Draft Environmental Assessment Study Report

Twin Creeks Environmental Centre Landfill Optimization Project Environmental Assessment

WM Canada

Watford, Ontario

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Executive Summary

This report documents the Environmental Assessment (EA) undertaken by Waste Management (WM) to provide approximately 14.3 million m³ of additional landfill disposal capacity at the existing Twin Creeks Environmental Centre (TCEC) in accordance with the approved Terms of Reference (ToR). The TCEC Landfill Optimization Project EA was initiated in April 2023 following approval of the ToR by the Minister of Environment, Conservation and Parks in December 2022.

Section 1 – Introduction

The Twin Creeks Environmental Centre (TCEC) is located at 5768 Nauvoo Road, approximately 1 kilometre north of the Village of Watford in the Township of Warwick, Ontario, southeast of the intersection of Zion Line and Nauvoo Road. The TCEC encompasses a site area of approximately 301 hectares (ha) and includes the Expansion Landfill, the closed Old Landfill, site offices, maintenance and weigh scale facilities, stormwater management ponds, leachate and landfill gas management infrastructure, a poplar plantation, an excess soil stockpile, and a Renewable Natural Gas (RNG) Facility.

The original Warwick Landfill commenced operations in 1972 and was acquired by WM Canada (WM) in 1996. The Expansion Landfill was approved under the *Ontario Environmental Assessment Act* (*OEAA*) in 2007, increasing the total landfill airspace capacity to approximately 26.5 million cubic metres (m³) over 101.8 ha of the site area. The TCEC operates under the Ontario Ministry of Environment, Conservation and Parks (MECP) Environmental Compliance Approval (ECA) No. A032203 and is authorized to receive up to 1.4 million tonnes per year of municipal, industrial, commercial, and institutional non-hazardous solid waste, including non-hazardous contaminated soil.

The purpose of the TCEC Landfill Optimization Project (the Project) is to provide additional landfill disposal capacity of approximately 14.3 million m³ as part of the optimization of the design and operation of the TCEC Expansion Landfill, which could extend the site life by approximately 12 years (from 2031 to 2043). There is a need for the continued development of the TCEC as it is a significant component of the provincial waste management network and infrastructure, which is lacking in sufficient and secure long-term disposal capacity. Optimizing the future development of the TCEC allows for on-going sustainable business operations and continued provision of essential financial support for community services and programs. This may be achieved through alternative landfill configurations (alternative methods) within the existing 301 ha TCEC site area. No changes are proposed to the size of the TCEC site area, approved service area, or annual fill rate.

Section 2 – Overview of the Environmental Assessment Process and Study Organization

The EA was undertaken in accordance with the *OEAA* and the Project is designated as a Part II.3 project under the *OEAA* in accordance with O.Reg. 50/24 (MECP, 2024). The EA was conducted in accordance with the approved ToR dated March 2022 (**Appendix A** of the Draft EA Study Report). The ToR approval by the Minister of Environment, Conservation and Parks marked the first step of the two-step *OEAA* approval process, with the EA constituting the second step. The EA addressed the requirements for expanding landfill capacity at the TCEC, as outlined in the ToR and applicable regulations.

Section 3 – Overview of the Undertaking

The purpose of the undertaking is to provide approximately 14.3 million m³ of additional long-term landfill disposal capacity at the existing TCEC landfill, ensuring continued service to WM's customers for residual non-hazardous solid waste over the next 12 years beyond the currently approved capacity. This extension supports the sustainable business opportunity identified by WM to optimize existing infrastructure investments and maintain economical waste disposal services across Southern Ontario. The undertaking aims to provide sufficient landfill capacity and waste management services to support municipalities and industrial, commercial, and institutional (IC&I) customers beyond the remaining years of capacity. By optimizing the landfill design and operations and leveraging significant investments made in existing infrastructure, WM will continue sustainable business operations while providing essential financial support for community services and programs.

Based on historical and forecasted filling rates, WM estimates that the TCEC landfill will reach its approved capacity by approximately 2031. Since its inception, TCEC has evolved into a critical regional facility serving municipalities, businesses, and Indigenous communities across Southern Ontario. The landfill provides cost-effective, environmentally secure disposal solutions for post-recycling and diversion residual waste generated by a broad customer base.

WM has expanded its operations at TCEC to include supporting infrastructure and innovative environmental initiatives. These include supplying cost-effective green energy to a local greenhouse business, managing landfill gas (LFG) to reduce greenhouse gas (GHG) emissions, supporting the closure of smaller landfill sites, and reducing vehicle traffic to waste facilities. The development of the Renewable Natural Gas (RNG) Facility will convert residual organics into clean energy, further aligning with Ontario's climate change goals.

TCEC is a major contributor to the local economy, providing stable, long-term jobs and financial support to the community through municipal taxes and local partnerships. Continued development and operation of the landfill will sustain these economic benefits over the long term.

The extension of the landfill's operational capacity is essential due to limited disposal alternatives in Ontario. On average, approximately 3.4 million tonnes of waste are currently exported to the United States annually due to a shortage of secure, long-term disposal options in the province. With a lack of sufficient and secure long term disposal capacity available in Ontario, there is an on-going requirement for the TCEC to continue to provide this landfill disposal service to its customers, fulfill long term contractual obligations to municipalities and businesses across Ontario, and support stable operation and growth for municipalities and businesses across Southern Ontario.

This undertaking is essential to:

- Sustain long-term landfill capacity and disposal services to meet forecasted demand;
- Support municipal and IC&I waste management programs aligned with provincial waste diversion policies;
- Maintain environmental safeguards including landfill gas capture and greenhouse gas mitigation efforts;
- Facilitate economic growth and community stability by supporting local employment and contributing to local municipal revenue;
- Minimize transportation-related emissions by providing regional waste processing and disposal infrastructure.

As part of the ToR, WM committed to examining opportunities for food and organic waste resource recovery in accordance with Policy 6.8 of Ontario's Food and Organic Waste Policy Statement. Proponents of new or expanded waste management systems for disposal should consider opportunities to divert food and organic waste. WM currently provides contracted collection services for green bin organics for resource recovery and/or residual waste disposal to some but not all of the southern Ontario municipalities affected by the Policy Statement. WM has long term contracts with various municipalities in Ontario to provide waste disposal capacity for post recycling and post diversion residual solid waste at the TCEC. WM will continue to support municipalities and is well positioned to provide competitive contracted services to these and other waste generators for collection of source separated material including food and organic waste for processing at a resource recovery facility.

The Food and Organic Waste Policy Statement also identifies that specified multi-unit residential buildings, generators in the industrial and commercial sectors, and larger institutions will be required to source separate and collect food and organic waste at

their facility by 2025. Further, all collected food and organic waste is to be sent for resource recovery. WM currently provides competitive contracted collection services to this range of waste generators across Ontario. Dependent on the specific waste generator and their requirements, these services can include collection of their source separated organic material for processing at a resource recovery facility. Collected organics are delivered by WM to a network of third-party composting and anaerobic digestion (AD) facilities located in southern Ontario with available processing capacity.

The TCEC itself is a final disposal facility and provides disposal capacity for post recycling and post diversion residual solid waste material generated by Ontario municipalities and IC&I facilities compliant with the Food and Organic Waste Policy Statement.

The continuation and enhancement of the TCEC landfill is aligned with Ontario's Strategy for a Waste-Free Ontario, the Climate Change Action Plan, and other provincial environmental objectives. WM remains committed to responsible waste management and environmental stewardship, ensuring TCEC's operation will contribute to a sustainable, economically viable waste management system for Southern Ontario well into the future.

As outlined in the ToR, WM has focused the preparation of the EA and the consideration of alternatives to the undertaking to address their specific needs and circumstances. The following four alternatives to the undertaking were identified:

1. Do nothing;
2. Redirect waste to a disposal facility elsewhere;
3. Develop a new disposal facility; and
4. Develop additional landfill disposal capacity within the TCEC.

Based upon the screening of the alternatives to the undertaking, WM concluded that Alternative 4, the development of additional landfill capacity within the TCEC site area, is the only reasonable option for the company, its customers, and the Province of Ontario. The other alternatives do not address WM's business opportunity to meet long-term customer commitments, avoid business risks or maximize the financial investment in the facility, and limit the benefits provided to the local community. The "Do Nothing" Alternative was carried forward in the EA to provide a benchmark against which to measure the alternative methods and to assess the advantages and disadvantages of the Preferred Alternative.

Section 4 – Description of the Environment Potentially Affected by the Undertaking

The existing TCEC is located within the Township of Warwick, in the County of Lambton, approximately 1 km north of the Village of Watford. The TCEC is situated south of Highway 402 and southeast of the intersection of Nauvoo Road and Zion Line. The municipal street address of the TCEC is 5768 Nauvoo Road, Watford, Ontario. The site is located on Lots 19 and 20, Concession 3, and Lot 20 and the western half of Lot 21, Concession 4, south of Egremont Road, Warwick. The TCEC encompasses a site area of 301 ha, which includes:

- Expansion landfill;
- the closed Old Landfill;
- a site office;
- a maintenance facility;
- a weigh scale;
- four stormwater management ponds;
- Leachate management infrastructure;
- Landfill Gas management infrastructure;
- a poplar system for leachate management;
- a poplar plantation;
- an excess soil stockpile; and
- RNG Facility.

The study areas identified for the EA include the existing TCEC site and the potentially affected surrounding areas. The generic On-site and Off-site Study Areas identified for the EA in the approved ToR are as follows (**Figure 4-1** of the Draft EA Study Report):

- On-site Study Area – the existing TCEC site;
- Off-site Study Area – the lands in the vicinity of the TCEC extending approximately 1 km out from the On-site Study Area.

As outlined in the approved ToR, the generic study areas identified above were refined during the EA to better suit the requirements of specific environmental components. Modifications to the study areas are outlined in **Table 4-1** of the Draft EA Study Report.

A preliminary description of the existing environmental conditions at the TCEC was provided in the approved ToR. The ToR contained the commitment that the existing environment will be characterized in the EA, and will address the five aspects of the environment as defined in the *OEAA*:

- natural environment;
- built environment;
- cultural environment;

- social environment; and
- economic environment.

For the purposes of this EA, the social and economic environments have been grouped into the socio-economic environment. The environmental aspects identified above were subdivided into environmental components and evaluation criteria to focus the assessment of effects as follows:

Environmental Aspect	Environmental Component	Evaluation Criteria
Natural Environment	Atmospheric Environment	• Air Quality – Dust • Air Quality – Landfill Gas and Combustion By-Products • Air Quality – Blowing Litter • Odour • Noise
	Hydrogeology	• Groundwater Quality • Groundwater Quantity
	Surface Water Environment	• Surface Water Quality • Surface Water Quantity
	Ecological Environment	• Terrestrial Ecosystems • Aquatic Ecosystems
Socio-Economic Environment	Social Environment	• Human Health • Effects on Local Community
	Economic Environment	• Economic Effects on Local Community
	Visual Landscape	• Visual Impact of Facility
Cultural Environment	Cultural Environment	• Cultural Heritage Resources • Archaeological Resources
Built Environment	Transportation	• Traffic Operations
	Current and Planned Future Land Use	• Effects on Current and Future Land Uses

The description of existing conditions (i.e., the existing environment potentially affected) is presented in **Section 4.3** of the Draft EA Study Report organized by environmental aspect and environmental component.

Section 5 – Alternative Methods of Carrying Out the Undertaking

The development of approximately 14.3 million m³ of additional landfill capacity within the 301 ha TCEC site area can be achieved through a:

- vertical expansion of the currently approved Expansion Landfill footprint;
- horizontal expansion over the closed Old Landfill to the east of the Expansion Landfill; or
- horizontal expansion into other available areas of the TCEC site.

As outlined in the approved ToR, based on a qualitative consideration of the potential vertical and horizontal expansion methods available within the site area, in addition to potentially locating waste in close proximity to the Village of Watford, horizontal Alternative Methods would result in significant additional costs and would not optimize the use of the available and constructed infrastructure at the site to the extent possible. Given the financial, technological, and community risks and concerns associated with the horizontal Alternative Methods, WM identified a preference for a vertical Alternative Method.

WM committed to undertaking a screening of vertical and horizontal Alternative Methods as part of the EA to confirm that a vertical Alternative Method would be preferred. Three areas within the TCEC site were identified as potentially available for the development of approximately 14.3 million m³ of additional landfill capacity:

- the vacant southern portion of the TCEC site south of the soil stockpile (43.2 ha);
- part of the Expansion Landfill footprint (excluding the north, west and south side slopes) plus the closed Old Landfill footprint to the east (79.2 ha); and
- the Expansion Landfill footprint (75.4 ha).

Alternative Method concepts were developed within each of these areas to support the screening. The three Alternative Methods were evaluated and comparatively screened against each other using criteria consisting of:

- Cost and Constructability considerations;
- Technical considerations;
- Environmental considerations;
- Social and Cultural considerations; and
- Land Use considerations

The screening level comparison shows that the Vertical Alternative Method is preferred over both Horizontal Alternative Methods for all criteria and considerations. This alternative best utilizes existing infrastructure, minimizes new land disturbance, and avoids the additional risks associated with the horizontal expansion options.

Based on the results of the screening, WM proceeded with the development of specific vertical Alternative Methods within the Expansion Landfill footprint to achieve the required additional landfill capacity. Three vertical Alternative Methods were

developed in the Conceptual Design Report (Supporting Document 2) for assessment in the EA and are summarized in **Section 5** of the Draft EA Study Report.

The conceptual design for each Alternative Method was prepared with the consideration of the requirements in O.Reg. 232/98 and the associated guidance document "Landfill Standards: A Guideline on the Regulatory and Approval Requirements for New or Expanding Landfilling Sites" (MOE, 2012). The aspects of the design and operations of the Alternative Methods included in the CDR are as follows:

- Landfill design and geometry (location, orientation, volume, key design features);
- Buffer zones around the waste footprint;
- Site development (phasing and schedule of landfill development and construction activities);
- Leachate generation, management, and treatment;
- LFG generation, management, and treatment;
- Stormwater management;
- Ancillary facilities;
- Traffic management; and
- Landfill operations (operating hours, site equipment, waste placement, daily and intermediate cover, and nuisance controls).

his alternative best utilizes existing infrastructure, minimizes new land disturbance, and avoids the additional risks associated with the horizontal expansion options.

Overview of Alternative Method 1

Alternative Method 1 includes the increase of final landfill side slopes from 4H:1V to 3H:1V between the original grade and elevation 320 masl (about 16 m in grade change), transitioning to a 20H:1V upper slope and peaking at elevation 324.5 masl over the Expansion Landfill. The proposed landfill expansion consists of five stages.

Overview of Alternative Method 2

Alternative Method 2 includes the increase of the final landfill side slopes from 4H:1V to 2.5H:1V between elevation 250 masl and elevation 310 masl, about 60 m in grade change, transitioning to a 20H:1V upper slope and peaking at elevation 319 masl over the Expansion Landfill. The proposed landfill expansion consists of four stages.

Overview of Alternative Method 3

Alternative Method 3 includes the increase of final landfill side slopes from 4H:1V to 2.5H:1V between elevation 260 masl and elevation 360 masl, about 100 m in grade change, peaking at elevation 360 masl over the Expansion Landfill. The proposed landfill expansion consists of four stages.

Section 6 – Net Effects of the Alternative Methods

The potential effects of the Alternative Methods were assessed using the evaluation criteria, indicators, rationale, and data sources from the approved ToR, provided in **Section 6.1.1** of the Draft EA Study Report, and considering the existing conditions. The potential environmental effects of each Alternative Method were identified based on the currently approved waste receipt volume of 1.4 million tonnes per year and the design considerations detailed in the Conceptual Design Report (**Supporting Document 2**). The key design considerations and assumptions for the effects assessment for each environmental component were documented, including the mitigation measures incorporated into the Project design. Mitigation measures beyond those included in the CDR were identified when required to minimize or mitigate the potential effects associated with each alternative method. The net environmental effects were then identified, taking into account the identified mitigation measures. The potential effects, mitigation measures, and net effects associated with the alternative methods were documented in a series of stand-alone Effects Assessment Reports (**Supporting Document 3**). The potential net effects are summarized below.

Natural Environment

Atmospheric Environment

Air Quality – Dust

The potential net effects of Alternative Method 1, Alternative Method 2 and Alternative Method 3 on Air Quality – Dust are as follows:

Alternative 1	Alternative 2	Alternative 3
• No net effects on air quality – dust. • With the application of mitigation strategies, predicted concentrations at discrete receptors are expected to decrease to levels similar to Future Baseline Conditions. • With the application of mitigation strategies, the frequencies of predicted exceedance at discrete receptors are expected to decrease to levels similar to Future Baseline Conditions. • With the application of mitigation strategies, the number of off-site receptors potentially affected are expected to decrease to quantities similar to Future Baseline Conditions.	• No net effects on air quality – dust. • With the application of mitigation strategies, predicted concentrations at discrete receptors are expected to decrease to levels similar to Future Baseline Conditions. • With the application of mitigation strategies, the frequencies of predicted exceedance at discrete receptors are expected to decrease to levels similar to Future Baseline Conditions. • With the application of mitigation strategies, the number of off-site receptors potentially affected are expected to decrease to quantities similar to Future Baseline Conditions.	• No net effects on air quality – dust. • With the application of mitigation strategies, predicted concentrations at discrete receptors are expected to decrease to levels similar to Future Baseline Conditions. • With the application of mitigation strategies, the frequencies of predicted exceedance at discrete receptors are expected to decrease to levels similar to Future Baseline Conditions. • With the application of mitigation strategies, the number of off-site receptors potentially affected are expected to decrease to quantities similar to Future Baseline Conditions.

Air Quality – Landfill Gas and Combustion By-Products

The potential net effects of Alternative Method 1, Alternative Method 2 and Alternative Method 3 on Air Quality – LFG are as follows:

Alternative 1	Alternative 2	Alternative 3
• No net effects on air quality – LFG	• No net effects on air quality – LFG	• No net effects on air quality – LFG

Air Quality – Blowing Litter

The potential net effects of Alternative Method 1, Alternative Method 2 and Alternative Method 3 on Air Quality – Blowing Litter are as follows:

Alternative 1	Alternative 2	Alternative 3
• No net effects on air quality – Blowing Litter	• No net effects on air quality – Blowing Litter	• No net effects on air quality – Blowing Litter

Odour

The potential net effects of Alternative Method 1, Alternative Method 2 and Alternative Method 3 on Odour are as follows:

Alternative 1	Alternative 2	Alternative 3
• Predicted odour concentrations may exceed criteria at discrete receptor locations. • Frequency of odour levels above defined odour benchmarks may increase. • Predicted odour concentrations are expected to be similar to or lower than Future Baseline Conditions.	• Predicted odour concentrations may exceed criteria at discrete receptor locations. • Frequency of odour levels above defined odour benchmarks may increase. • Predicted odour concentrations are expected to be similar to or lower than Future Baseline Conditions.	• Predicted odour concentrations may exceed criteria at discrete receptor locations. • Frequency of odour levels above defined odour benchmarks may increase. • Predicted odour concentrations are expected to be similar to or lower than Future Baseline Conditions.

Noise

The potential net effects of Alternative Method 1, Alternative Method 2 and Alternative Method 3 on Noise are as follows:

Alternative 1	Alternative 2	Alternative 3
• Landfill and construction equipment will be positioned significantly closer to the site perimeter and at marginally higher ground elevations compared to other Alternative Methods, resulting in a comparatively greater impact at the nearest POR. Noise levels to meet applicable landfilling noise guidelines during daytime hours, with considerable mitigation measures.	• Noise levels to meet applicable landfilling noise guidelines during daytime hours, with some mitigation measures.	• Noise levels to meet applicable landfilling noise guidelines during daytime hours, with some mitigation measures.

Hydrogeology

Groundwater Quality

The potential net effects of Alternative Method 1, Alternative Method 2 and Alternative Method 3 on Hydrogeology - Groundwater Quality are as follows:

Alternative 1	Alternative 2	Alternative 3
• None, so long as the hydraulic trap design is maintained as required under the Waste and Sewage ECAs. • Under any of the Alternative Methods chosen, the at-Capacity CLS is calculated to be 163 years post-closure.	• None, so long as the hydraulic trap design is maintained as required under the Waste and Sewage ECAs. • Under any of the Alternative Methods chosen, the at-Capacity CLS is calculated to be 163 years post-closure.	• None, so long as the hydraulic trap design is maintained as required under the Waste and Sewage ECAs. • Under any of the Alternative Methods chosen, the at-Capacity CLS is calculated to be 163 years post-closure.

