and operation of the Duffin Creek WPCP. A number of permits and regulatory approvals will be required to conform with engineering design standards, health and safety best practices and environmental regulations.

According to current TRCA jurisdiction mapping, the locations of proposed boreholes do not fall within the TRCA-regulated area; therefore, at this stage, no permits are foreseen to be required for the geotechnical and hydrogeological subsurface investigation program.

Table 9.20 identifies the agencies and municipalities to be consulted and the permits and approvals that may be required in support of the Duffin Creek WPCP Expansion, and Figure 9.12 presents the associated typical permits and approvals timeline.

The anticipated permits are based on a concept level of the proposed upgrades and will need to be confirmed as part of the design and preconstruction stages.

Table 9.20 Approvals, Permits and Consultation Program for the Design and Preconstruction Phases

Regulatory agency	Permit/Approval/Notification	Assumed minimal approval timeline
Toronto and Region Conservation Authority	Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Permit	1 month
	Acquisition and Easement	12 to 18 months
	Permission to Enter	0.5 months
City of Pickering	Sanitary/Storm Sewer Discharge Permit	2 to 4 months
	Site Plan Approval	1 month
	Building Permit	2 months
	Noise Exemption Permit	1 month
	Tree Cutting Permit	1 to 2 months
	Road Occupancy Permit	0.5 months
Utilities Authority	Consultation with respective authorities	To be determined
Ministry of Environment, Climate and Parks	SAR Consultation and Endangered Species Act Approval	12 months
	Environmental Compliance Approval – Sewage	6 to 12 months
	Environmental Compliance Approval – Air and Noise	6 to 12 months
	Environmental Activity and Sector Registry or Permit to Take Water	6 to 12 months
Ministry of Citizenship and Multiculturalism (MCM)	Ministry letter indicating the archaeological assessment report has been entered into the Ontario Public Register of Archaeological Reports	Minimum 12 weeks
Ministry of Citizenship and Multiculturalism (MCM) and Local Area Municipalities	MCM review letter indicating cultural heritage due diligence	Minimum 30 days
Ministry of Labour	Notice of Project	To be determined
Electrical Safety Authority (ESA)	ESA Approval	2 to 3 months
Technical Standards and Safety Authority (TSSA)	TSSA Approval	To be determined

Regulatory agency	Permit/Approval/Notification	Assumed minimal approval timeline
Environment and Climate Change Canada	Migratory Bird Timing Window	To be determined
	Species at Risk Act (SARA) Notification	3 months

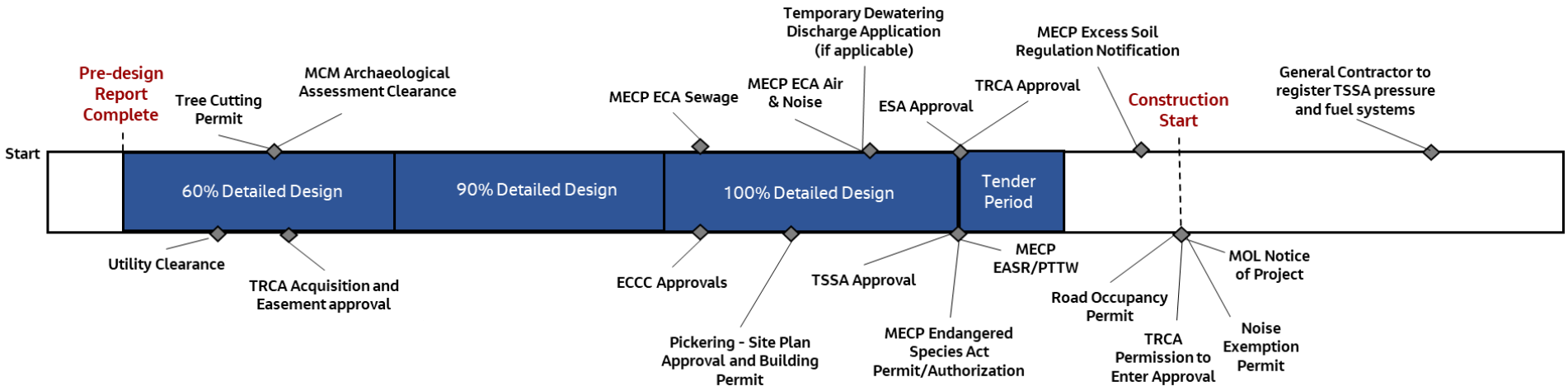

Figure 9.12 **Summary of Schedule for Various Permits and Approvals for the Duffin Creek WPCP Expansion Design and Pre-Construction Phase**

9.8.3 Project Schedule

Raw wastewater flow and load projections were developed based on the population projections described in Chapter 3 of the Project Report. Flow and load projections indicate that the plant's current design sewershed population (1.55 million people) will be met around 2030, and the plant's current rated ADF (630 ML/d) will be met around 2036. By 2030, the plant is forecast to be operating at 88% of its rated hydraulic capacity.