Groundwater Quantity

The potential net effects of Alternative Method 1, Alternative Method 2 and Alternative Method 3 on Hydrogeology - Groundwater Quantity are as follows:

Alternative 1	Alternative 2	Alternative 3
• None, so long as the hydraulic trap design is maintained as required under the Waste and Sewage ECAs.	• None, so long as the hydraulic trap design is maintained as required under the Waste and Sewage ECAs.	• None, so long as the hydraulic trap design is maintained as required under the Waste and Sewage ECAs.

Surface Water Quality

The potential net effects of Alternative Method 1, Alternative Method 2 and Alternative Method 3 on Surface Water - Quality are as follows:

Alternative 1	Alternative 2	Alternative 3
• Presuming the mitigation measures presented herein are implemented and maintained as required, the risk for impacts to Surface Water Quality due to erosional effects will be effectively managed. • There is no expected net effect to Surface Water Quality from leachate impacts with the implementation of a seepage monitoring and repair program under Alternative Method 1. • No effects to surface water quality (as long as the Mitigation Measures continue to be carried out).	• Presuming the mitigation measures presented herein are implemented and maintained as required, the risk for impacts to Surface Water Quality due to erosional effects will be effectively managed. • There is no expected net effect to Surface Water Quality from leachate impacts with the implementation of a seepage monitoring and repair program under Alternative Method 2. • No effects to surface water quality (as long as the Mitigation Measures continue to be carried out).	• Presuming the mitigation measures presented herein are implemented and maintained as required, the risk for impacts to Surface Water Quality due to erosional effects will be effectively managed. • There is no expected net effect to Surface Water Quality from leachate impacts with the implementation of a seepage monitoring and repair program under Alternative Method 3. • No effects to surface water quality (as long as the Mitigation Measures continue to be carried out).

Surface Water Quantity

The potential net effects of Alternative Method 1, Alternative Method 2 and Alternative Method 3 on Surface Water - Quantity are as follows:

Alternative 1	Alternative 2	Alternative 3
• Increase in peak flows of up to 11% from Future Baseline Conditions. • Changes in catchment areas within the landfill optimization area are between -23% and 37% when compared to Future Baseline Conditions. • No change in off-site areas. • Increase in peak flows of up to 11% from Future Baseline Conditions.	• Increase in peak flows of up to 10% from Future Baseline Conditions. • Changes in catchment areas within the landfill optimization area are between -22% and 34% when compared to Future Baseline Conditions. • No change in off-site areas. • Increase in peak flows of up to 10% from Future Baseline Conditions.	• Increase in peak flows of up to 11% from Future Baseline Conditions. • Changes in catchment areas within the landfill optimization area are between -24% and 36% when compared to Future Baseline Conditions. • No change in off-site areas. • Increase in peak flows of up to 11% of Future Baseline Conditions.

Ecological Environment

Terrestrial Ecosystems

The potential net effects of Alternative Method 1, Alternative Method 2 and Alternative Method 3 on Terrestrial Ecosystem are as follows:

Alternative 1	Alternative 2	Alternative 3
• Minimal net effects with identified mitigation measures.	• Minimal net effects with identified mitigation measures.	• Minimal net effects with identified mitigation measures.

Aquatic Ecosystems

The potential net effects of Alternative Method 1, Alternative Method 2 and Alternative Method 3 on Aquatic Ecosystem are as follows:

Alternative 1	Alternative 2	Alternative 3
• No net effects to aquatic biota are anticipated.	• No net effects to aquatic biota are anticipated.	• No net effects to aquatic biota are anticipated.

Socio-Economic Environment

Social Environment

The potential net effects of Alternative Method 1, Alternative Method 2 and Alternative Method 3 on Social Environment are as follows:

Alternative 1	Alternative 2	Alternative 3
• Predicted odour concentrations may exceed criteria at discrete receptor locations and the frequency of odour levels above defined odour benchmarks may increase. • Visual CEV of 78, with 3 high CEV viewpoints, two moderate CEV viewpoints, and one low CEV viewpoint. • No net effects from litter, dust, noise, birds, and traffic. • Minor changes to use and enjoyment of property are anticipated due to increased odour at recreational areas located south of the landfill. • Minor changes in the level of satisfaction with living and working in the community due to increased odour and changes to the visual landscape.	• Predicted odour concentrations may exceed criteria at discrete receptor locations and the frequency of odour levels above defined odour benchmarks may increase. • Visual CEV of 77, with 3 high CEV viewpoints, two moderate CEV viewpoints, and one low CEV viewpoint. • No net effects from litter, dust, noise, birds, and traffic. • Minor changes to use and enjoyment of property are anticipated due to increased odour at recreational areas located south of the landfill. • Minor changes in the level of satisfaction with living and working in the community due to increased odour and changes to the visual landscape.	• Predicted odour concentrations may exceed criteria at discrete receptor locations and the frequency of odour levels above defined odour benchmarks may increase. • Visual CEV of 81, with 3 high CEV viewpoints and three moderate CEV viewpoints. • No net effects from litter, dust, noise, birds, and traffic. • Minor changes to use and enjoyment of property are anticipated due to increased odour at recreational areas located south of the landfill. • Minor changes in the level of satisfaction with living and working in the community due to increased odour and changes to the visual landscape.

Economic Environment

The potential net effects of Alternative Method 1, Alternative Method 2 and Alternative Method 3 on Economic Environment are as follows:

Alternative 1	Alternative 2	Alternative 3
• Existing 35 stable employment positions will continue for an additional 12 years during operation of Alternative Method 1. • Based on the average annual contributions, estimated at approximately $4.1 million, host community payments for the duration of Alternative Method 1 are estimated to amount to approximately $50 million. • Based on the trend of increasing tax rates over the	• Existing 35 stable employment positions will continue for an additional 12 years during operation of Alternative Method 2. • Based on the average annual contributions, estimated at approximately $4.1 million, host community payments for the duration of Alternative Method 2 are estimated to amount to approximately $50 million. • Based on the trend of increasing tax rates over the	• Existing 35 stable employment positions will continue for an additional 12 years during operation of Alternative Method 3. • Based on the average annual contributions, estimated at approximately $4.1 million, host community payments for the duration of Alternative Method 3 are estimated to amount to approximately $50 million. • Based on the trend of increasing tax rates over the

Alternative 1	Alternative 2	Alternative 3
past 5 years, it is conservatively assumed that WM's property tax contribution will continue to form at least 3.5% of the Township's property tax revenue for the duration of Alternative Method 1. • WM will continue to contribute to community projects during operation of Alternative Method 1. • Based on an annual average of $2.5 million in local expenditures, an estimated $30 million will be contributed to the local economy over the duration of Alternative Method 1.	past 5 years, it is conservatively assumed that WM's property tax contribution will continue to form at least 3.5% of the Township's property tax revenue for the duration of Alternative Method 2. • WM will continue to contribute to community projects during operation of Alternative Method 2. • Based on an annual average of $2.5 million in local expenditures, an estimated $30 million will be contributed to the local economy over the duration of Alternative Method 2.	past 5 years, it is conservatively assumed that WM's property tax contribution will continue to form at least 3.5% of the Township's property tax revenue for the duration of Alternative Method 3. • WM will continue to contribute to community projects during operation of Alternative Method 3. • Based on an annual average of $2.5 million in local expenditures, an estimated $30 million will be contributed to the local economy over the duration of Alternative Method 3.

Visual Landscape

The potential net effects of Alternative Method 1, Alternative Method 2 and Alternative Method 3 on Visual Landscape are as follows:

Alternative 1	Alternative 2	Alternative 3

• Total CEV values for six viewpoints:
  • High = 48
  • Moderate = 22
  • Low = 8
• Total CEV = 78
	• Total CEV values for six viewpoints:
	  • High = 48
	  • Moderate = 21
	  • Low = 8
	• Total CEV = 77
		• Total CEV values for six viewpoints:
		  • High = 61
		  • Moderate = 20
		  • Low = 0
		• Total CEV = 81

Cultural Environment

Cultural Heritage Resources

The potential net effects of Alternative Method 1, Alternative Method 2 and Alternative Method 3 on Cultural Heritage Resources are as follows:

Alternative 1	Alternative 2	Alternative 3
• No net effects to the heritage attributes of identified BHRs and CHLs.	• No net effects to the heritage attributes of identified BHRs and CHLs.	• No net effects to the heritage attributes of identified BHRs and CHLs.

Archaeological Resources

The potential net effects of Alternative Method 1, Alternative Method 2 and Alternative Method 3 on Archaeological Resources are as follows:

Alternative 1	Alternative 2	Alternative 3
• No net effects on on-site Archaeological Resources and areas of archaeological potential. • No net effects on the cemetery property.	• No net effects on on-site Archaeological Resources and areas of archaeological potential. • No net effects on the cemetery property.	• No net effects on on-site Archaeological Resources and areas of archaeological potential. • No net effects on the cemetery property.

Built Environment

Transportation

The potential net effects of Alternative Method 1, Alternative Method 2 and Alternative Method 3 on Transportation are as follows:

Alternative 1	Alternative 2	Alternative 3
• No net effects predicted.	• No net effects predicted.	• No net effects predicted.

Land Use

The potential net effects of Alternative Method 1, Alternative Method 2 and Alternative Method 3 on Land Use are as follows:

Alternative 1	Alternative 2	Alternative 3
• No significant net effects anticipated between the TCEC operation and any current land uses; setback distances are maintained. Legally established existing land uses (considered sensitive) within 500 m of the landfill site are permitted to continue to exist (pursuant to Section 34(9) of the Planning Act) • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls. • No significant net effects anticipated between the TCEC operation and any planned land uses; setback distances are maintained.	• No significant net effects anticipated between the TCEC operation and any current land uses; setback distances are maintained. Legally established existing land uses (considered sensitive) within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the Planning Act) • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls. • No significant net effects anticipated between the TCEC operation and any planned land uses; setback distances are maintained.	• No significant net effects anticipated between the TCEC operation and any current land uses; setback distances are maintained. Legally established existing land uses (considered sensitive) within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the Planning Act) • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls. • No significant net effects anticipated between the TCEC operation and any planned land uses; setback distances are maintained.

Alternative 1	Alternative 2	Alternative 3
• No significant net effects anticipated between the TCEC operation and any off-site recreational resources; setback distances are maintained. Legally established existing off-site recreational resources (considered sensitive) within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*). • No significant net effects anticipated between the TCEC operation and any existing and operating agricultural land use; setback distances are maintained. Legally established existing operating agricultural land uses within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*). • No significant net effects anticipated between the TCEC operation and any sensitive land use; setback distances are maintained. Legally established existing sensitive land use (considered sensitive) within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*).	• No significant net effects anticipated between the TCEC operation and any off-site recreational resources; setback distances are maintained. Existing off-site recreational resources (considered sensitive) within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*) . • No significant net effects anticipated between the TCEC operation and any sensitive land use; setback distances are maintained. Legally established existing sensitive land use (considered sensitive) within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*). • No significant net effects anticipated between the TCEC operation and any existing and operating agricultural land use; setback distances are maintained. Legally established existing agricultural land uses within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*).	• No significant net effects anticipated between the TCEC operation and any off-site recreational resources; setback distances are maintained. Legally established existing off-site recreational resources (considered sensitive) within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*). • No significant net effects anticipated between the TCEC operation and any sensitive land use; setback distances are maintained. Legally established existing sensitive land use (considered sensitive) within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*) . • No significant net effects anticipated between the TCEC operation and any existing and operating agricultural land use; setback distances are maintained. Legally established existing operating agricultural land uses within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*).

Section 7 – Comparative Evaluation of Net Effects and Identification of the Preferred Alternative

The results of the comparative evaluation of net effects for each alternative method, and the identification of the Preferred Alternative, as detailed in **Section 7** of the Draft EA Study Report are summarized below.

A comparison of Alternative Method 1, Alternative Method 2 and Alternative Method 3 was conducted to identify a Preferred Alternative for the undertaking. The predicted net effect(s) associated with each alternative method for each indicator were identified, and a preference rating was assigned (i.e., Preferred, Not Preferred, No Substantial Difference). Each alternative method was then rated at the criteria level (i.e., Preferred,

Not Preferred, No Substantial Difference) based on the identified preference rating for each indicator, and a rationale was provided.

Environmental Component	Evaluation Criteria	Preferred Alternative		
		Alternative Method 1	Alternative Method 2	Alternative Method 3
Natural Environment				
Atmospheric Environment	Air Quality – Dust	**No Substantial Difference**	**No Substantial Difference**	**No Substantial Difference**
	Air Quality – Landfill Gas and Combustion By-Products	**No Substantial Difference**	**No Substantial Difference**	**No Substantial Difference**
	Air Quality – Blowing Litter	**No Substantial Difference**	**No Substantial Difference**	**No Substantial Difference**
	Odour	**No Substantial Difference**	**No Substantial Difference**	**No Substantial Difference**
	Noise	**Not Preferred**	**No Substantial Difference**	**No Substantial Difference**
Preferred Alternative for the Atmospheric Environment		**Not Preferred**	**No Substantial Difference**	
Hydrogeology	Groundwater Quality	**No Substantial Difference**	**No Substantial Difference**	**No Substantial Difference**
	Groundwater Quantity	**No Substantial Difference**	**No Substantial Difference**	**No Substantial Difference**
Preferred Alternative for Hydrogeology		**No Substantial Difference**		
Surface Water Environment	Surface Water Quality	**No Substantial Difference**	**No Substantial Difference**	**No Substantial Difference**
	Surface Water Quantity	**Not Preferred**	**Preferred**	**Not Preferred**
Preferred Alternative for the Surface Water Environment		**Not Preferred**	**Preferred**	**Not Preferred**
Ecological Environment	Terrestrial Ecosystems	**No Substantial Difference**	**No Substantial Difference**	**No Substantial Difference**
	Aquatic Ecosystems	**No Substantial Difference**	**No Substantial Difference**	**No Substantial Difference**
Preferred Alternative for the Ecological Environment		**No Substantial Difference**		
Socio-Economic Environment				
Social Environment	Effects on Local Community	**Not Preferred**	**Preferred**	**Not Preferred**
Preferred Alternative for the Social Environment		**Not Preferred**	**Preferred**	**Not Preferred**
Economic Environment	Economic Effects on Local Community	**No Substantial Difference**	**No Substantial Difference**	**No Substantial Difference**

Environmental Component	Evaluation Criteria	Preferred Alternative		
		Alternative Method 1	Alternative Method 2	Alternative Method 3
Preferred Alternative for the Economic Environment		**No Substantial Difference**		
Visual Landscape	Visual Impact of Facility	**Not Preferred**	**Preferred**	**Not Preferred**
Preferred Alternative for Visual Landscape		**Not Preferred**	**Preferred**	**Not Preferred**
Cultural Environment				
Cultural Environment	Cultural Heritage Resources	**No Substantial Difference**	**No Substantial Difference**	**No Substantial Difference**
	Archaeological Resources	**No Substantial Difference**	**No Substantial Difference**	**No Substantial Difference**
Preferred Alternative for the Cultural Environment		**No Substantial Difference**		
Built Environment				
Transportation	Traffic Operations	**No Substantial Difference**	**No Substantial Difference**	**No Substantial Difference**
Preferred Alternative for Transportation		**No Substantial Difference**		
Current and Planned Future Land Use	Effects on Current and Future Land Uses	**No Substantial Difference**	**No Substantial Difference**	**No Substantial Difference**
Preferred Alternative for Current and Planned Future Land Use		**No Substantial Difference**		
Overall Preferred Alternative		**Not Preferred**	**Preferred**	**Not Preferred**

Alternative Method 2 is preferred over Alternative Methods 1 and 3 based on the comparative evaluation of the net effects of the Surface Water Environment (Surface Water Quantity), Social Environment (Effects on the Local Community), and Visual Landscape (Visual Impact of the Facility) as follows:

- Alternative Method 2 has the lowest increase in peak flows, has the lowest peaking elevation resulting in reduced runoff velocity and enhanced stormwater infiltration, and has the lowest increase in drainage area.
- Alternative Method 2 will result in an overall lower visual effect, and minor changes in the level of satisfaction with living and working in the community due to changes to the visual landscape. Section 8 – Net Effects of the Preferred Alternative

Net Effects of the Preferred Alternative

No net effects are expected for the following evaluation criteria:

- Air Quality – Landfill Gas and Combustion By-products
- Air Quality – Blowing Litter
- Groundwater Quantity
- Surface Water Quality
- Aquatic Ecosystems
- Cultural Heritage Resources
- Archaeological Resources
- Traffic Operations
- Climate Change (GHG Emissions)[1]

The net effects of the Preferred Alternative, summarized from **Section 8.2** of the Draft EA Study Report, are as follows:

Evaluation Criteria	Net Effects
Atmospheric Environment	
Air Quality – Dust	Concentrations of 24-hour TSP and 24-hour PM_{10} are predicted to exceed their respective criteria at discrete receptor locations under the three development scenarios. The maximum predicted 24-hour TSP concentrations ranged from 172 µg/m³ to 281 µg/m³ (criteria is 120 µg/m³), and the maximum predicted 24-hour PM_{10} concentrations ranged from 67 µg/m³ to 100 µg/m³ (criteria is 50 µg/m³). • The maximum predicted frequency of exceedance of 24-hour TSP and 24-hour PM_{10} at discrete receptor locations under the three development scenarios ranged from 0.5% (approximately 2 days per year) to 2.2% (approximately 8 days per year) at R4 for 24-hour TSP, and 0.4% (approximately 1.5 days per year) to 1.3% (approximately 5 days per year) at R4 for 24-hour PM_{10}. • Changes in the number of discrete receptors experiencing exceedances varies under the three development scenarios. A total of between 3 and 9 sensitive receptors were predicted to be affected by the exceedances of 24-hour TSP, while 3 sensitive receptors were predicted to be affected by the exceedances of 24-hour PM_{10}.
Air Quality – LFG and Combustion By-Products	No net effects. Changes in predicted concentrations will be minimal, and no exceedances are anticipated.
Air Quality – Blowing Litter	No net effects.
Odour	• Changes in the predicted concentration at each receptor vary depending on the stage of landfill operations. The maximum predicted odour concentrations exceed 1 OU/m³ at all receptors under all three development scenarios. Exceedances of 3 OU/m³ were predicted at between one (1) and 8 receptors depending on the development scenario.

[1] This is not an evaluation criteria; rather, it is an assessment that was conducted for the Preferred Alternative.

Evaluation Criteria	Net Effects
	No exceedances of 5 OU/m³ were predicted at any of the receptors under any development scenario. • Changes in frequency of predicted exceedances at each receptor vary depending on the stage of landfill operations. The highest overall frequency of exceedance of 1 OU/m³ ranged between 0.45% of the time at receptor R4 and 2.9% of the time at receptor R7 depending on the development scenario, compared to 1% of the time at R4 and R7 under Future Baseline Conditions. The highest overall frequency of exceedance of 3 OU/m³ ranged between 0.002% and 0.12% of the time at receptor R4, compared to 0.01% of the time at R4 under Future Baseline Conditions. • Changes in the number of discrete receptors with predicted concentrations the exceed criteria vary depending on the stage of landfill operations. Exceedances of 1 OU/m³ greater than 0.5% of the time were predicted to occur at between zero (0) and 19 receptors depending on the development scenario, compared to 6 under Future Baseline Conditions. Exceedances of 3 OU/m³ were predicted to occur at between one (1) and 8 receptors depending on the development scenario compared to two (2) under Future Baseline Conditions. • Predicted concentrations, frequency of predicted exceedance, and number of discrete receptors experiencing exceedances are expected to be similar to Future Baseline Conditions and decrease over the life of the Project as final cover is applied.
Noise	• Noise levels will meet applicable landfilling noise guidelines during daytime hours, with the implementation of the identified mitigation measures. • Changes in sound levels were qualitatively rated as insignificant (less than or equal to 3 dB).
Hydrogeology	
Groundwater Quality	Under the Preferred Alternative, the at-capacity CLS will increase 61 years to 163 years post-closure.
Groundwater Quantity	None, as long as the hydraulic trap design is maintained as required under the Waste and Sewage ECAs.
Surface Water Environment	
Surface Water Quality	No net effects provided that existing and additional mitigation measures are carried out.
Surface Water Quantity	• Increase in peak flows of up to 10% from Future Baseline Conditions. • Changes in catchment areas within the landfill optimization area are between -22% and 34% when compared to Future Baseline Conditions. • Increase in peak flows of up to 10% from Future Baseline Conditions.
Ecological Environment	
Terrestrial Ecosystems	Minimal net effect from prolonged attractiveness of the landfill to avifaunal scavengers with the implementation of identified mitigation measures.
Aquatic Ecosystems	No net effects.
Social Environment	
Human Health	• Risks associated with bromodichloromethane, 1,1,2,2-tetrachloroethane, and vinyl chloride are anticipated to be minimal. • No measurable long-term or short-term adverse health impacts were predicted to occur as a result of exposure to LFG combustion emissions, with the exception of worst-case H_2S concentrations.
Effects on Local Community	• Potential increases in predicted odour concentrations at discrete receptors; the frequency of exceedance and the number of affected receptors will vary depending on the stage of landfill operations.

Evaluation Criteria	Net Effects
	• Potential increases in predicted dust concentrations at discrete receptors at some points during site operation compared to Future Baseline Conditions; the frequency of exceedance and the number of affected receptors will vary depending on the stage of landfill operations. • Visual CEV of 77, with three high CEV viewpoints, two moderate CEV viewpoints, and one low CEV viewpoint. The Preferred Alternative was determined to have a high visual effect on 23 receptors, a moderate visual effect on 52 receptors, a low visual effect on 15 receptors. • No net effects from litter, noise, birds, and traffic. • Minor changes to use and enjoyment of property are anticipated due to increased odour at recreational areas located south of the landfill. • Minor changes in the level of satisfaction with living and working in the community due to increased odour and changes to the visual landscape.
Economic Environment	
Economic Effects on Local Community	Existing 35 stable employment positions will continue for an additional 12 years during operation of the Preferred Alternative. • Based on the average annual contributions under the current Host Community Agreement, estimated at approximately $4.1 million, host community payments for the duration of the Preferred Alternative are estimated to amount to approximately $50 million. • Based on the trend of increasing tax rates over the past 5 years, it is conservatively assumed that WM's property tax contribution will continue to form at least 3.5% of the Township's property tax revenue for the duration of the Preferred Alternative. • WM will continue to contribute to community projects during operation of the Preferred Alternative. • Based on an annual average of $2.5 million in local expenditures, an estimated $30 million will be contributed to the local economy over the duration of the Preferred Alternative.
Visual Landscape	
Visual Impact of the Facility	Total CEV values for six viewpoints: • High = 48 • Moderate = 21 • Low = 8 Total CEV = 77 The Preferred Alternative was determined to have a high visual effect on 23 receptors, a moderate visual effect on 52 receptors, a low visual effect on 15 receptors.
Cultural Environment	
Cultural Heritage Resources	No net effects.
Archaeological Resources	No net effects.
Transportation	
Traffic Operations	No net effects.
Current and Planned Future Land Use	
Effects on Current and Planned Land Uses	• The Preferred Alternative will require new planning approvals (County and Local OP, Township ZBL, and Site Plan Control), and result in continued restrictions for surrounding land uses for an additional 12 years.

Evaluation Criteria	Net Effects
Other	
Solar Exposure*	• Decrease (maximum 0.09% during the colder months and less than 0.03% during the summer months) in total solar energy received over the entire Phase 1-4 greenhouse. • Decrease (maximum 0.04% during any month) in total solar energy received over the entire Phase 5-8 greenhouse.
Climate Change (GHG emissions)*	No significant net effects.

Note: * This is not an evaluation criteria; rather, it is an assessment that was conducted on the Preferred Alternative.

No cumulative effects were identified.

Advantages and Disadvantages of the Preferred Alternative

The net effects of the Preferred Alternative were used to identify the advantages and disadvantages of the Preferred Alternative over the 'Do Nothing' Alternative. The 'Do Nothing' Alternative represents the future conditions if the Project does not proceed and is used as a benchmark against which the Preferred Alternative is compared. A description of the advantages and disadvantages of the Preferred Alternative over the 'Do Nothing' alternative is provided in **Section 8.4** of the EA Study Report.

Under the 'Do Nothing' Alternative, WM would not proceed with the development of additional disposal capacity within the TCEC, and landfill operations would cease in 2031 when the currently approved Expansion Landfill reaches capacity. WM would be unable to continue to provide disposal services to its customers and fulfill long-term contractual commitments within Ontario, and these customers, including a number of municipalities across Southern Ontario, would need to find alternate ways to manage their waste. The opportunity to optimize the investment in the facility infrastructure would be lost along with the economic contributions to the local economy. The 'Do Nothing' Alternative is not a viable option for WM's on-going business, its customers, and the Province of Ontario.

The Preferred Alternative was determined to have the following advantages over the 'Do Nothing' Alternative:

- lower peak storage used for SWM Ponds 2 and 4;
- 2% reduction in peak flows leaving the site;
- no changes to local businesses for an additional 12 years;
- 16 fewer 'high' effect visual receptors;
- continuation of 35 stable employment positions for an additional 12 years;

- continued host community payments, which make up approximately 24% of the Township's total gross annual operating budget and an approximately 36% of the Township's total municipal revenue, for an additional 12 years, amounting to approximately $50 million;
- continued property tax contributions (approximately 3.5% of the Township's property tax revenue) for an additional 12 years;
- continued contributions to community projects for an additional 12 years;
- an estimated $30 million in contributions to the local economy over 12 years;
- no need to accommodate future waste at another existing landfill or a new landfill elsewhere; and
- increased quantity of LFG available for use as a source of RNG as an alternative to fossil fuels.

The Preferred Alternative was determined to have the following disadvantages compared to the 'Do Nothing' Alternative:

- the predicted concentrations of dust contaminants at discrete receptors, the frequency of predicted exceedances, and the number of discrete receptors experiencing exceedances will be higher, but with the application of mitigation strategies, the predicted concentrations at discrete receptors, the frequencies of predicted exceedances at discrete receptors, and the numbers of off-site receptors potentially affected are expected to decrease to levels similar to Future Baseline Conditions;
- higher potential for blowing litter;
- higher sound levels (due to active landfilling operations versus ancillary sources) depending on the stage of landfill development;
- the CLS will be extended by 61 years;
- prolonged attractiveness of the landfill area to avifauna scavengers;
- increase in odour at discrete receptor locations, and continued dust emissions, litter, noise, birds, and traffic during operations for an additional 12 years;
- increase in the number of 'moderate' effect visual receptors by 15;
- minor changes to the use and enjoyment of property due to increased odour at recreational areas located south of the landfill;
- continued site traffic for an additional 12 years;
- will require new planning approvals (County and Local OP, Township ZBL, and Site Plan Control), and result in continued restrictions for surrounding land uses for an additional 12 years; and

- overall higher releases of GHGs due to the increase in total waste tonnage in place and continuation of on-site traffic.

Geotechnical Feasibility of the Preferred Alternative

A geotechnical feasibility study assessing potential vertical expansion methods was completed during the Terms of Reference (ToR) stage, with a commitment to undertaking a more detailed assessment of the Preferred Alternative during the Environmental Assessment (EA). Through consultation, feedback was received regarding geotechnical issues related to settlement of the landfill base and stability of the landfill side slopes. An additional geotechnical review was conducted for the Preferred Alternative, as documented in **Supporting Document 5**.

A settlement analysis was conducted to assess if the landfill base grades would meet the 0.5% minimum grade design toward the leachate collection system under the increased waste loading. The analysis concluded that cell floor settlement will not have a significant effect on functionality of the leachate collection systems. Overall slope in a westerly direction will be maintained, and leachate will continue to drain toward the designated withdrawal points.

A stability analysis was conducted to determine the safety factor associated with increasing the side slopes from 4H:1V to 2.5H:1V. The static safety factors and seismic safety factors are considered acceptable and comparable to typical target values.

Section 9 – Consultation and Engagement

In accordance with the MECP's Code of Practice: Preparing and Reviewing Environmental Assessments in Ontario (January 2014), Code of Practice: Consultation in Ontario's Environmental Assessment Process (January 2014), and as required by Section 5.1 of the *OEAA*, a consultation and engagement program involving government agencies, Indigenous communities and groups, and the public was carried out throughout the EA process.

A broad group of participants were consulted and engaged in the EA process. This included:

- Governmental departments, ministries, and agencies with an interest in the Project, referred to as the Government Review Team (GRT);
- Local municipalities, including the host Township of Warwick and the County of Lambton;
- Indigenous communities in the vicinity of the study areas or with a potential interest in the Project; and
- The general public, including local residents, landowners, businesses, and other stakeholders with an interest in the EA.

The list of participants was developed during the Terms of Reference (ToR) phase and was updated throughout the EA, with additions and removals made as necessary or upon request.

The following consultation and engagement activities were undertaken during the EA:

- Distribution of Notices (including Notice of Commencement, Notices of Public Information Sessions);
- Three Public Information Sessions (with a fourth planned concurrent with the release of the Draft EA Study Report);
- Review of Draft Existing Conditions Reports (ECRs) and Draft Effects Assessment Reports (EARs) by agencies, Indigenous communities and groups, and members of the public;
- Project website, email, and dedicated telephone contact;
- Consultation with agencies and organizations;
- Engagement with Indigenous communities and groups;
- Municipal council meetings and Public Liaison Committee meetings;
- Site tours;
- Media publications; and
- Review of the Draft EA Study Report.

During the ToR phase, the following Indigenous communities and organizations were identified as having a potential interest in the Project and were contacted during both the ToR and EA phases:

- Aamjiwnaang First Nation;
- Caldwell First Nation;
- Chippewas of Kettle and Stony Point First Nation (CKSPFN);
- Chippewas of the Thames First Nation (COTTFN);
- Delaware Nation at Moraviantown;
- Métis Nation of Ontario;
- Munsee Delaware Nation;
- Oneida Nation of the Thames; and
- Walpole Island First Nation – Bkejwanong Territory (WIFN).

Notices were provided to these Indigenous communities via email, mail, and through individual community consultation protocols. In addition to formal notifications, engagement activities such as meetings and technical reviews were conducted based on each community's preferences and requests. A commitment was made to continue

engagement with Indigenous groups with a potential interest in the Project throughout the EA.

Public Information Sessions were held on April 19, 2023, June 20, 2024, and November 27, 2024. A fourth session will be held on November 19, 2025, concurrent with the release of the Draft EA Study Report. These sessions provided opportunities for participants to learn about the Project, ask questions, and provide feedback.

Further details of all consultation and engagement activities are provided in **Section 9** of the Draft EA Study Report and in **Supporting Document 4**.

Section 10 – Monitoring and Commitments for the Undertaking

Monitoring strategies were developed so that environmental effects can be monitored during construction, operation and maintenance of the landfill to confirm that:

- predicted net effects are not exceeded;
- unexpected negative effects are addressed; and
- implemented mitigation measures are effective.

A Compliance Monitoring Program will be developed to confirm that the undertaking is implemented in accordance with the commitments outlined in the EA Study Report and any conditions of approval issued by the MECP.

Mitigation commitments include the development and/or continuation of management plans, monitoring programs, in-design mitigations, ECA amendments, implementation of operational controls, and contingency measures.

Monitoring commitments include the continuation of on-going monitoring programs, implementing monitoring programs as part of ECA amendments, implementing regular inspections, and undertaking compliance monitoring as required.

Specific monitoring details and commitments relating to each environmental component are outlined in **Section 10** of the Draft EA Study Report. WM will also develop a Compliance Monitoring Program to detail how WM will report annually on their compliance with the commitments made in the EA Study Report.

Section 11 – Approvals

The proposed undertaking will require additional approvals following EA approval. Amendments to the following ECAs issued by the Ministry of the Environment, Conservation and Parks (MECP) will be required:

- Waste ECA Number A032203

- Changes to the Design and Operations Plan for the proposed optimization.
- Updates to landfill gas (LFG) collection system, leachate collection system, and associated infrastructure.
- Incorporate updated noise monitoring protocols.
- Updates to Best Management Practices Plans (BMPPs) to account for new mitigation controls.
- Updates to the 2007 Environmental Monitoring Program (EMP) regarding groundwater and surface water quality monitoring.

- Industrial Sewage Works ECA Number 8177-CUSNXX
  - Changes to the Design and Operations Plan for the proposed optimization.
  - Modifications to the on-site existing stormwater management infrastructure.
  - Updates to the 2007 EMP regarding groundwater and surface water quality monitoring.
  - Updates to the Surface Water Contingency and Remedial Action Plan Warwick Landfill Site (, dated April 29, 2008 (Jagger Hims Limited, 2008) to account for new mitigative measures.
- Air ECA Number 6318-CX4NFX
  - Modifications to the emission control equipment for LFG and RNG management. landfill gas management infrastructure.
  - Updates to BMPPs the dust best management practices plan to account for new dust mitigation controls.
  - Incorporate updated noise monitoring protocol.

The following additional approvals are also anticipated to be required:

- Species at Risk (SAR):
  - An Information Gathering Form (IGF) has been submitted to the Ontario Ministry of Environment, Conservation, and Parks (MECP) for review and concurrence that the proposed undertaking will not result in effects to Species at Risk (SAR) or their habitat.
- Archaeological Resources:
  - A Stage 1 Archaeological Assessment has been completed and will be submitted to the Ministry of Citizenship and Multiculturalism (MCM) for review. Clearance will be required prior to site alterations, in accordance with the *Ontario Heritage Act*.

- Municipal Land Use Approvals:
  - Official Plan Amendments (County and Township): Required to permit the expansion of the existing landfill, as per both the County of Lambton and Township of Warwick Official Plans.
  - Zoning By-law Amendment (Township of Warwick): Required to reference the new EA approval and proposed landfill height.
  - Site Plan Control Agreement Amendment: Required to allow for the vertical expansion within the existing landfill footprint, in accordance with Section 41 of the *Planning Act*.

These approvals and amendments will be coordinated with the relevant provincial ministries and municipal authorities to ensure full regulatory compliance and alignment with planning policies.

Acronyms, Units and Glossary

Acronyms

Acronym	Definition
AA	Archaeological Assessment
AADT	Average Annual Daily Traffic
AAQC	Ambient Air Quality Criteria
AD	Anaerobic Digestion
ASI	Archaeological Services Inc.
ASR	Automobile Shredder Residue
BAO	Bereavement Authority of Ontario
BHR	Built Heritage Resource
BMP	Best Management Practices
BMPP	Best Management Practices Plan
CAAQS	Canadian Ambient Air Quality Standards
CAD	Canadian Dollar
CAGR	Compounded Annual Growth Rate
CCME	Canadian Council of Ministers of the Environment
CDR	Conceptual Design Report
CEV	Combined Effect Value
CHL	Cultural Heritage Landscapes
CKSPFN	Chippewas of Kettle and Stony Point First Nation
CLS	Contaminating Lifespan
COC	Contaminants of Concern
COTTFN	Chippewas of the Thames First Nation
CR	Concentration Ratios
C&D	Construction and Demolition
D&F	Dioxins and Furans
D&O	Design and Operations
DFO	Fisheries and Oceans Canada
EA	Environmental Assessment
EB	East-bound
EBS	Engineered BioSlurry

Acronyms

Acronym	Definition
ECA	Environmental Compliance Approval
ECCC	Environment and Climate Change Canada
EGLE	Environment, Great Lakes and Energy
ELC	Ecological Land Classification
EMP	Environmental Monitoring Program
EPA	Environmental Protection Agency
ESA	*Endangered Species Act*
ESDM	Emission Summary and Dispersion Modelling
EVGS	Early Vertical Gas System
FY	Fiscal Year
GHG	Greenhouse Gas
GIS	Geographic Information System
GRT	Government Review Team
GTA	Greater Toronto Area
GWP	Global Warming Potential
HC	Health Canada
HCM	Highway Capacity Manual
HDPE	High-Density Polyethylene
HDR	HDR Corporation
HELP	Hydrologic Evaluation of Landfill Performance
HHRA	Human Health Risk Assessment
IAA	*Impact Assessment Act*
IC&I	Industrial, Commercial, and Institutional
ID	Identification
IDF	Intensity-Duration-Frequency
IGF	Information Gathering Form
ILCR	Incremental Lifetime Cancer Risk
ISO	International Organization for Standardization
LFG	Landfill Gas
LMP	Leachate Management Plan
LOS	Level of Service
MCM	Ontario Ministry of Citizenship and Multiculturalism

Acronyms

Acronym	Definition
MECP	Ontario Ministry of Environment, Conservation and Parks
MMAH	Ontario Ministry of Municipal Affairs and Housing
MNR	Ontario Ministry of Natural Resources
MNRF	Ontario Ministry of Natural Resources and Forestry (now Ontario Ministry of Natural Resources)
MOE	Ontario Ministry of Environment (now Ontario Ministry of Environment, Conservation and Parks)
MOECC	Ontario Ministry of Environment and Climate Change (now Ontario Ministry of Environment, Conservation and Parks)
MPAC	Municipal Property Assessment Corporation
NPC	Noise Pollution Control
OEAA	*Ontario Environmental Assessment Act*
OMAFRA	Ontario Ministry of Agriculture, Food and Agribusiness
OP	Official Plan
OWMA	Ontario Waste Management Association
PAH	Polycyclic Aromatic Hydrocarbon
PFA	Process Funding Agreement
PIS	Public Information Session
PLCS	Primary Leachate Collection System
PLIL	Primary Leachate Indicator List
PM	Particulate Matter
POI	Point of Impingement
POR	Point of Reception
PPS	Provincial Policy Statement
PRD	Parks and Recreation Department
PRTCMP	Parks, Recreation, Tourism & Culture Master Plan
PTTW	Permit to Take Water
PVP	Property Value Protection
RCP	Representative Concentration Pathways
RNG	Renewable Natural Gas
ROF	Recyclable Organic Feedstock
SAR	Species at Risk
SCC	Species of Conservation Concern
SCRCA	St. Clair Region Conservation Authority

Acronyms

Acronym	Definition
SD	Supporting Document
SDL	Secondary Drainage Layer
SF	Slope Factor
SGRA	Significant Groundwater Recharge Area
SLEP	Sarnia-Lambton Economic Partnership
SLIL	Secondary Leachate Indicator List
SSO	Source Separated Organics
STR	Short-Term Receptor
SWH	Significant Wildlife Habitat
SWM	Stormwater Management
TCEC	Twin Creeks Environmental Centre
TEF	Benzo(a)pyrene
TEQ	Toxic Equivalency
THC	Total Hydrocarbon
ToR	Terms of Reference
TRB	Transportation Research Board
TRS	Total Reduced Sulphur
TRT	Technical Review Team
TSP	Total Suspended Particulate
TSS	Total Suspended Solids
USD	United States Dollars
VACF	Visual Absorption Capacity Factor
VLR	Vacant Lot Receptor
VOC	Volatile Organic Compound
WB	West-bound
WHO	World Health Organization
WIFN	Walpole Island First Nation
WM	WM Canada (Proponent)
WPLC	Warwick Public Liaison Committee
WQMN	Water Quality Monitoring Network
YMCA	Young Men’s Christian Association
ZBL	Zoning By-Law

Units

Unit	Definition
µg	microgram
µg/m³	microgram per cubic metre
µm	micrometre
A	amperes
cm	centimetre
cm/s	centimetres per second
cms	cubic metres per second
dB	Decibel
dBA	Decibel, weighted to reflect human sensitivity to sound using the A-weighting scale.
dBAI	A-weighted sound pressure level of an impulsive sound measured with a sound level meter set to "impulse" response corresponding to a rising slope time of 35 ms
h	hour
ha	hectares
ha·m	hectare-metre
hrs	hours
Hz	hertz
kg	kilogram
km	kilometre
km/h	kilometres per hour
kN/m³	kiloNewtons per cubic metre
kPa	kilopascal
L	Litre
L/s	Litres per second
m	metre
m²	square metres
m³	cubic metres
M m³	million cubic metres
m³/day	cubic metres per day
m³/h	cubic metres per hour
m³/s	cubic metres per second
m³/year	cubic metres per year
masl	metres above sea level
mbgs	metres below ground surface
mm	millimetre
MPa	megapascal
mS	millisiemens

Units

Unit	Definition
OU	odour unit
OU/m³	odour units per cubic metre
pg	picogram
TEQ/m³	toxic equivalency per cubic metre
V	voltage
v/c	volume to capacity ratio

Glossary

Term	Definition
Approval	Permission granted by an authorized individual or organization for an undertaking to proceed. This may be in the form of program approval, certificate of approval or provisional certificate of approval.
Active cell	A landfill cell is a waste-holding unit within the landfill area. The “active cell” is the waste-holding unit where waste is currently being deposited.
Active face	The working surface of a landfill within the active cell upon which waste is deposited each day before placement of daily cover. Often referred to as “working face” or “active working face”.
Ambient monitoring	The systematic, long-term assessment of pollutant levels by measuring the quantity and types of certain pollutants in the surrounding, outdoor air.
Approval	Permission granted by an authorized individual or organization for an undertaking to proceed. This may be in the form of program approval, certificate of approval or provisional certificate of approval.
Aquifer	A formation or body of permeable rock that stores and transmits groundwater.
Atmospheric Environment	The atmospheric environment includes air quality, odour, noise, and litter.
Automobile Shredder Residue	Commonly referred to as “auto fluff”, is produced as a waste stream when scrap vehicles are shredded to recover metals. The material may include a complex mix composed of plastics, foams, rubber, glass, moisture, dirt and small fragments of uncovered metals contaminated with fluids and lubricants.
Avifauna	Birds found in a specific region.
Benthic Invertebrate	Organisms that live on or within the bottom of water bodies like rivers and lakes and do not have a vertebral column.
Biodiversity	The variety of life found in an ecosystem or region.
Built Heritage Resource	“…a building, structure, monument, installation or any manufactured or constructed part or remnant that contributes to a property’s cultural heritage value or interest as identified by a community, including an Indigenous community” (Ministry of Municipal Affairs and Housing 2024, 40).
Capacity (Disposal Volume)	The total volume of air space available for disposal of waste at a landfill site for a particular design (typically in m³); includes both waste and daily cover materials but excludes the final cover.