For the solids handling processes, based on the projected digested and imported sludge production, it is projected that a fifth incinerator and dewatering capacity upgrades will be required around 2036; therefore, design and construction should be planned to have the proposed upgrades and expansion available for operation prior to 2036.

The implementation of the RNG purification facility will be planned upon completion of ongoing capital projects (that is, Contract T-20-230 Digester Upgrades and Refurbishment and Contract T-20-08 Biosolids Treatment Replacement Contract 1) that will maximize biogas generation with the existing digesters, with an expected completion by 2026.

9.8.3.1 Stage 4 Liquids Treatment Expansion, including RNG Purification Facility

The schedule is based on the traditional design-bid-build contract approach. The following tasks must be completed sequentially and are proposed for the liquid expansion project. Duration and sequencing are presented in Table 9.21. The symbol X in Table 9.21 denotes the project stage duration.

1. Duffin Creek WPCP Expansion and Upgrades – Preferred solution study:
    - To advance the next phase of implementation planning for the capacity expansion, the Regions will initiate a detailed planning study to make key decisions on the technologies and processes for liquid and solid processes and develop a conceptual design and implementation plan for all major expansions. This study will include detailed technology evaluations for each process and will define a long-term implementation strategy for the Duffin Creek WPCP capacity expansion.
2. Preliminary design:
    - The project approach will include contractor prequalification prior to the tendering phase. Contractor prequalification can occur after completion of preliminary design.
3. Subsurface investigations (Phase 1 – 27 boreholes):
    - Subsurface investigations are proposed to be conducted in a two-phase approach. The proposed two-phase approach is to meet the minimum excess soil sampling requirements. The first round of investigation (27 boreholes) can occur in parallel or immediately after preliminary design.
4. Detailed design.
5. Subsurface investigations (Phase 2 – 43 boreholes):
    - The second phase of investigations (43 boreholes) is required to collect additional soil characterization information and should occur prior to tendering the construction contract.
6. General contractor tender and award.
7. Construction.

Table 9.21 **Proposed Schedule for the Stage 4 Liquids Treatment Expansion Project**

Activity	Duration (years)	1	2	3	4	5	6	7	8	9
Preferred solution study	1	x								
Preliminary design	1		x							
SI – Phase 1	2		x	x						
Detailed design	1			x						
SI – Phase 2	1				x					
Tender and award period	1					x				
Construction	4						x	x	x	x

The overall design and construction for the Duffin Creek WPCP Stage 4 liquids treatment expansion project is anticipated to take approximately nine years. Given the forecast population projections, Stage 4 needs to be in operation by 2036; therefore, the Duffin Creek expansion preferred solution study should begin in early 2027.

9.8.3.2 Solids Treatment Expansion

The following tasks must be completed sequentially and are proposed for the solids expansion project. Duration and sequencing are presented in Table 9.22:

1. Preliminary design:
    - The project approach should include contractor prequalification prior to the tendering phase. Contractor prequalification can occur after completion of preliminary design.
2. Fluidized bed incineration system equipment prepurchase contract:
    - Vendor tender and award
    - Vendor detailed design
    - Fabrication.
3. Fluidized bed incineration system equipment installation contract:
    - Detailed design
    - Design and preconstruction permits and approvals
    - General contractor tender and award
    - Construction and commissioning.

Table 9.22 Proposed Schedule for the Solids Treatment Expansion Project

Contract type	Activity	Duration (years)	1	2	3	4	5	6	7	8	9	10
Fluidized Bed Incineration System Equipment Prepurchase and Installation Contract	Preliminary design	1	x									
Fluidized Bed Incineration System Equipment Prepurchase Contract	Vendor tender and award	1		x								
	Vendor detailed design	2			x	x						
	Fabrication	2					x	x				
Fluidized Bed Incineration System Equipment Installation Contract	Detailed design	1					x					
	Contractor tender and award	1							x			
	Construction	3								x	x	x

The overall design and construction for the Duffin Creek WPCP solids treatment expansion project is anticipated to take approximately ten years.

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