Glossary

Term	Definition
Channelized	Channelized right-turns have separate turn lanes that diverge from the roadway and allow vehicles to perform the turn at higher speeds rather than coming to a full stop or slowing down to perform the right-turn at the intersection. Channelized right-turns are typically under yield control rather than stop control.
Circular Failure Surface	A hypothetical curved plane within a slope along which a potential soil failure might occur.
Combustion Gases	Combustion Gases include sulphur dioxide, nitrogen dioxide, carbon monoxide, hydrogen chloride and hydrogen sulphide (evaluated within the "combustion gases" group due to its presence as a gas under ambient conditions and its irritating effects to the eyes and respiratory system)
Composting facility	A facility designed to compost organic matter either in the presence of oxygen (aerobic) or absence of oxygen (anaerobic).
Composting	The controlled microbial decomposition of organic matter, such as food and yard wastes, in the presence of oxygen, into finished compost (humus), a soil-like material. Humus can be used in vegetable and flower gardens, hedges, etc.
Concentration Ratio (CR)	For combustion gases, potential health risks to residents for acute and chronic exposures were assessed as concentration ratio values (CR). CR values were calculated by dividing the predicted air concentration with the reference concentration (RfC), according to the following equation: Concentration Ratio = Predicted Air Concentration / Reference Concentration
Contaminant of Concern (COC)	Chemical substances found at the site that are determined to pose an unacceptable risk to human health or the environment.
Cultural Heritage Landscape	"…a defined geographical area that may have been modified by human activity and is identified as having cultural heritage value or interest by a community, including an Indigenous community. The area may include features such as buildings, structures, spaces, views, archaeological sites or natural elements that are valued together for their interrelationship, meaning or association" (Ministry of Municipal Affairs and Housing 2024, 41).
Deciduous	A tree or plant that seasonally sheds leaves in autumn.
Delay	Delay is the amount of time, expressed in seconds, that a vehicle is expected to have to wait when traveling through an intersection. Delays are often expressed as Level of Service level grades.
Discrete Receptor	A specific location where air quality models predict pollutant concentrations.
Ecological Land Classification	A landscape mapping tool developed for the province of Ontario by H.T. Lee and others whereby ecological units are delineated on the basis of similar vegetation and soil characteristics.
Electrofishing	A method used to sample fish populations to understand the density, abundance, and species composition in a particular waterbody. An electric current is used to temporarily stun fish, which can then be collected for identification prior to being released alive.

Glossary

Term	Definition
Environment	As defined by the Environmental Assessment Act, environment means: • air, land or water; • plant and animal life, including human life; • the social, economic and cultural conditions that influence the life of humans or a community; • any building, structure, machine or other device or thing made by humans; • any solid, liquid, gas, odour, heat, sound, vibration or radiation resulting directly or indirectly from human activities; or • any part or combination of the foregoing and the interrelationships between any two or more of them (ecosystem approach).
Environmental Assessment (EA)	A systematic planning process that is conducted in accordance with applicable laws or regulations aimed at assessing the effects of a proposed undertaking on the environment.
Evaluation criteria	Evaluation criteria are considerations or factors taken into account in assessing the advantages and disadvantages of various alternatives being considered.
Existing Landfill	The landfill along the eastern portion of the TCEC that was the 'Warwick Landfill' that opened in 1972.
Expansion Landfill	The landfill west of the Existing Landfill at the TCEC that was approved for construction in 2008, with landfilling commencing in late 2009.
Fugitive emissions	Unintended releases of gases or vapours into the atmosphere.
Greenhouse gas (GHG)	Any of the gases whose absorption of solar radiation is responsible for the greenhouse effect, including carbon dioxide, methane, ozone, and the fluorocarbons.
Guideline B-7	Groundwater quality management tool adopted by the MECP for the reasonable use of groundwater resources adjacent to waste disposal sites (Procedure B-7-1). The reasonable use concept outlines the MECP's expectation of sites that discharge contaminants that could impact groundwater resources and provide guidance toward establishment of contaminant attenuation zones (CAZ).
Impact	Includes negative and positive, direct and indirect effects to an identified built heritage resource and cultural heritage landscape. Direct impacts include destruction of any, or part of any, significant heritage attributes or features and/or unsympathetic or incompatible alterations to an identified resource. Indirect impacts include, but are not limited to, creation of shadows, isolation of heritage attributes, direct or indirect obstruction of significant views, change in land use, land disturbances (Ministry of Citizenship and Multiculturalism 2006b). Indirect impacts also include potential vibration impacts.
Incremental Lifetime Cancer Risk (ILCR)	For carcinogenic chemicals, potential risks are expressed as an Incremental Lifetime Cancer Risk Level (ILCR) which is calculated by multiplying the estimated exposure by the cancer slope factor (q1*). An ILCR of 1 x 10-6 is considered to be an acceptable risk level per pathway by the Ontario Ministry of the Environment.
Indicators	Indicators are specific characteristics of the evaluation criteria that can be measured or determined in some way, as opposed to the actual criteria, which are fairly general.
Known Built Heritage Resource or Cultural Heritage Landscape	A known built heritage resource or cultural heritage landscape is a property that has recognized cultural heritage value or interest. This can include a property listed on a Municipal Heritage Register, designated under Part IV or V of the Ontario Heritage Act, or protected by a heritage agreement, covenant or easement, protected by the Heritage Railway Stations Protection Act or the Heritage Lighthouse Protection Act, identified as a Federal Heritage Building, or located within a U.N.E.S.C.O. World Heritage Site (Ministry of Citizenship and Multiculturalism 2022).
Land Use	Land use refers to the human activities and purposes for which land is utilized. It encompasses various economic and cultural uses, such as agricultural, residential, commercial, institutional, industrial, mining, conservation and recreational practices.

Glossary

Term	Definition
Landfill gas (LFG)	The gases produced from the wastes disposed in a landfill; the main constituents are typically carbon dioxide and methane, with small amounts of other organic and odour-causing compounds.
Landfill site	An approved engineered site/facility used for the final disposal of waste. Landfills are waste disposal sites where waste is spread in layers, compacted to the smallest practical volume, and typically covered by soil.
Leachate	Liquid that drains from solid waste in a landfill and which contains dissolved, suspended and/or microbial contaminants from the breakdown of this waste.
Level of Service (LOS)	Level of Service is a letter grade intended to represent the amount of delay (in seconds) experienced by a traffic movement. Level of Service ranges from 'A' (least delay) to 'F' (most delay). Typically, Level of Service 'A', 'B', and 'C' are considered acceptable, Level of Service 'D' is considered within acceptable range but justifies monitoring, and Level of Service 'E' and 'F' indicate deficiencies.
Metals	Metals: arsenic, cadmium, lead, and mercury
Mitigation	Measures taken to reduce adverse impacts on the environment.
Moraine	Material (usually soil and rock) left behind by a moving glacier.
Natural Environment	The natural environment, as defined for the EA, includes the atmospheric environment, geology and hydrogeology, the surface water environment, and the ecological environment.
Natural Heritage	Refers to the components of the natural environment, inclusive of flora, fauna, ecosystems, and geological structures that provide important functions and hold special value for present and future generations.
Particulate Matter	Particulate Matter includes: Total Suspended Particulate, PM10 and PM2.5
Phytoremediation System	A technology that uses plants to reduce the level of toxic contaminants in the environment by extracting and immobilizing pollutants from soil or water.
Point of Reception (POR)	A location where noise from landfill operations, ancillary facilities, pest control devices or haul route is received which is: • on the façade of a dwelling; • on the property of, and within 30 m of a dwelling; • on the façade of a noise-sensitive commercial-purpose building (e.g., hotel, motel); or • on the façade of a noise-sensitive institutional-purpose building (e.g., hospital, day nursery, educational facility, place of worship not on commercially or industrially zoned land); • on a vacant lot zoned for noise-sensitive use that is accessible by road or navigable waterway.
Poplar Plantation	A plantation of fast-growing poplar trees planted to stabilize soil, reduce leachate, aid in contaminant uptake, and improve site aesthetics.
Potential Built Heritage Resource or Cultural Heritage Landscape	A potential built heritage resource or cultural heritage landscape is a property that has the potential for cultural heritage value or interest. This can include properties/project area that contain a parcel of land that is the subject of a commemorative or interpretive plaque, is adjacent to a known burial site and/or cemetery, is in a Canadian Heritage River Watershed, or contains buildings or structures that are 40 or more years old (Ministry of Citizenship and Multiculturalism 2022).
Proponent	A person who: • carries out or proposes to carry out an undertaking; or • is the owner or person having charge, management or control of an undertaking.

Glossary

Term	Definition
Provincially Significant Wetland	Wetlands that are designated as significant by the province of Ontario, as determined by a science-based ranking system.
Queue	Vehicle queues are expressed in metres. The 95th percentile queue is typically used to determine storage needs, but the 50th percentile queue is also used to understand average queues.
Receptor	The person, plant or wildlife species that may be affected due to exposure to a contaminant.
Renewable Natural Gas (RNG)	Product of the decomposition of organic matter that is collected from the landfill site, as opposed to traditional natural gas, which is collected from deep wells.
Riparian Area	Refers to the area immediately adjacent to a waterbody that is the interface between terrestrial and aquatic ecosystems.
Sedimentation Pond	A constructed pond built to capture surface water runoff from impervious surfaces and retain it while suspended sediments and other particulates settle out of the water column. Used to improve water quality prior to discharging to the landscape.
Sewage ECA	Amended ECA for an Industrial Sewage Works No. 2403-BE6LZ4, dated August 21, 2019
Significant Wildlife Habitat	Specific habitat types used by wildlife that are considered significant in Ontario based on a discrete set of criteria developed by the Ministry of Natural Resources and Forestry. Includes seasonal concentration areas, rare vegetation communities or specialized habitats for wildlife, habitats of Species of Conservation Concern, and animal movement corridors.
Significant Woodland	Forested areas that are ecologically important in terms of species composition, tree age and stand history, ecological functions, and contributions to the broader landscape. Criteria for determining if a treed feature is a Significant Woodland in Lambton County are described in the Lambton County Official Plan (County of Lambton 2020).
Significant Groundwater Recharge Area	An area where groundwater recharge rates are predicted to be typically greater than that of surrounding areas.
Significant	With regard to cultural heritage and archaeology resources, significant means “resources that have been determined to have cultural heritage value or interest. Processes and criteria for determining cultural heritage value or interest are established by the Province under the authority of the Ontario Heritage Act” (Ministry of Municipal Affairs and Housing 2024, 52).
Species at Risk	Species listed on the Species at Risk in Ontario List (SARO), Ontario Regulation (O. Reg.) 230/08. These include species identified by the Committee on the Status of Species at Risk in Ontario (COSSARO) as provincially Endangered or Threatened. Species listed by COSSARO as Endangered or Threatened are protected by the Endangered Species Act, 2007 (ESA), which includes protection of the species’ habitat.
Species of Conservation Concern	Inclusive of species in the following categories: • Species designated provincially as Special Concern; • Species that have been assigned a conservation status (S-Rank) of S1 to S3 or SH by the Natural Heritage Information Centre (Ministry of Natural Resources and Forestry); and • Species that are designated federally as Threatened or Endangered by the Committee for the Status of Endangered Wildlife in Canada (COSEWIC), but not provincially by Committee on the Status of Species at Risk in Ontario (COSSARO). If these species are listed under the Species at Risk Act (SARA) under Schedule 1 they are protected by the federal Act but not the provincial ESA.

Glossary

Term	Definition
Storage and Taper	Exclusive turning lanes for left-turns or right-turns can have two components to the lanes design: storage and taper. The storage is the section for storing vehicles while they wait to perform their turn. The taper is the segment of the left-turn lane where the lane begins to widen until it reaches the storage segment. The taper is intended for vehicles to transition from the adjacent through-lane and decelerate prior to entering the storage area.
Study area	A designated region covered under the scope of a particular scientific investigation or study. For ecological impact studies, the Study Area typically includes a specific tract of land plus the surrounding area, or primary zone of influence. The Study Area usually considers adjacent lands (that is, the distance from a particular natural feature for considering potential negative impacts from a proposed undertaking) within at least 120m.
Subwatershed	A watershed is an area of land that water flows over and/or through before draining into a particular waterbody. A subwatershed is a small watershed that is generally nested within a larger watershed, and drains a smaller landmass in comparison to the overall watershed.
Terms of Reference (ToR)	A terms of reference is a document that sets out detailed requirements for the preparation of an Environmental Assessment.
Thermal regime	A regular pattern of temperature fluctuation within a waterbody.
Time of concentration	The time required for water falling on the most remote point of a drainage basin to reach the outlet where remoteness relates to time of travel rather than distance.
Undertaking	Is defined in the Environmental Assessment Act as follows: • An enterprise or activity or a proposal, plan or program in respect of an enterprise or activity by or on behalf of Her Majesty in right of Ontario, by a public body or public bodies or by a municipality or municipalities; • A major commercial or business enterprise or activity or a proposal, plan or program in respect of a major commercial or business enterprise or activity of a person or persons other than a person or persons referred to in clause (1) that is designated by the regulations; or • An enterprise or activity or a proposal, plan or program in respect of an enterprise or activity of a person or persons, other than a person or persons referred to in clause (a), if an agreement is entered into under section 3.0.1 in respect of the enterprise, activity, proposal, plan or program ("enterprise").
Vascular flora	Plant species that possess a vascular system, comprised of xylem and phloem, used to distribute water, minerals, and other resources to different tissues.
Volatile Organic Compounds (VOCs)	Volatile organic compounds are compounds that have a high vapor pressure and low water solubility. Volatile Organic Compounds include: 1,1-Dichloroethane, Methylene chloride, Dimethylsulphide, 1,2-Dichloroethane, Methyl mercaptan, Chloroethane, Butan-2-ol, Trichloroethylene, 1,1,2-Trichloroethane, Bromodichloromethane, Benzene, 1,1,2,2-Tetrachloroethane, Vinyl Chloride, Ethyl mercaptan, 1,1-Dichloroethylene, and Octane
Volume-to-Capacity Ratio (V/C)	The volume-to-capacity (v/c) ratio is a measure of the degree of capacity utilized at an intersection or for a specific traffic movement. Volume-to-capacity ratios can range from zero (when there is no demand), to 1.00 (when the movement is operating at capacity). If a v/c ratio exceeds 1.00 then the software is either underestimating the capacity for existing conditions, or is predicting that the intersection will not be able to serve the projected demand within the analysis period, resulting in queue buildup.
Waste ECA	Amended Environmental Compliance Approval (ECA) No. A032203, dated December 19, 2020.
Waste	Refuse from places of human or animal habitation; unwanted materials left over from a manufacturing process.

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1 Introduction

This section of the Draft Environmental Assessment (EA) Study Report presents background information about the Twin Creeks Environmental Centre (TCEC), and an overview of the TCEC Landfill Optimization Project, the proponent (WM Canada), and the EA.

1.1 Background

WM Canada (WM), in consultation with agencies, the Township of Warwick, Indigenous communities, and the public, has undertaken an EA to provide additional landfill disposal capacity at the TCEC.

The TCEC, located at 5768 Nauvoo Road, Watford, Ontario, is approximately 1 kilometre (km) north of the Village of Watford in the Township of Warwick, southeast of the intersection of Zion Line and Nauvoo Road. The regional setting of the TCEC is shown on **Figure 1-1**.

The TCEC is a 301-hectare (ha) regional facility serving the Province of Ontario that provides safe and convenient disposal services for communities, businesses and industries. The landfill is approved to receive municipal, industrial, commercial, and institutional (IC&I) solid non-hazardous wastes generated, including non-hazardous contaminated soil. The landfill is engineered with environmental protection systems that meet or exceed regulatory requirements including engineered liners and covers, leachate collection and removal, landfill gas (LFG) collection and control, and leachate management through on-site phytoremediation and off-site disposal, and is subject to highly regulated monitoring and reporting requirements.

The TCEC commenced operations in 1972 as the Warwick Landfill, which was acquired by WM in 1996. The TCEC includes the Expansion Landfill, the closed Old Landfill (i.e., the original Warwick Landfill), a site office, a maintenance facility, a weigh scale, four stormwater management (SWM) ponds, leachate management infrastructure, LFG management infrastructure, a popular system for leachate management, a poplar plantation, an excess soil stockpile, and a Renewable Natural Gas (RNG) Facility. These facilities are shown on **Figure 1-2**.

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Figure 1-1. Regional Setting

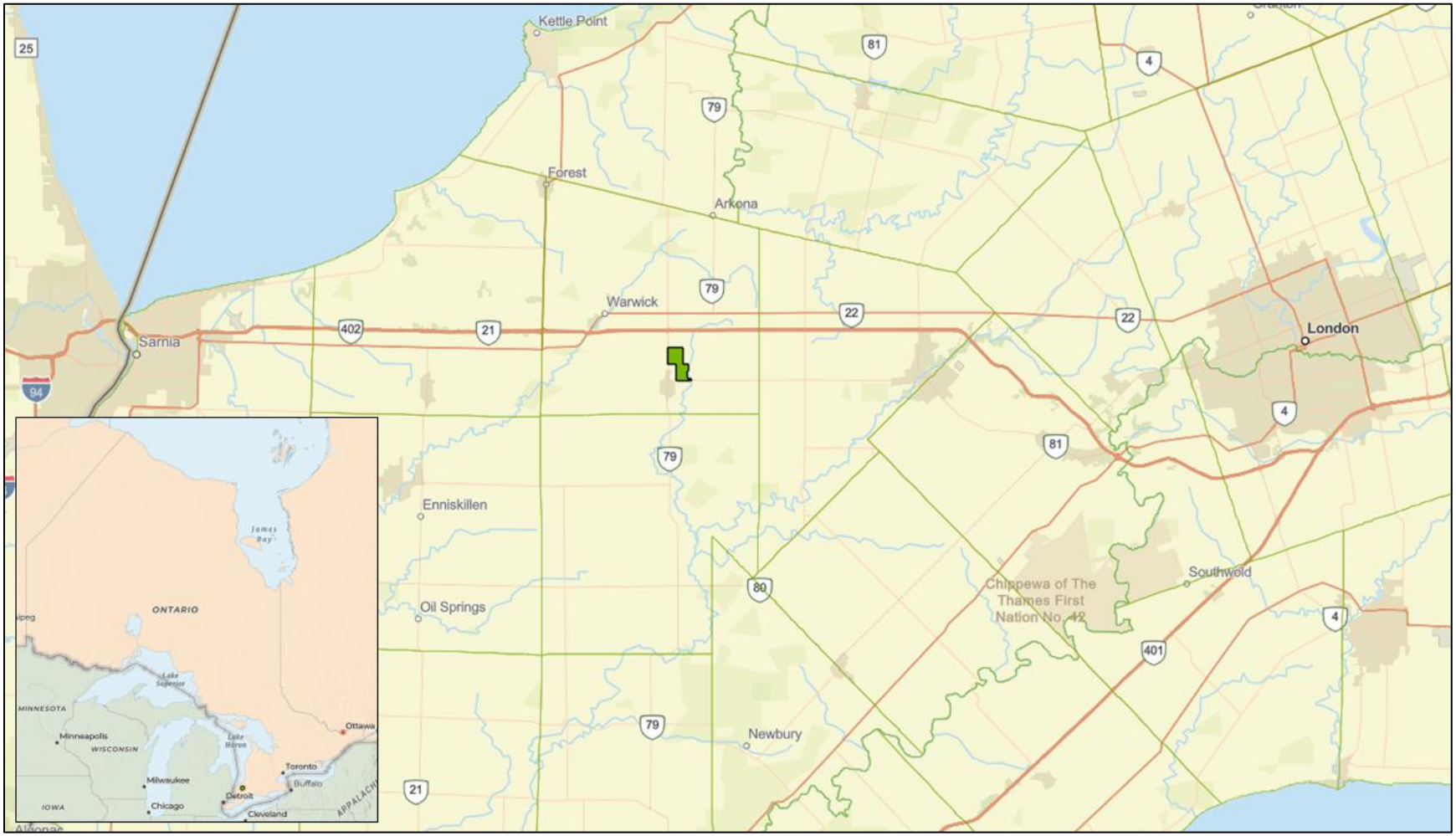
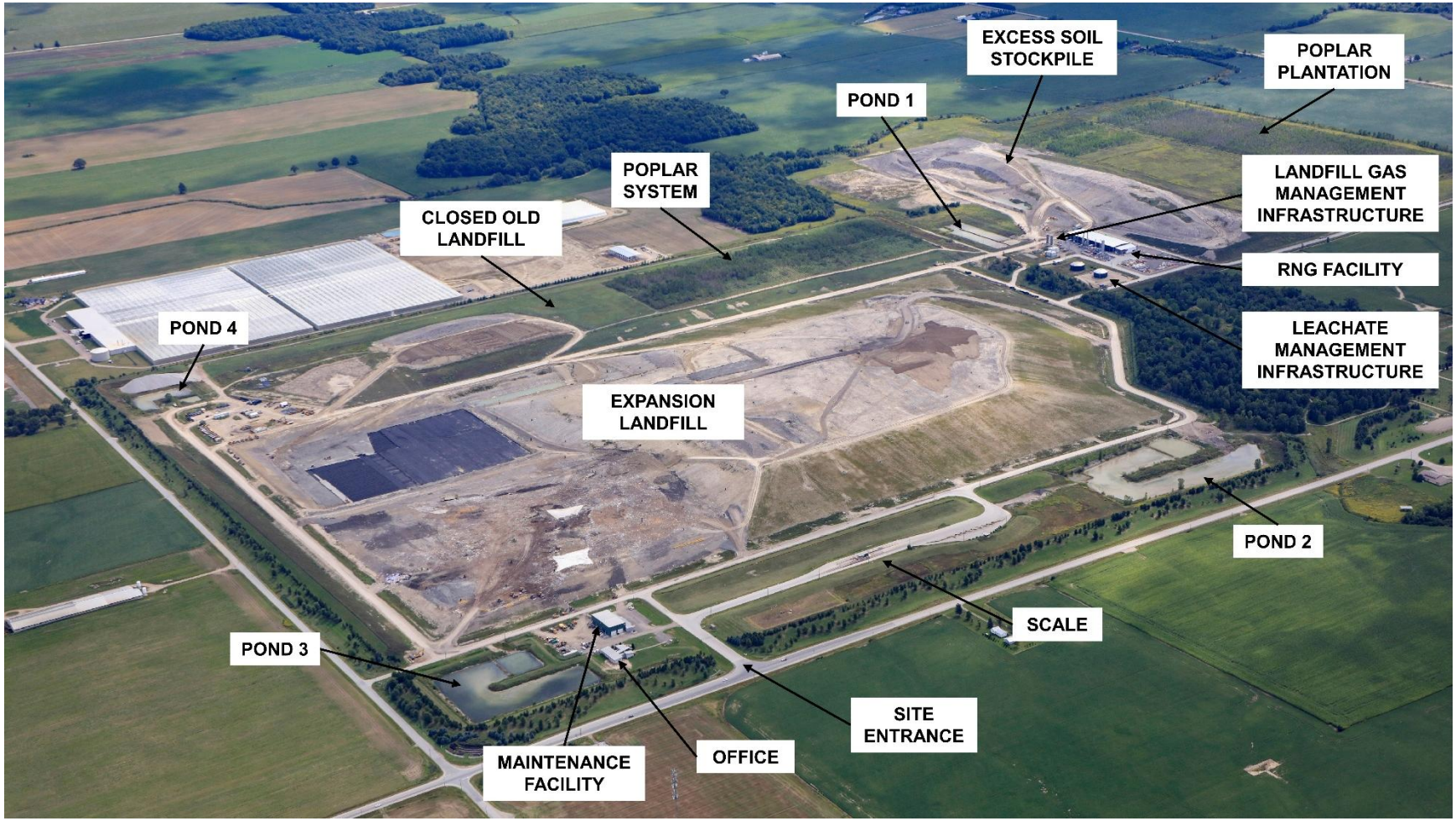


Figure 1-2. TCEC Site



The Warwick Landfill was approved for expansion under the *Ontario Environmental Assessment Act* (*OEAA*) in 2007 (MECP, 1990), and waste was first deposited into the Expansion Landfill in November 2009. The pre-existing site was originally approved for a waste capacity of 3,072,000 cubic metres (m³) within an area of 32.4 ha. The approval of the Expansion Landfill increased the total airspace capacity to 26,508,000 m³ over an area of 101.8 ha, within the total TCEC site area of 301 ha. The Expansion Landfill is operated by WM under the Ontario Ministry of Environment, Conservation and Parks (MECP) Environmental Compliance Approval (ECA) No. A032203. Under the ECA, the landfill is allowed to receive up to a maximum of 1.4 million tonnes per year of waste, including contaminated soil, for disposal at the site. There are approximately 6 years of approved landfill airspace capacity remaining at the TCEC (i.e., capacity will be reached in approximately 2031).

1.2 TCEC Landfill Optimization Project

The purpose of the TCEC Landfill Optimization Project (the Project) is to provide additional landfill disposal capacity of approximately 14.3 million m³ as part of the optimization of the design and operation of the TCEC Expansion Landfill, which could extend the site life by approximately 12 years (from 2031 to 2043). This may be achieved through alternative landfill configurations (alternative methods) within the existing 301 ha TCEC site area. No changes are proposed to the size of the TCEC site area, approved service area, or annual fill rate.

There is a need for the continued development of the TCEC as it is a significant component of the provincial waste management network and infrastructure, which is lacking in sufficient and secure long-term disposal capacity. Optimizing the future development of the TCEC allows for on-going sustainable business operations and continued provision of essential financial support for community services and programs.

1.3 Proponent

The proponent for the Project is WM Canada (WM). WM provides a broad range of comprehensive waste management related services across North America, including collection, transfer, recycling and resource recovery, and disposal services throughout Canada.

WM employs over 1,500 skilled workers and qualified professionals across six provinces and manages its Canadian operations from its head office, located in Kitchener, Ontario. Within Ontario, WM's operations include seven natural gas fueling stations, five materials recovery / baling facilities, 15 transfer stations, 16 hauling sites, and two active landfills. Over the past 50 years, the company has provided services to over 250,000 residential, commercial, and industrial customers in Ontario alone.

WM is a local company and primary service provider for the collection and disposal of waste generated in the Township of Warwick, Lambton County and throughout

Ontario. The company's mission is to maximize resource value while minimizing environmental impact to improve economic and environmental sustainability for its stakeholders, including municipal partners, and residential and commercial customers.

WM is proud to be an active supporter of community events and programs that make the Township of Warwick and surrounding areas a strong and healthy place to live, work, and play. Community benefits include host community fees, local sports club donations, downtown amenities, arena upgrades, a dog park addition, Watford and Warwick fire department donations, and various other charitable contributions and community events.

The WM contact for this project is:

Mr. Wayne Jenken
Landfill Engineering Manager, Canada Area
WM Canada
5768 Nauvoo Road, Watford, ON N0M 2S0
Phone: 519.849.5810
E-mail: wjenken@wm.com

1.4 TCEC Landfill Optimization Project EA

The EA is being carried out in accordance with the requirements of the *OEAA* and the EA Terms of Reference (ToR) (**Appendix A**), which was approved by the MECP on December 13, 2022.

The EA Study Report documents the approved study process as well as the results and recommendations. In accordance with the approved ToR, phases of the EA included the following:

1. Describing the environment potentially affected by the Project in relation to the proposed evaluation criteria, indicators, and data sources.
2. Describing each of the conceptual design alternative methods in sufficient detail for assessment.
3. Predicting the environmental effects for each alternative method using the criteria, indicators, and data sources, considering mitigation measures.
4. Conducting a comparative evaluation of the alternative methods and identifying the Preferred Alternative based on the results of the comparative evaluation.
5. Assessing the effects of the Preferred Alternative on the environment.

A thorough and inclusive consultation and engagement program was undertaken as part of the EA. The results of the EA and updates were provided to agencies, Indigenous communities, and the public at key milestones during EA preparation.

2 Overview of the Environmental Assessment Process and Study Organization

This section of the Draft Environmental Assessment (EA) Study Report provides an overview of the EA process, the regulatory environment, and the organization of the EA Study Report.

2.1 EA Process

The EA was undertaken in accordance with the Terms of Reference (ToR) approved by the Minister of Environment, Conservation and Parks in December 2022 (**Appendix A**) and the requirements of the *Ontario Environment Assessment Act* (*OEAA*), which are described in **Section 2.2.1**. The development of the ToR was the first step in the two-step *OEAA* approval process for the Project, with the second step being the EA.

An overview of the EA process for the Twin Creeks Environmental Centre (TCEC) Landfill Optimization Project EA is provided in **Figure 1-1**.

2.2 Regulatory Environment

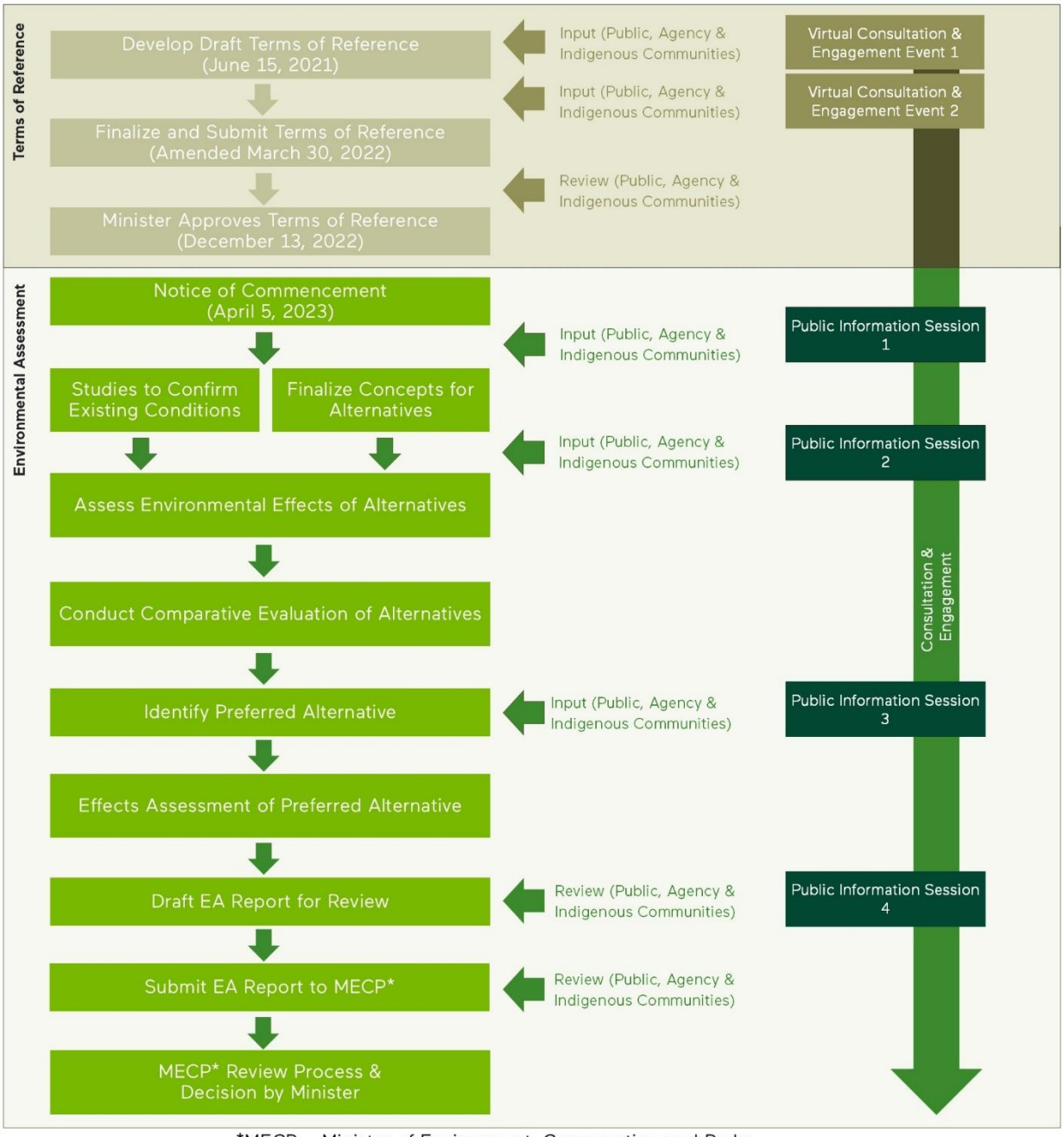
2.2.1 Ontario Environmental Assessment Act

The overall purpose of the *OEAA* is to promote good environmental planning through the protection, conservation, and management of Ontario's environment. The intent of the *OEAA* is to have proponents predict the environmental effects of their proposed initiatives or projects before they are carried out (MECP, 1990). To achieve this, the *OEAA* ensures that proponents consider environmental concerns and opportunities associated with a project along with alternatives, and that the potential effects are investigated and mitigated through the planning process prior to implementation and construction. A key component of the *OEAA*, as well as good planning, is to ensure that reasonable and meaningful consultation and engagement opportunities for members of the public, agencies, Indigenous communities, and other key stakeholders are provided throughout the planning process.

The *OEAA* requires a ToR to be prepared and approved by the Minister of Environment, Conservation and Parks prior to undertaking the EA. At the time of ToR development, the Project was designated as an undertaking in accordance with Section 4 of Ontario Regulation (O.Reg.) 101/07 of the *OEAA*, which was revoked in February 2024 (MECP, 2007a). After the revisions to the *OEAA* and associated regulations, the Project is designated as a Part II.3 project under the *OEAA* in accordance with O.Reg. 50/24 (MECP, 2024).

The ToR for the EA (approved December 2022) sets the framework, considerations, and commitments for how the EA will be undertaken and provides overall direction for the EA. **Appendix B** of this EA Study Report details how the EA has fulfilled the commitments made in the approved ToR.

Figure 2-1. TCEC Landfill Optimization Project EA Process



*MECP = Ministry of Environment, Conservation and Parks

2.2.1.1 Undertaking by a Private Proponent

WM prepared the approved ToR (**Appendix A**) in accordance with subsection 6(2)(c) of the *OEAA* that was in effect at the time, which allowed WM to set out in detail the requirements for preparation of the EA. WM planned to proceed under subsection 6(2)(c) and 6.1(3) of the *OEAA*, which allowed proponents to focus the EA and consideration of alternatives to address their specific needs and circumstances (MECP, 1990). The *OEAA* has since been revised, and subsections 6(2)(c) and 6.1(3) are now subsection 17.4(2)(c).

The approved ToR provided justification for the rationale for the undertaking as well as selection of the alternative to the undertaking, which allowed the EA to commence at the alternative methods stage (i.e., alternative landfill configurations). Commencing the EA at the alternative methods stage is supported by the Code of Practice for Preparing and Reviewing Environmental Assessments in Ontario (MECP, 2014a) as follows:

> *Cases may arise where proponents have previously considered alternatives during a separate planning or decision-making process. If the previous planning process had similar provisions to those of the Environmental Assessment Act then the proponent may have sought and received approval at the terms of reference stage to limit the discussion of previously examined alternatives.*

Under the requirements of the *OEAA*, the proponent must include a description of the rationale as part of the EA documentation. WM has provided a description of the rationale for the undertaking in **Section 3** of this EA Study Report, which also includes a summary of the alternatives to the undertaking for context purposes.

The organization of the EA Study Report is discussed further in **Section 2.3**.

2.2.2 Impact Assessment Act

The *Impact Assessment Act* (*IAA*) is a piece of federal legislation that guides the EA process within Canada (Government of Canada, 2019). It provides a framework for actions to be taken to protect vital terrestrial and aquatic environments throughout the EA process. A Federal EA may be required if a proponent proposes a specific undertaking listed on the IAA Physical Activities Regulations.

The proposed undertaking is not identified as a designated project under the *IAA* and, based on correspondence received from the Impact Assessment Agency of Canada in November 2020, it has been confirmed that the Project will not be subject to review under the *IAA*.

2.3 Organization of the EA Study Report

The EA was prepared according to the requirements set out in the approved ToR and the *OEAA*, and includes a description of the:

- purpose of the Project (also referred to as ‘the undertaking’);

- rationale for the undertaking;
- undertaking based on the consideration of alternative methods;
- environment potentially affected by the undertaking;
- effects that will be caused or that might reasonably be expected to be caused on the environment by the undertaking or the alternative methods;
- mitigation measures that are necessary to prevent or reduce significant adverse effects on the environment;
- advantages and disadvantages to the environment as a result of the undertaking; and
- consultation and engagement process undertaken by WM for the EA.

Further to the *OEAA* requirements, WM has complied with both the MECP's Code of Practice for Preparing and Reviewing Environmental Assessments in Ontario (MECP, 2014a) and Code of Practice for Consultation in Ontario's Environmental Assessment Process (MECP, 2014b) when completing the EA. WM has also considered the MECP's guide: Considering Climate Change in the Environmental Assessment Process (MECP, 2017a).

The EA Study Report comprises the following chapters, appendices, and technical reports/reference documents for addressing the requirements set out in the approved ToR:

EA Study Report Sections	
Section 1	**Introduction** Provides an introduction to and background information regarding the TCEC, the undertaking, the proponent (WM), and the EA.
Section 2	**Overview of the EA Process and Study Organization** Describes the process used to carry out the EA, the *OEAA* requirements, and provides an overview of the organization of the EA Study Report.
Section 3	**Overview of the Undertaking** Identifies the purpose of and rationale for the undertaking, including the preferred alternative to the undertaking.
Section 4	**Description of the Environment Potentially Affected by the Undertaking** Provides an overview of the existing environmental conditions in both the On-site Study Area and Off-site Study Areas.
Section 5	**Alternative Methods of Carrying Out the Undertaking** Identifies and describes the Alternative Methods of carrying out the undertaking.
Section 6	**Net Effects of the Alternative Methods** Identifies and describes the net effects for the Alternative Methods for each environmental component.
Section 7	**Comparative Evaluation of Net Effects and Identification of the Preferred Alternative** Provides the comparative evaluation of the Alternative Methods and identifies the Preferred Alternative.

EA Study Report Sections	
Section 8	**Net Effects Assessment of the Preferred Alternative** Presents an assessment of the effects of the Preferred Alternative and a description of any potential cumulative effects. Climate change considerations for the Preferred Alternative are discussed, and the advantages and disadvantages of the Preferred Alternative are identified.
Section 9	**Consultation and Engagement** Provides an overview of the consultation and engagement process and a summary of consultation and engagement activities undertaken.
Section 10	**Monitoring and Commitments for the Undertaking** Describes the commitments as well as the monitoring strategy and schedule for the Preferred Alternative.
Section 11	**Approvals** Outlines the anticipated approvals required for implementing the preferred undertaking.
Section 12	**References** Provides the references used in the EA Study Report.

EA Study Report Appendices	
Appendix A	Approved Terms of Reference
Appendix B	Terms of Reference Commitments Table

Supporting Documents	
Supporting Document 1	**Existing Conditions Reports**
SD 1-1	Air Quality Existing Conditions Report
SD 1-2	Noise Existing Conditions Report
SD 1-3	Hydrogeology Existing Conditions Report
SD 1-4	Surface Water Quality Existing Conditions Report
SD 1-5	Surface Water Quantity Existing Conditions Report
SD 1-6	Ecological Environment Existing Conditions Report
SD 1-7	Human Health Existing Conditions Report
SD 1-8	Socio-Economic Environment Existing Conditions Report
SD 1-9	Visual Landscape Existing Conditions Report
SD 1-10	Cultural Heritage Resources Existing Conditions Report
SD 1-11	Archaeological Resources Existing Conditions Report
SD 1-12	Transportation Existing Conditions Report
SD 1-13	Land Use Existing Conditions Report
Supporting Document 2	**Conceptual Design Report**
Supporting Document 3	**Effects Assessment Reports**
SD 3-1	Air Quality Effects Assessment Report
SD 3-2	Noise Effects Assessment Report
SD 3-3	Hydrogeology Effects Assessment Report

Supporting Documents	
SD 3-4	Surface Water Quality Effects Assessment Report
SD 3-5	Surface Water Quantity Effects Assessment Report
SD 3-6	Ecological Environment Effects Assessment Report
SD 3-7	Human Health Effects Assessment Report
SD 3-8	Socio-Economic Environment Effects Assessment Report
SD 3-9	Visual Landscape Effects Assessment Report
SD 3-10	Cultural Heritage Resources Effects Assessment Report
SD 3-11	Archaeological Resources Effects Assessment Report
SD 3-12	Transportation Effects Assessment Report
SD 3-13	Land Use Effects Assessment Report
Supporting Document 4	**Record of Consultation and Engagement**
Supporting Document 5	**Geotechnical Feasibility Review for the Preferred Alternative**
Supporting Document 6	**Solar Exposure Assessment**

The requirements set out in Section 3.3 of the approved ToR and the location where each is addressed in the EA Study Report and/or reference documents are provided in **Table 2-1**.

Table 2-1. Requirements from the Approved Terms of Reference and Where Addressed

Terms of Reference Requirement	Section/Document Where Addressed
A description of the purpose of the undertaking.	• Section 3 of the EA Study Report
The rationale for the undertaking.	• Section 3 of the EA Study Report
A description of the undertaking based on the consideration of alternative methods.	• Section 5 of the EA Study Report • Supporting Document 2 to the EA Study Report
A description of the environment potentially affected by the undertaking.	• Section 4 of the EA Study Report • Supporting Document 1 to the EA Study Report
An assessment of the alternative methods of carrying out the undertaking, including:	
• A description of the effects that will be caused or that might reasonably be expected to be caused on the environment by the undertaking or the alternative methods; and	• Section 6 of the EA Study Report • Section 7 of the EA Study Report • Section 8 of the EA Study Report • Supporting Document 3 to the EA Study Report
• A description of the mitigation measures that are necessary to prevent or reduce significant adverse effects on the environment.	• Section 6 of the EA Study Report • Section 8 of the EA Study Report • Supporting Document 3 to the EA Study Report
An evaluation of the advantages and disadvantages to the environment as a result of the undertaking.	• Section 8 of the EA Study Report • Supporting Document 3 to the EA Study Report
A description of the consultation and engagement process undertaken by WM for the EA.	• Section 9 of the EA Study Report • Supporting Document 4 to the EA Study Report

3 Overview of the Undertaking

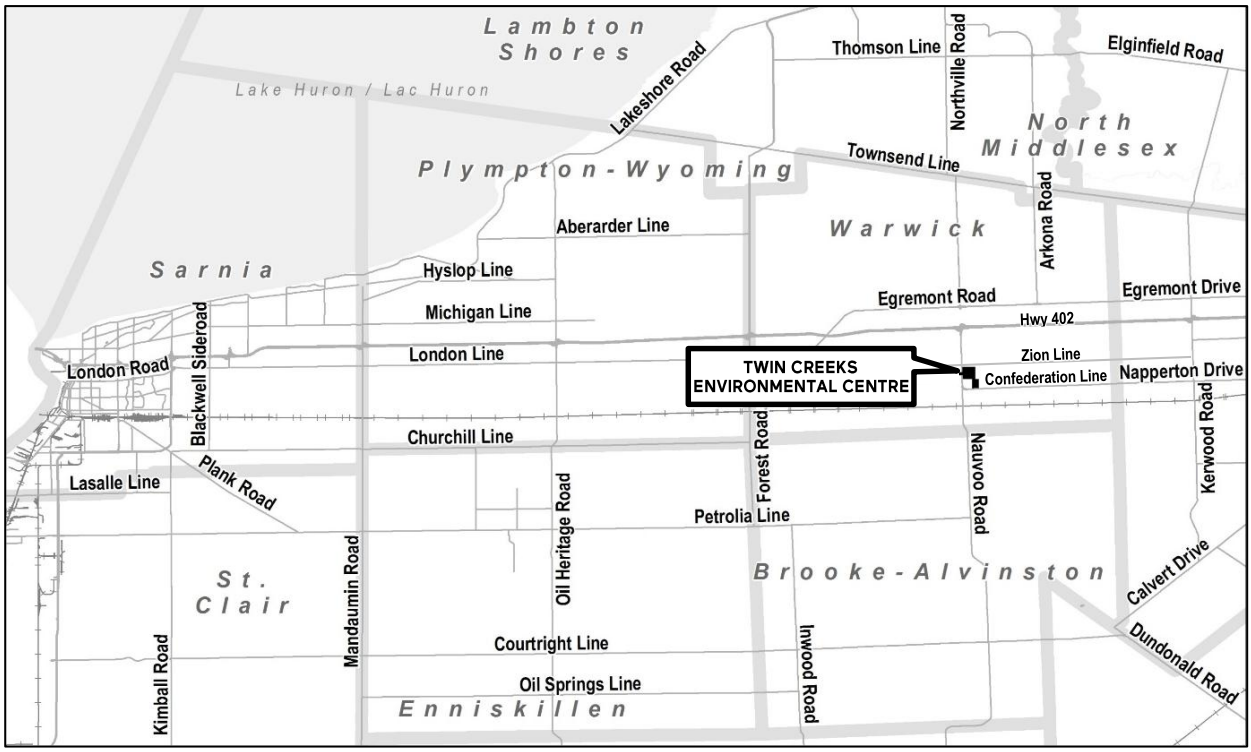
This section of the Draft Environmental Assessment (EA) Study Report presents an overview of the undertaking (i.e., the Project) including the purpose, rationale, and alternatives to the undertaking.

3.1 Description of the Undertaking

The Twin Creeks Environmental Centre (TCEC) is located at 5768 Nauvoo Road, Watford, Ontario, approximately 1 kilometre (km) north of the Village of Watford in the Township of Warwick, southeast of the intersection of Zion Line and Nauvoo Road (**Figure 3-1**).

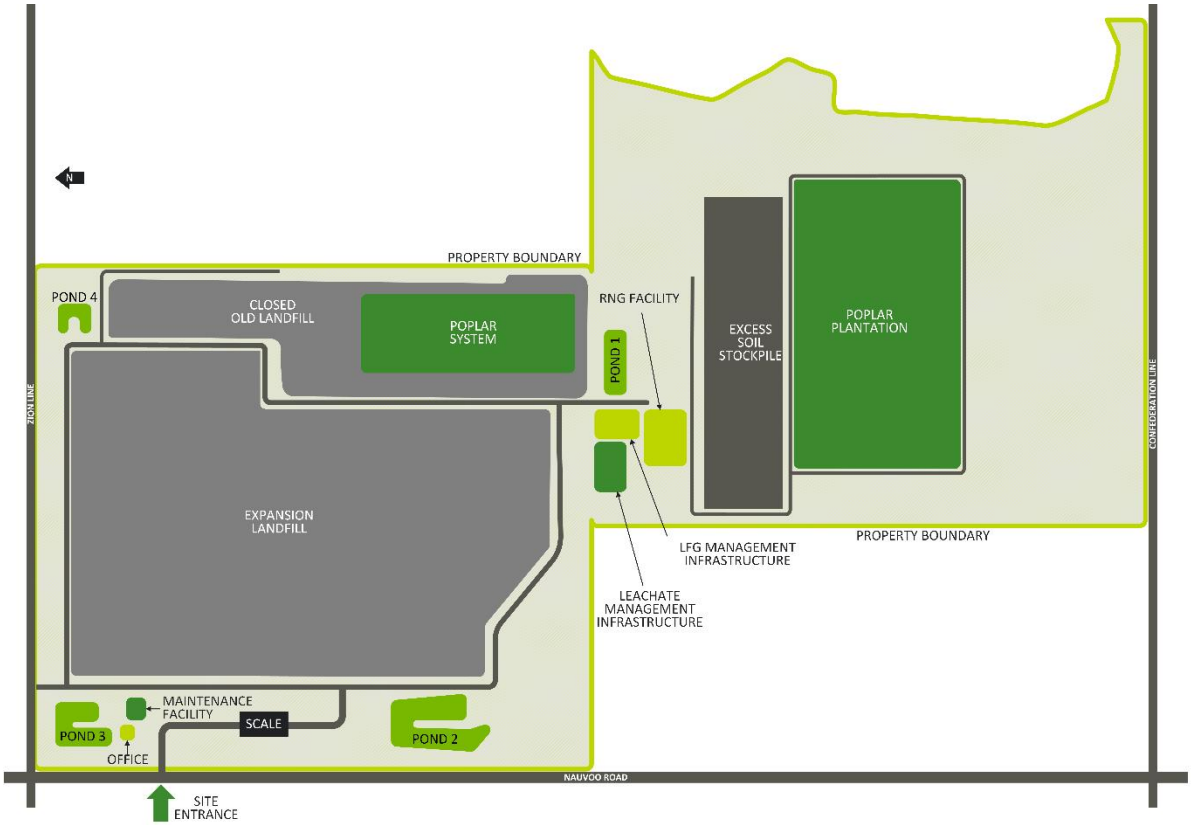
There are approximately 6 years of approved landfill airspace capacity remaining at the TCEC (i.e., capacity will be reached in approximately 2031). The proposed landfill optimization would provide additional airspace of approximately 14.3 million cubic metres (m^3), which could extend the site life by approximately 12 years (from 2031 to 2043) and may be achieved through alternative landfill configurations (alternative methods) within the existing 301 hectares (ha) TCEC site area.

Figure 3-1. Location of the TCEC



The landfill was approved under the *Ontario Environmental Assessment Act (OEAA)* for expansion in 2007 and has total airspace capacity of approximately 26.5 million m³ over an area of 101.8 ha (referred to as the Closed Old Landfill and Expansion Landfill in **Figure 3-2**). The landfill optimization would increase the overall airspace capacity to approximately 40.8 million m³.

Figure 3-2. Layout of the TCEC



No changes are proposed to the size of the TCEC site area, approved service area, haul route, or annual fill rate.

3.2 Purpose of the Undertaking

The purpose of the landfill optimization is to provide approximately 14.3 million m³ of additional landfill disposal capacity as part of the optimization of the design and operation of the TCEC Expansion Landfill, thereby extending the life of the site to 2043.

The landfill is approved to receive municipal, industrial, commercial and institutional (IC&I) solid non-hazardous wastes generated, including non-hazardous contaminated soil. By optimizing the landfill design and operation, maximizing the use of the constructed infrastructure and significant investment made at the TCEC, WM will be able to continue sustainable business operations and provision of essential financial support for community services and programs. The undertaking will also provide

longer-term certainty of service continuity to WM's customers beyond the remaining 6 years of capacity.

3.3 Rationale for the Undertaking

The rationale for the undertaking is twofold:

1. There is a need for additional landfill capacity at the TCEC as it is a significant component of the provincial waste management network and infrastructure, both now and in the future, serving a broad area and customer base across Southern Ontario; and
2. WM is providing waste management services and facilities that support Ontario's climate change strategy and the reduction of greenhouse gas (GHG) emissions through management of landfill gas (LFG), supporting closure of smaller landfill sites and an overall reduction in vehicles travelling to waste management facilities, consistent with provincial legislation.

3.3.1 Need for the Undertaking

There is a need for the continued development of the TCEC as it is a significant component of the provincial waste management network and infrastructure, which is lacking in sufficient and secure long-term disposal capacity.

A discussion of the waste managed by WM at the TCEC, population growth and waste generation in Southern Ontario, landfill capacity in Ontario, and landfill capacity in the United States is provided below in support of the need.

3.3.1.1 Waste Managed by WM at the TCEC

WM provides a broad range of waste management related services across North America, Canada and Ontario. Within Ontario this includes collection of recyclables and waste, recyclables processing, waste transfer and transport, and waste disposal among other related services.

The TCEC landfill provides cost effective services to a broad customer base largely across Southern Ontario. This includes a range of municipalities and Indigenous communities without their own disposal capacity, along with numerous industrial, commercial, and institutional (IC&I) businesses. Approximately 28% of the waste received at the TCEC is post-recycling and post-diversion residential residual waste from municipalities. This includes municipalities such as the Township of Warwick (the host community), Lambton County (including City of Sarnia), City of Guelph, and Peel Region (Caledon, Brampton, and Mississauga). Most municipal customers have long term (e.g., 10 years or greater) waste disposal contracts with WM to provide certainty of disposal capacity at the TCEC. Many of these municipalities have closed their own landfill sites due to factors such as increased regulatory requirements and associated costs, the risks and costs associated with long term liabilities, and encroaching urban development. Given these uncertainties, WM provides cost-effective and secure

access to an essential service for these Ontario municipalities and communities now, and into the future.

The majority of the waste received at the TCEC is from Ontario's IC&I sector, including third-party waste management companies and haulers without their own landfills. These companies provide their customers with a range of waste management services including collection, business- and industry-specific recycling and diversion programs, and disposal. Economical and reliable provision of these services allows the businesses to continue operating competitively. WM estimates that the TCEC manages approximately 25% of IC&I waste generated within Southern Ontario. **Table 3-1** provides a summary of the historical tonnes managed by WM in Ontario since 2017. As shown in **Table 3-1**, approximately 20%-30% of the waste managed at TCEC consists of material controlled by WM (i.e., internal) through collection contracts or as delivered to their network of transfer stations. The remaining 70%-80% (i.e., external) of the waste comes directly to TCEC from municipalities or third parties.

Table 3-1. Historical Waste Quantities Managed at the TCEC (tonnes)

Year	Waste Disposed at Twin Creeks Environmental Centre		
	WM Controlled (Internal)	Third Party Controlled (External)	Total
2017	213,881	604,255	818,136
2018	399,990	919,435	1,319,425
2019	275,784	1,136,829	1,412,613
2020	395,264	935,242	1,330,506
2021	442,240	956,306	1,398,546
2022	367,436	1,022,433	1,389,869
2023	305,325	1,093,725	1,399,050
2024	308,187	1,091,199	1,399,386

Since 2017 and the increase in the annual fill rate, TCEC has effectively been operating at the approved annual limit of 1.4 million tonnes. In 2019, as shown in **Table 3-1**, an additional quantity of waste was disposed at the landfill following approval from the MECP. An emergency request to receive up to an additional 50,000 tonnes during the year was approved to address increased waste generated by municipal customers due to both population growth and issues in the recycling market, and the challenges encountered in directing waste to alternate disposal facilities in Michigan.

3.3.1.2 Population Growth and Waste Generation in Southern Ontario

In 2024, the Toronto area was the fastest growing metropolitan area in Canada and

the United States for the second year in a row[2], with the population increasing by 269,000 persons, up from an increase of 255,000 persons in 2023. The growth of municipalities in the Greater Toronto Area (GTA) (i.e., Peel, York, and Durham regions) is primarily due to immigration. It is anticipated that these areas will continue to show increases in population and the resulting economic growth in the future.

The Ontario Ministry of Finance (2025) released updated population projections for the period of 2024 to 2051. From these projections, Ontario's population is projected to increase by approximately 27.4% or almost 4.4 million people during this period. The GTA is expected to be the fastest growing region adding almost 1.7 million new people (22% increase). The GTA will account for almost 46% of the Ontario population. The population of Central Ontario is projected to grow by almost 35% and Southwestern Ontario is expected to see growth of over 31%. These three regions effectively represent the area serviced by the TCEC.

The projected significant growth in population, with its associated economic and business growth to support a larger work force, will result in a continued demand for WM to provide waste management and disposal services to existing and new municipal and IC&I customers.

The wastes managed at the TCEC are typically post-recycling and post-diversion residual waste. The Government of Ontario developed plans to divert more waste from disposal and, in 2020, announced proposed changes to its Food and Organic Waste Policy Statement (the Policy Statement). The Policy Statement, issued in 2018, focuses on resource recovery of organic waste from the residential and commercial sectors and sets targets for municipalities, multi-unit residential buildings and IC&I facilities. It should be noted that the majority of TCEC's municipal customers (i.e., those in the GTA and Southern Ontario) have had residential organics collection programs in place for over a decade. As of August 29, 2024, the proposal to amend the Policy Statement was still under review[3] and no further updates have been provided.

While there may be some reduction in organics from the waste stream with the implementation of this Policy Statement, there is unlikely to be significant reductions in the quantities of waste delivered to TCEC. The Policy Statement contains targets in 2023 and 2025 for waste reduction and resource recovery by generator type; however, no regulations have been introduced by the government. Even with targets for

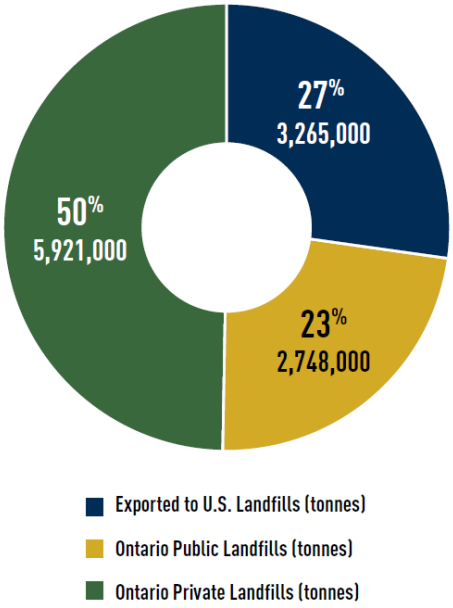
[2] F. Clayton, Toronto Metropolitan University Centre for Urban Research and Land Development. (April 22, 2025). Toronto was the Fastest Growing Metropolitan Area in the United States and Canada for the Second Straight Year in 2024. Retrieved from: https://www.torontomu.ca/content/dam/centre-urban-research-land-development/BLOG/blog98/CUR_Blog_Toronto_was_the_Fastest_Growing_Metropolitan_Area.pdf

[3] Environmental Registry of Ontario. (August 29, 2024). ERO number 019-2498. Proposal to amend the Food and Organic Waste Policy Statement. https://ero.ontario.ca/notice/019-2498.

increased diversion, there will still be increasing quantities of residual material that requires disposal in future years related to population growth.

As presented in **Figure 3-3**, in 2019 approximately 8.67 million tonnes of post-diversion residual waste were managed at Ontario landfills (public and private). An additional 3.3 million tonnes of waste was exported to the United States, predominantly to Michigan. More recent data available for Michigan indicates that this has remained relatively constant over the subsequent years. A total of 11.87 million tonnes of waste generated in Ontario required disposal in 2019. It is anticipated that this quantity will continue to increase as the population and economy in Ontario expands. In comparison, WM managed 2.45 million tonnes of waste generated in Ontario for disposal during 2020. Over half of this waste was managed at the TCEC landfill, and an additional 184,000 tonnes disposed at a WM landfill in the United States. The balance of the total was disposed at other private and municipal owned disposal sites across the Province.

Figure 3-3. 2019 Ontario Waste Landfilled as a Percentage (tonnes)



Source: OWMA's State of Waste in Ontario: Landfill Report – January 2021, Figure 11.

3.3.1.3 Landfill Capacity in Ontario

In January 2021, the Ontario Waste Management Association (OWMA) released their State of Waste in Ontario: Landfill Report (3rd Landfill Report) which provided an assessment of landfill disposal capacity in Ontario. At that time, it was estimated that, there were approximately 67.7 million tonnes of remaining capacity in municipal landfills and 76.7 million tonnes of remaining capacity in private commercial landfills[4]

[4] OWMA's State of Waste in Ontario: Landfill Report – January 2021.

in Ontario. This remaining tonnage was estimated to provide the Province, as a whole, with capacity for about 15.5 years or until 2037. This assumed that almost 30% of Ontario's waste would continue to be directed to Michigan for disposal. Any restrictions on waste export to the United States would dramatically reduce the remaining landfill capacity within Ontario (i.e. until approx. 2032).

The OWMA report also noted that the majority of the remaining landfill disposal capacity is held by private sector landfills (53%), which is an increase from 36% in 2017. The remaining municipal landfill capacity, which is effectively restricted by service area, decreased to 47% from 64% in 2017. Municipalities typically manage their landfills to preserve capacity for residential waste by minimizing IC&I waste disposal through market pricing strategies. The remaining disposal capacity in Ontario is becoming concentrated in a fewer number of large regional sites. The OWMA reports that 60% of the remaining disposal capacity is held by only seven landfills, and 85% of the remaining capacity is held by 15 of the largest landfills. The trend may be for smaller open landfills to continue to close as their capacity is depleted, directing increased waste volumes to a fewer number of large regional sites in the future. It is noted that Waste to Resources Ontario (W2RO), formerly OWMA, is scheduled to release an updated report in 2025.

There are seventeen major or large active landfill sites in Ontario:

- Four located in Eastern Ontario near Ottawa – one municipal facility, three private facilities;
- Three located in Northern Ontario (Sault St. Marie, Sudbury and North Bay) – three municipal facilities;
- One located in Northwestern Ontario (Thunder Bay) – one municipal facility; and
- Nine located in Southern Ontario – six municipal facilities, three private facilities.

The nine sites in Southern Ontario include:

- Niagara Waste Systems (Walker South) Landfill, Niagara Falls;
- Waste Connections Ridge Landfill, Chatham-Kent;
- WM TCEC, Warwick Township;
- City of Brantford Mohawk Landfill, Brantford;
- City of Toronto Green Lane Landfill, St. Thomas;
- Region of Waterloo Landfill, Waterloo Region;
- City of London W12A Landfill, London;
- City of Hamilton Glanbrook Landfill, Hamilton; and
- Essex-Windsor Landfill, Essex County.

Since 2020, there have been three approvals for significant additional landfill capacity in Southern Ontario:

- In 2020, Waste Connections received approval for the expansion of the Ridge Landfill in Chatham-Kent, adding 30 million m³ of disposal capacity and extending the operating life of the landfill for a further 20 years;
- In 2024, GFL Environmental Inc. received approval to add 15.1 million m³ of disposal capacity over a 20-year period as part of the future development of its Eastern Ontario Waste Handling Facility in North Stormont; and
- In 2024, the City of London received approval for the capacity expansion of their W12A Landfill by 13.8 million m³ over a 25-year period.

A proposal by Walker Environmental for a new private landfill in Oxford County with a capacity of 17 million m³ was discontinued in 2022 due to lack of municipal support.

Most municipalities are now focused on conserving their landfill capacity for residential waste and limiting the amount of IC&I and/or construction and demolition (C&D) waste accepted. Siting new landfill capacity within municipal boundaries continues to be challenging as the population and density of municipalities in Southern Ontario increases.

Access to landfill disposal capacity in Ontario is restricted by daily and/or annual fill rates and service area. With a few exceptions (e.g., Toronto Green Lane Landfill) municipal landfill sites have service areas which restrict the landfill to serve only waste generators within the municipality. Private landfills typically have broader, but still restricted, service areas and fill rates. The service area for the TCEC landfill is the entirety of Ontario, and the landfill has an approved annual fill rate of 1.4 million tonnes. As noted previously, the landfill is effectively operating at its approved annual limit.

The Waste Connections Ridge Landfill is now permitted to receive 1.6 million tonnes of waste annually. It had previously reported to operate at capacity on an annual basis and had to reduce intake or redirect waste to the United States near the end of the calendar year[5]. The recent fill rate increase was intended to address this situation. It should be noted that, as part of the recent EA approval to expand the Ridge Landfill, the landfill service area for residential waste was restricted to only the municipality of Chatham-Kent.

The other large operating private landfill in Southern Ontario is the Walker South Landfill in Niagara Falls. This landfill has an all Ontario service area and an annual fill rate limit of 1.1 million tonnes. It is also understood that this landfill operates at capacity each year. There is an EA in progress to support the continued operation of this facility with additional future disposal capacity.

It is evident that access to landfill disposal capacity within Southern Ontario is highly restricted and limited both annually and long term based on municipal landfill service area restrictions, private landfill sites operating at their annual fill rate limits, very

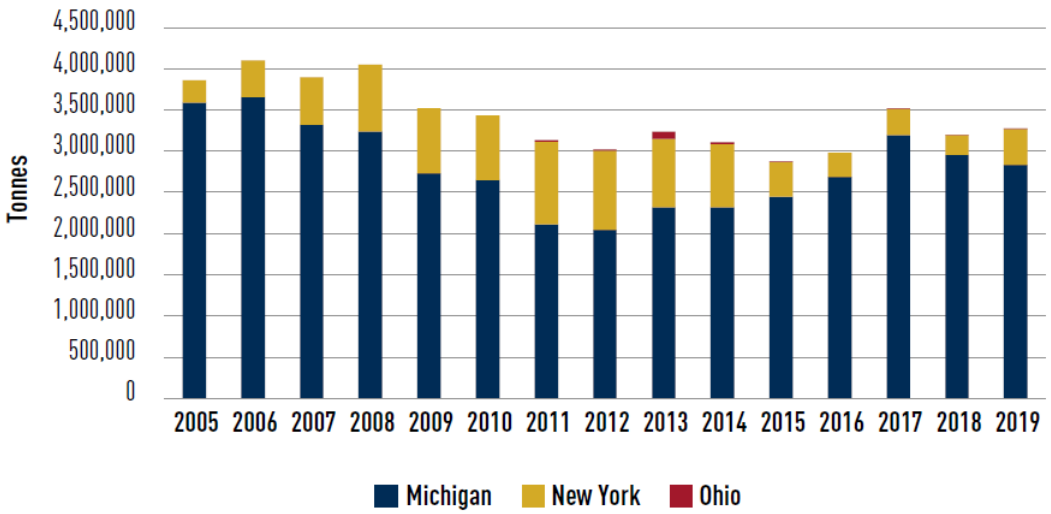
[5] Dillon Consulting. (December 2017). Ridge Landfill Expansion Environmental Assessment – Supporting Document #1 Purpose/Opportunity Assessment – Ridge Landfill Expansion Terms of Reference.

limited new landfill capacity being planned, and the decreasing total capacity available due to annual consumption which is expected to grow with increasing population and economic growth. Amendments to the *OEAA* (e.g., Bill 197) regarding municipal support requirements for approval of any new landfill site in the Province may also continue to impede or delay development of landfill capacity in the future.

3.3.1.4 Landfill Capacity in the United States

As noted earlier, approximately 30% of the waste generated in Ontario requiring disposal is managed outside Canada. According to the 2021 OWMA Report, since 2005, an average of 3.4 million tonnes of Ontario waste was exported to Michigan, New York, or Ohio. The total was as high as 4 million tonnes in 2008 prior to the City of Toronto redirecting its residential waste from Michigan to the landfill they purchased in Ontario. Some amount of waste may be exported from Eastern Ontario to New York; however, most of the waste is being exported from Southern Ontario to Michigan for disposal. The most recent summary of waste export data from OWMA is shown in **Figure 3-4**. This figure presents a breakdown of the tonnes of waste from Ontario exported to three states in the United States up to 2019.

Figure 3-4. Total Ontario Waste Exports (2005 – 2019)



Source: OWMA's State of Waste in Ontario: Landfill Report – January 2021. Figure 9.

The Michigan Department of Environment, Great Lakes and Energy (EGLE) prepares an annual Report of Solid Waste Landfilled in Michigan detailing the amount of solid waste received by each landfill in the state and to the extent possible, also identifies the origin of the waste by state or country (i.e., Canada). These reports have been prepared since Fiscal Year (FY) 1996 and are based on a fiscal year (October 1 to September 30). It is this data which the OWMA incorporates in their reporting.

The Michigan Department of EGLE report for FY2024 indicates that approximately 3.14 million tonnes of waste was received at Michigan landfills from Canada in

FY2024. Waste generated in Canada consistently represents approximately 14% of the waste landfilled in Michigan[6]. The 2024 tonnage represents an estimated 1.7% increase compared to 2023. It is noted that the WM Pine Tree Acres Landfill in Michigan received approximately 2.12 million tonnes of waste from Ontario in 2024.

It should be noted that since 2011, based on an agreement between Ontario and Michigan, the GTA municipalities have agreed that residential waste from these municipalities would not be exported for disposal in the state. However, IC&I waste was not affected by this agreement and now accounts for almost all of the waste exported from Ontario to Michigan.

The trend of waste export from Ontario for disposal in U.S. landfill sites or waste to energy facilities in New York should be expected to continue for the foreseeable future. With limited and restricted landfill capacity in Ontario, there is no ability to manage the 3.4 million tonnes of annually exported waste within the Province. That said, the practice of waste export will continue to be faced with its own set of risks and challenges, and the potential to negatively affect Ontario businesses and municipalities. Some of these risks and challenges include the following:

- It is anticipated that landfill capacity in Michigan will continue to diminish, particularly with the shortage of landfill capacity in the Northeastern United States. Rail haul of waste from areas without disposal capacity to areas of the country with accessible and cost-effective disposal is increasing demand for landfill capacity. For example, WM's Pine Tree Acres Landfill in Michigan has approximately 7 years of capacity remaining.
- At this time, tipping fees in Michigan continue to be lower than in Ontario. Michigan has implemented a landfill tipping fee tax to fund other waste management programs. While the tax remains relatively low ($0.36 United States Dollars [USD] per ton), the State recently contemplated increasing the tax to $5 USD per ton (approximately $6.90 Canadian Dollar [CAD] per tonne), with a reassessment every 5 years[7]. Currency risk in the form of foreign exchange fluctuations and tariffs may also pose a risk to the economics associated with disposal of waste in the United States.
- A number of recent changes in the logistics sector have resulted in a shortage of long-haul equipment and qualified drivers, plus limitations on the operating hours for a driver. Compounded by road congestion and border wait times, the service risk to customers and transportation cost to export waste for Ontario generators has continued to increase.

[6] Michigan Department of Environment, Great Lakes, and Energy. (February 19, 2025). Report of Solid Waste Landfilled in Michigan – Fiscal Year 2024. Referenced Tables 1 and 2 on page 4.

[7] M. Bluestein, WILX10. (April 23, 2025). Legislation to raise landfill tipping fees in Michigan has been reintroduced. https://www.wilx.com/2025/04/23/legislation-raise-landfill-tipping-fees-michigan-has-been-reintroduced/.

- Any restrictions or closures to the US border will obviously obstruct the flow of waste from Ontario to Michigan for disposal. The circumstances affecting export at the border are typically related to health and safety factors, the most recent example being restrictions associated with the COVID pandemic. The implementation of import tariffs by the United States. also resulted in border restrictions and increased costs. With any prolonged restriction or closure of the border there is essentially no landfill capacity in Ontario available to accommodate the volume of waste currently generated.

3.3.1.5 Summary of the Need for the Undertaking

It is evident that the TCEC landfill is a significant component of the provincial waste management network and infrastructure, both now and in the future, serving a broad area and customer base across Southern Ontario. The TCEC landfill, like the other private landfills in the region, is operating at its annual limit. Municipal landfills are restricted by their service areas and are typically managed to only receive locally generated residential waste. Consequently, in the order of 3.4 million tonnes of waste is exported from Ontario to the United States each year for disposal. With a lack of sufficient and secure long-term disposal capacity available in Ontario, there is an on-going requirement for the TCEC to continue to provide this landfill disposal service, supporting stable operation and growth for municipalities and businesses across Southern Ontario.

The projected significant growth in population, with its associated economic and business growth to support a larger work force, will also result in a continued demand for WM to provide service to existing and new municipal and IC&I customers. The on-going development and operation of the TCEC will allow WM to provide these customers with secure access to an essential service within Ontario in a cost-effective manner for the long term.

3.3.2 Consistency with Provincial Legislation

3.3.2.1 Overview of Provincial Legislation

In June 2016, the Ontario government passed the *Waste Free Ontario Act*, which enacted two Acts: the *Resource Recovery and Circular Economy Act*, *2016*, and the *Waste Diversion Transition Act*, *2016* (MECP, 2016a; MECP, 2016b; MECP, 2016c). Under this legislation, the province is moving toward a circular economy framework by establishing a producer responsibility regime. Extended producer responsibility for the Blue Box program falls under O.Reg. 391/21: Ontario's Blue Box Regulation, which was amended on September 4, 2025 (MECP, 2021).

In 2017, the MECP released the Strategy for a Waste-Free Ontario: Building the Circular Economy (the Strategy). The Strategy outlines a vision for Ontario where waste is considered a resource that can be recovered, reused and reintegrated to achieve a circular economy (MECP, 2017b). The ultimate goal of the Strategy is to achieve zero waste and zero GHG from the waste sector. The Strategy further

identifies four overall objectives which include a total of 15 actions to be taken and implemented by 2050. Several of the actions relate to the need for landfill including increased resource recovery, disposal bans, reduction of food and organic wastes, and ensuring landfills are well planned and managed to minimize their need and reduce GHG emissions.

In April 2018, the government issued the Food and Organic Waste Policy Statement (the Policy Statement), following from the *Resource Recovery and Circular Economy Act*, *2016*, which focuses on resource recovery of organic waste from the residential and commercial sectors and sets targets for municipalities, multi-unit residential buildings and IC&I facilities (MECP, 2018a; MECP, 2016b). Policy 6.8 of the Policy Statement directs that "proponents of new or expanded waste management systems for disposal should consider resource recovery opportunities for food and organic waste".

In November 2018, the MECP (2018b) released Preserving and Protecting our Environment for Future Generations: A Made-in-Ontario Environment Plan which outlined various commitments to reduce litter and waste in Ontario communities. Subsequently in March 2019, the Ministry released the Reducing Litter and Waste in Our Communities: Discussion Paper identifying three waste management goals for Ontario, including:

1. Decrease the amount of waste going to landfill;
2. Increase the Province's overall diversion rate; and
3. Reduce GHGs from the waste sector.

The government indicated that it will "continue to look to private sector innovation because we know that addressing climate change and reducing GHG emissions requires collaboration with businesses and stakeholders" (MECP, 2019). Initiatives such as capturing LFG for beneficial use is a prime example of innovation.

The Province of Ontario is also beginning to shift its legislation and economics towards a Circular Economy through the Strategy for a Waste Free Ontario: Building a Circular Economy and Ontario's Food and Organic Waste Framework (MECP, 2016a; MECP, 2018c). The Framework lays out a broad-based approach to attempt to achieve a vision of a circular economy that moves towards zero food and organic waste and zero GHG emissions from the waste sector. Legislative measures have not yet been implemented to enact the Food and Organic Waste Action Plan or the Food and Organic Waste Policy Statement (MECP, 2018a). The Framework includes a set of objectives and initiatives for reducing food waste, including banning food and organic waste from disposal (anticipated to start in 2030) and imposing a mandatory organics diversion strategy. These initiatives will require municipalities to provide source separated food and organic waste collection to their residents.

3.3.2.2 Food and Organic Waste Resource Recovery Opportunities as Part of the Project

As part of the ToR for the EA, WM committed to examining opportunities for food and organic waste resource recovery in accordance with Policy 6.8 of Ontario's Food and Organic Waste Policy Statement. Proponents of new or expanded waste management systems for disposal should consider opportunities to divert food and organic waste. This commitment aligns with the Province of Ontario's broader vision, articulated in the Strategy for a Waste-Free Ontario: Building a Circular Economy and the Food and Organic Waste Framework, which seeks to achieve zero food and organic waste and zero GHG emissions from the waste sector (MECP, 2017b; MECP, 2018c).

Ontario's Food and Organic Waste Framework sets out four key objectives: (1) reduce food waste; (2) recover resources from food and organic waste; (3) support resource recovery infrastructure; and (4) promote the beneficial use of recovered resources. WM's organics management programs, municipal customer base, infrastructure investments, and innovation initiatives are consistent with these objectives (MECP, 2018c). In conjunction with the release of the Strategy for a Waste-Free Ontario, the Province identified that a disposal solution for residuals would still be required and forecasted that 16 new or expanded landfills would be required by 2050 (MECP, 2017b). Waste to Resources Ontario (W2RO) currently estimates that Ontario will have exhausted its approved landfill disposal capacity in approximately 2033, which is approximately two years after the TCEC will have reached its currently approved capacity[8].

Municipal Organics Diversion Within the Twin Creeks Service Area

The Food and Organic Waste Policy Statement focuses on resource recovery of organic waste from the residential and commercial sectors and sets targets for municipalities, multi-unit residential buildings and IC&I facilities (MECP, 2018a). The majority of TCEC's municipal customers (i.e., those in the GTA and southern Ontario) have had residential organics collection programs in place for over a decade. The Policy Statement includes obligations for municipalities in southern Ontario to have in place a collection program for food and organic waste, dependent on population and population density, by 2025. WM is aware that most of these southern Ontario municipalities have already implemented or are taking the necessary steps to implement a food and organic waste recovery program to meet their obligation. The majority of these municipalities also operate leaf and yard waste collection and composting programs.

WM currently provides contracted collection services for green bin organics for resource recovery and/or residual waste disposal to some but not all of the southern Ontario municipalities affected by the Policy Statement. WM has long term contracts with various municipalities in Ontario to provide waste disposal capacity for post

[8] W2RO (2025). W2RO Advocacy Pillars. https://www.w2ro.org/cpages/home.

recycling and post diversion residual solid waste at the TCEC. WM will continue to support municipalities and is well positioned to provide competitive contracted services to these and other waste generators for collection of source separated material including food and organic waste for processing at a resource recovery facility. The TCEC is a final disposal facility and provides disposal capacity for post recycling and post diversion residual solid waste material.

Based on municipal diversion rates and participation levels, a significant portion of the residential waste stream from key customers is already diverted before reaching the TCEC landfill. WM's role in managing residual waste for these municipalities complements the upstream diversion achieved through their green bin programs.

Organics Services for IC&I Customers

The Food and Organic Waste Policy Statement also identifies that specified multi-unit residential buildings, generators in the industrial and commercial sectors, and larger institutions will be required to source separate and collect food and organic waste at their facility by 2025 (MECP, 2018a). Further, all collected food and organic waste is to be sent for resource recovery. WM currently provides competitive contracted collection services to this range of waste generators across Ontario. Dependent on the specific waste generator and their requirements, these services can include collection of their source separated organic material for processing at a resource recovery facility. Collected organics are delivered by WM to a network of third-party composting and anaerobic digestion (AD) facilities located in southern Ontario with available processing capacity.

According to WM's 2025 Sustainability Data Center, approximately 5% of IC&I customers in Canada currently receive organics collection service. In Ontario, this percentage is lower with approximately 1% of IC&I customers requesting organics collection and processing services. This represents in the order of 38,000 tonnes/year of organics. WM also provides annual diversion reports to IC&I customers, quantifying organics tonnage collected and processed, which assists them in meeting local regulatory requirements and corporate sustainability goals.

In the years following the COVID 19 pandemic, WM has observed that shifting economic conditions have contributed to a measurable reduction in organics generation and participation across the IC&I market sector. Many businesses have adjusted operations, reduced staff levels, or consolidated food service activities in response to evolving consumer demand and cost pressures. It appears that rising input costs, including labour, transportation, and processing fees, have further influenced waste diversion behaviour, with some IC&I customers noticeably limiting or discontinuing separate organics collection in order to manage their expenses. As a result, WM has seen overall volumes of organic material entering IC&I diversion programs decline compared to pre pandemic levels.

The TCEC itself is a final disposal facility and provides disposal capacity for post recycling and post diversion residual solid waste material generated by Ontario IC&I facilities compliant with the Food and Organic Waste Policy Statement.

Organics Processing and Recovery Infrastructure in Ontario

At this time, a complete list of compost and AD facilities in Ontario accepting food and organic waste for resource recovery is not publicly available. There are a number of challenges in identifying information for these facilities, as follows:

- Environmental Compliance Approvals (ECAs) are not readily accessible for some older existing facilities that have not obtained recent approvals.
- A significant number of on-farm AD facilities, which fall under Ontario Ministry of Agriculture, Food and Agribusiness' (OMAFRA) permit-by-rule framework are not tracked.
- There is often a difference between the permitted capacity and the actual operating capacity due to planned future expansion plans, differences in feedstock mix, and general operations.
- Various facilities have recently updated their operating permits to allow for increased feedstock tonnage.
- There are a number of new organics processing facilities that are expected to come online in Ontario and begin operations within the next 5 years.

The industry association W2RO is in the process of preparing a State of Organics Report which is expected to include this type of information and be released in 2026. The Canadian Biogas Association (2023) published a market summary report which presents high level data on AD capacity in Ontario. However, the focus of the report is on biogas and Renewable Natural Gas (RNG) production from a range of AD facilities including agricultural AD, industrial AD, and municipal AD including wastewater treatment facilities.

Generally, several operating organics processing facilities in Ontario are still actively sourcing feedstock and the market has seen a fair amount of competition which have driven tipping fees lower over the last number of years. Various facilities have either recently updated their operating permits to allow for increased feedstock tonnage or are in the process of being built and operational within the next 5 years. As many facilities have installed biogas upgrading to RNG systems, the revenue model for these facilities have shifted where the majority of revenue is coming from the RNG end-product rather than in the tipping fee. Therefore, this has also contributed to the trend of lowered tipping fees.

Finally, Ecostrat Inc. (2022) released a report prepared for The Atmospheric Fund, which appears to include the most comprehensive data set for compost and AD facilities. The report estimates that over 577,000 tonnes/year of source separated organics (SSO) is generated by municipalities and an additional 704,000 tonnes/year

of solid recyclable organic feedstock (ROF) is generated by IC&I sources in Ontario. It is evident that sufficient processing capacity for SSO exists in the Province to support the numerous municipal green bin programs. Ecostrat notes that the development of new AD capacity is typically linked to long term feedstock supply contracts in order to finance the project. IC&I feedstock generators are often unwilling to enter into these types of agreements. In addition, the availability of feedstock is uncertain being highly dependent on IC&I generators implementing an at-source organics diversion program and the quality of the feedstock produced by the generator. A contaminated feedstock is very challenging to manage and process resulting in it typically being managed as a residual waste through disposal.

WM's Organics Processing and Recovery Infrastructure

WM is one of North America's largest providers of organics processing capacity, operating nearly 50 facilities across the continent, including 33 composting facilities, three (3) CORe® depackaging plants producing Engineered BioSlurry® (EBS) for energy recovery, two (2) organics extraction facilities, two (2) FOG2FuelSM plants converting fats, oils, and grease into biodiesel feedstock, and multiple green waste and wood processing sites. In 2023, WM recovered 3.78 million tonnes of organic material across its North American network, with material processed into high-quality compost, RNG feedstock, or soil amendments.

WM continues to invest in new infrastructure, with two (2) additional CORe® facilities and a large-scale AD plant in development. These projects will expand capacity to manage organics generated by both municipal and IC&I customers. WM continues to monitor and assess the demand for these services in the Ontario marketplace to support the capital investment.

The approvals are in place for WM to develop an on-site aerobic composting facility for leaf and yard waste, agricultural waste, and wood currently sent to third party facilities. The TCEC is permitted to compost up to 7,500 tonnes/year. WM monitors the quantity of material received annually as part of its recycling drop-off area while planning for implementation of this facility.

Innovation and Pilot Projects

WM actively pursues innovative solutions to enhance organics recovery. The company recently supported an organics pilot project in Guelph, focused on the IC&I sector. The pilot looked at the IC&I sector within a specific area, aimed at improving collection efficiency, reducing contamination, and developing stable end markets for finished compost. A full collection route was established, including participants from hotels, multi-residential buildings, schools, and office settings. The program operated at no cost for over three (3) months, focusing on participation, education, and impact communication..

Technology-driven solutions such as the WM patented CORe® process enable post-collection separation of food waste from mixed waste streams, providing an alternative pathway for diversion where at-source separation is not practical.

In addition, WM leverages its sustainability and environmental solutions teams to work with customers across industries to identify and implement diversion strategies, often incorporating data analytics tools to track waste generation, diversion rates, and GHG impacts.

Maximizing Organics Recovery Through Renewable Natural Gas

WM is advancing a major sustainability investment at the TCEC with the development of an RNG facility. This project is designed to recover energy from the remaining organic material in the landfill that is not captured through upstream organics diversion programs, transforming LFG into pipeline-quality natural gas.

Currently, LFG generated at TCEC is collected and either flared or used to supply heat to the adjacent 40-acre greenhouse facility. The new RNG facility will be directly connected to a natural gas transmission line, enabling the distribution of renewable energy to homes and businesses across Ontario. The project will be the largest RNG production and distribution facility in the province and is expected to come online in early 2026. Once fully operational, it is expected to reduce GHG emissions by approximately 70,000 tonnes of CO_2e annually. In addition to generating clean, low-carbon energy, the facility will create significant economic benefits, including approximately 100 construction jobs, 5 to 10 full-time operational positions, and substantial investment into Ontario.

3.3.2.3 Summary

WM has long term contracts with various municipalities in Ontario to provide waste disposal capacity for post recycling and post diversion residual solid waste at the TCEC. WM will continue to support municipalities and is well positioned to provide competitive contracted services to these and other waste generators for collection of source separated material including food and organic waste for processing at a resource recovery facility. WM also offers contracted services to the IC&I sector including the collection and processing of source separated organic material.

The TCEC itself is a final disposal facility and provides disposal capacity for post recycling and post diversion residual solid waste material generated by Ontario municipalities and IC&I facilities compliant with the Food and Organic Waste Policy Statement.

Even with the introduction and implementation of the above-noted provincial initiatives, residual materials will remain which require proper management and disposal for the foreseeable future.

Continued operation of the TCEC landfill aligns with the Province of Ontario’s Strategy for a Waste-Free Ontario, Climate Change Action Plan goal of reducing GHG

emissions, and the Made in Ontario Environment Plan to reduce litter and waste in communities (MECP, 2016a; MECP, 2017b; MECP, 2018b). WM has invested in many initiatives to reduce GHG emissions and divert more materials, as follows:

- WM has installed an LFG collection system at the landfill to collect methane gas (a major source of GHGs) which is converted to produce green energy. An RNG Facility is currently being constructed at the TCEC to convert LFG to RNG, which will be supplied to the local natural gas network.
- The TCEC landfill provides long-term residential waste disposal capacity to the County of Lambton and other Ontario municipalities. Over time, this has allowed the County and other Ontario municipalities to close a number of smaller landfill sites which did not have control systems to manage GHG emissions associated with LFG.
- WM provides a network of regional transfer stations across Southern Ontario to collect material from a larger number of small generators and consolidate the material for transport. As a result, the number of vehicles travelling long distances to appropriate processing and disposal facilities is significantly reduced. This also supports a substantial decrease in the emission of GHGs associated with the transportation of waste. The TCEC landfill receives waste from these transfer stations.

The combination of established municipal SSO programs in TCEC's customer base, use of third party facilities for WM's IC&I organics collection services, on-going assessment of the Ontario marketplace for investment opportunities in this sector supports the TCEC Landfill project in meeting the intent of Policy 6.8 of Ontario's Food and Organic Waste Policy Statement. WM's actions are consistent with Ontario's vision for a circular economy and align with both provincial organics diversion priorities and WM's own long-term sustainability commitments.

As part of a complete organics management strategy, WM is also investing in downstream solutions to address material that cannot be practically recovered before disposal. The development of the RNG Facility at TCECs will ensure that residual organics are put to beneficial use, turning emissions into a source of clean energy.

By combining robust diversion programs with advanced energy recovery for residuals, WM is demonstrating leadership in managing organics across their full lifecycle and supporting Ontario's climate and circular economy goals.

3.3.3 Sustainability and Community

WM prepares an annual Sustainability Report to disclose and discuss the company's progress towards achieving and meeting its environmental, social and governance

commitments[9]. The overarching environmental goals are to increase materials recovery, and reduce GHG emissions and target beneficial use.

WM aspires to make the communities where its staff live and work safe, resilient, and sustainable. WM is investing in a quieter, cleaner collection fleet; supporting programs that preserve biodiversity and conservation; continuing programs that prioritize community safety; and organizing environmental education programs and activities, including facility tours, community events and social media engagement campaigns. The company applies a range of Key Performance Indicators to measure and track success and overall achievement of stated sustainability goals.

WM strives to support Ontario communities and businesses in achieving their waste diversion efforts and goals, minimizing disposal requirements. This included the collection of approximately 225,000 tonnes of recyclable and organic material in 2020 for use as a material resource.

On a community specific basis, WM also applies its sustainability goals striving to not only reduce GHG emissions, but also to enhance natural resources. The company continuously considers projects to help make communities better places to work and live. WM supports initiatives that enhance the environment, promote education, and improve the livability of communities where the company operates. The optimization of the TCEC landfill design and operation is required to allow the TCEC to remain a sustainable business operation with the landfill providing the essential financial support for a wide range of additional services and programs to remain viable in the local community.

The TCEC is a well-established business in the local community providing 35 stable, long-term jobs for residents of the area. The on-going operation of the landfill allows WM to provide significant financial contributions to the local economy, through donations to support the local community by means of a host community agreement and municipal taxes. Under the current host community agreement, WM contributes host community fees to the Township of Warwick of approximately $4.1 million annually, which amounts to approximately 24% of the Township's gross annual operating budget and approximately 36% of the Township's total municipal revenue.

WM endeavours to maximize the use of businesses and services within the local community and across the broader region in support of the on-going development and operation of the TCEC. WM purchases goods and services from Watford/Warwick based businesses totalling approximately $2.5 million annually. This contribution to the local economy related to food services, repair and maintenance, construction, equipment rental and purchase, etc. Annual expenditures for goods and services within Lambton County accounts for, on average, an additional $2.2 million per year. For those goods and services not available within the local area, the TCEC's expenditures involving other Ontario based businesses were an additional $12.8 million in 2024.

[9] Waste Management. (2025). 2025 Sustainability Report – We're Driving Sustainability.

Since 2008, WM has also provided approximately $2 million in payments direct to TCEC neighbours as part of a Community Commitments Agreement and over $800,000 for additional community projects. These community contributions have supported the purchase of two new fire trucks, creation of walking trails, improvements to recreation facilities, and development of a dog park, amongst other smaller projects.

In addition to providing no cost disposal for residential waste to the Township of Warwick, the TCEC also hosts a waste, yard waste, and recycling depot. Township residents are allowed to drop off residential waste, yard waste, white goods and metal, cardboard and blue box (containers and paper) materials at this depot.

In addition, through the TCEC, financial support is also provided to various educational initiatives like WM's Green Leader program, displays at local festivals, etc. In 2025, WM identified local winners of the Green Leader program with the Town of Petrolia, awarding $15,000 for several local revitalization projects.

3.4 Alternatives To the Undertaking

"Alternatives to" the undertaking are functionally different ways of addressing the sustainable business opportunity and need for the TCEC landfill to continue to provide disposal capacity over the long term. WM identified and considered specific "alternatives to" the proposed undertaking that address the opportunity and are within the company's business mandate and ability to implement.

Consistent with the MECP Code of Practice for Preparing and Reviewing Terms of Reference for Environmental Assessments in Ontario, WM identified a range of "alternatives to" for providing long-term disposal capacity that are appropriate and reasonable for them (a private sector company) to implement.

The following four alternatives were identified:

1. Do nothing;
2. Redirect waste to a disposal facility elsewhere;
3. Develop a new WM disposal facility; and
4. Develop additional disposal capacity within the TCEC site area.

WM does not own or operate any thermal treatment facilities. This type of alternative is not within the company's business mandate and ability to implement.

Each of the 'alternatives to' were considered in the context of their ability to meet the need for long term disposal capacity to serve Ontario municipalities and the IC&I sector, and the business opportunity identified by WM. A summary description of each 'alternative to' and an assessment of how each addresses the opportunity are presented below.

3.4.1 Alternative 1 – Do Nothing

The “do nothing” alternative implies that WM would not undertake the development of new long-term disposal capacity. WM would only be able to continue with their current business operations at the TCEC for approximately 6 years based on current landfilling rates (i.e., until approximately 2031). Landfill operations would have to cease once the existing landfill is at capacity.

As noted in **Section 3.3.1**, the TCECs landfill provides cost effective services to a broad customer base largely across Southern Ontario, which includes a range of municipalities and Indigenous communities without their own disposal capacity along with numerous IC&I businesses. Most municipal customers have long-term (e.g., 10 years or greater) waste disposal contracts with WM to provide certainty of disposal capacity at the TCEC. Many of these municipalities have been faced with the need to close their own landfill sites. WM provides these municipalities and communities with secure access to an essential service within Ontario and in a cost-effective manner.

The majority of the waste (approximately 72%) received at the TCEC is from the IC&I sector within Ontario, including third-party waste management companies and haulers who do not typically own a landfill. These companies provide their customers with a range of waste management services including collection, business and industry specific recycling and diversion programs, and disposal. Provision of disposal capacity for post-recycling/post-diversion (i.e., residual) waste to these businesses in a cost-effective and secure manner ensures these companies can continue operating competitively. WM estimates that the TCEC manages approximately 25% of IC&I waste generated within Southern Ontario.

The TCEC landfill, like the other private landfills in the region, is operating at its annual limit. With a lack of sufficient and secure long-term disposal capacity available in Ontario, there is an on-going requirement for the TCEC to continue to provide this landfill disposal service, supporting stable operation and growth for municipalities and businesses across Southern Ontario.

The closure of the TCEC landfill would result in the loss of local employment and indirect employment, as well as reduced municipal and third-party business revenues related to discontinued TCEC annual operating expenditures.

The “do nothing” alternative would not allow WM to continue to provide disposal services to its customers and fulfill long-term contractual commitments within Ontario. These customers, including a number of municipalities across Southern Ontario, would need to find alternate ways to manage their waste. The opportunity to optimize the investment in the facility infrastructure would be lost along with the economic contributions to the local economy. This alternative is not a viable option for WM’s on-going business, its customers, and the Province of Ontario. It has been included to provide a benchmark against which to measure the other alternatives and to assess the advantages and disadvantages of the Preferred Alternative.

3.4.2 Alternative 2 – Redirect Waste to a Disposal Facility Elsewhere

This alternative involves WM redirecting waste to a disposal facility elsewhere (transport material to other approved disposal facilities in Ontario and/or the United States). There would be no development of new long term disposal capacity at the TCEC. WM does not own or control any other landfills currently operating within Southern Ontario.

The TCEC landfill has an all Ontario service area and an annual fill rate of 1.4 million tonnes. The landfill is effectively operating at its approved annual limit. Access to landfill disposal capacity in Ontario is restricted by daily and/or annual fill rates and service area. With a few exceptions (e.g., City of Toronto's Green Lane Landfill) municipal landfill sites have service areas which restrict the landfill to serve only waste generators within the municipality. Private landfills typically have broader, but still restricted, service areas and fill rates. The other large private landfills in Southern Ontario, including the Waste Connections Ridge Landfill and Walker South Landfill, are reported to operate at their annual capacity.

The Michigan Department of EGLE reports that historically the total quantity of waste exported from Ontario to that state has generally been in the order of 2.5 million to over 3 million tonnes annually. In 2024, the WM Pine Tree Acres Landfill in Michigan received approximately 2.12 million tonnes of waste from Ontario.

At a minimum, with virtually no excess landfill disposal capacity available within Southern Ontario for the 1.4 million tonnes managed at TCEC, WM would need to redirect the waste volume it controls (20-30% of the waste managed at the TCEC) to its landfill in Michigan. The remaining 70-80% of waste from external sources would also need to be redirected to landfill sites largely located in the United States

This alternative would not allow WM to continue to provide disposal services to its customers and fulfill long-term contractual commitments within Ontario. These customers, including a number of municipalities across Southern Ontario, would need to find alternate ways to manage their waste. This will likely require export to the United States since landfill capacity within Southern Ontario is both restricted and limited. The opportunity to optimize the investment in the TCEC facility infrastructure would be lost along with the economic contributions to the local economy. This alternative is not a viable option for WM's on-going business, its customers, and the Province of Ontario.

3.4.3 Alternative 3 – Develop a New Disposal Facility

This alternative requires WM to develop a new waste disposal facility at a location within Southern Ontario capable of continuing to service the customer base for the TCEC. The ability to develop a new disposal facility is limited to those properties owned by WM including the potential expansion of an existing landfill.

WM owns a number of closed landfill sites in Southern Ontario, and other properties such as transfer stations and hauling yard sites, which do not have the property area, site infrastructure and environmental controls to manage 1.4 million tonnes of waste

annually over a period of approximately 12 years. In addition, significant financial investment would be required to enhance and upgrade off-site infrastructure including access roads and, in some cases, the site has been transitioned to alternative land uses.

This alternative would not allow WM to continue to provide disposal services to its customers and fulfill long term contractual commitments within Ontario; as such, these customers, including a number of municipalities across Southern Ontario, would need to find alternate ways to manage their waste. The opportunity to optimize the investment in the TCEC facility infrastructure would be lost along with the economic contributions to the local economy. This alternative is not a viable option for WM's on-going business, its customers, and the Province of Ontario.

3.4.4 Alternative 4 – Develop within the TCEC Site Area

This alternative would involve WM developing additional landfill capacity within the 301 ha TCEC site area. The additional capacity would be developed through either a vertical expansion of the currently approved Expansion Landfill footprint or a horizontal expansion into other areas of the TCEC site. Within the TCEC site a range of existing land uses and development opportunities may potentially exist. This alternative would be able to optimize and utilize the extensive existing infrastructure constructed at the TCEC including site features for leachate and gas management, stormwater management, roads, administration and maintenance, etc.

A vertical expansion would involve redesigning the originally planned and approved final contours of the Expansion Landfill including potential changes to the grade of the side slopes and the peak elevation.

A horizontal expansion within the overall 301 ha TCEC site area may require that development occur on the partially-lined closed Old Landfill area at the east of the site. The southern portion of the TCEC site currently includes a 28.3 ha poplar plantation used to dispose on-site treated leachate, and approximately 36 ha currently used for agriculture and recreation.

Development within the TCEC site area is the only practical, environmentally sound, and cost-effective option to address the identified business opportunity to allow WM to operate in the long-term. WM has been successfully operating the TCEC landfill since 1996 and it has become an important addition to the local community by creating employment opportunities, contributing financially to the Township of Warwick, and supporting local initiatives within the community. This alternative is the most financially and economically viable option to both WM and its customers; utilizing land already owned by WM and optimizing the significant investment that has been made in the supporting site infrastructure that has already been developed, including environmental controls.

3.4.5 Preferred Alternative to the Undertaking

These alternatives, and the identification of the preferred "alternative to", were presented to the public during the consultation and engagement on the development of the ToR. Based on the comments received the description of Alternative 4 was more broadly defined to include all development options within the TCEC site area and a summary of the advantages and disadvantages of the alternatives was included.

WM has determined that development of additional landfill capacity within the TCEC site area (Alternative 4) is the only reasonable alternative for the company, its customers, and the Province of Ontario. The other alternatives do not address WM's business opportunity to meet long-term customer commitments, avoid business risks or maximize the financial investment in the facility, and limit the benefits provided to the local community. A summary of the advantages and disadvantages of the alternatives in addressing the opportunity identified by WM is provided in **Table 3-2**.

Table 3-2. Advantages and Disadvantages of the Alternatives

Alternative To	Advantages	Disadvantages
Alternative 1 – Do Nothing	• Provides a benchmark against which to assess potential effects of the project.	• Does not allow WM to continue to provide disposal services and meet commitments. • No opportunity for WM to optimize the investment in the TCEC site infrastructure. • Economic contributions to the local economy end. • Lack of sufficient and long-term disposal capacity in Ontario.
Alternative 2 – Redirect Waste Elsewhere	• No advantages identified.	• Would require the potential export of an additional 1.4 million tonnes of waste to Michigan. • No opportunity for WM to optimize the investment in the TCEC site infrastructure. • Economic contributions to the local economy end. • Lack of sufficient and long-term disposal capacity in Ontario.
Alternative 3 – Develop a New Facility	• No advantages identified.	• WM does not own any other suitable properties in Southern Ontario. • Would require the potential export of an additional 1.4 million tonnes of waste to Michigan. • No opportunity for WM to optimize the investment in the TCEC site infrastructure. • Economic contributions to the local economy end. • Lack of sufficient and long-term disposal capacity in Ontario.

Alternative To	Advantages	Disadvantages
Alternative 4 – Develop within the TCEC Site Area	• Allows WM to continue to provide disposal services within Southern Ontario and meet their business commitments. • Allows WM to optimize the investment in the TCEC site infrastructure. • Economic contributions to the local economy will continue for an extended period of time. • Provides Ontario with additional long-term disposal capacity.	• No disadvantages identified.

The 'Do Nothing' Alternative has been carried forward in the EA for comparison against the preferred undertaking to assess its potential effects on the existing environment.

3.5 Summary

WM has determined that there is a sustainable business opportunity and need for the TCEC landfill to continue to provide disposal capacity over the long term. By optimizing the use of the constructed infrastructure and significant investment made at the TCEC, WM will be able to continue providing economical waste disposal services to customers over the long term.

The TCEC landfill is an integral and critical part of the existing waste management infrastructure serving Southern Ontario and the Province as a whole. It provides disposal capacity for post-recycling and post-diversion residual wastes from an extensive number of municipalities, businesses, and Indigenous communities across Southern Ontario. Additional long-term disposal capacity will allow the continuous and on-going operation of the TCEC in order to provide essential and secure long term, financially stable waste disposal service to existing and new customers in Ontario.

The company has invested extensively in supporting infrastructure at the facility and now provides access to cost effective green energy for a local greenhouse business. The landfill supports Ontario's climate change strategy and the reduction of GHG emissions through management of LFG, supporting closure of smaller landfill sites and an overall reduction in vehicles travelling to waste management facilities. The development of the RNG Facility at TCEC will also allow residual organics to be put to beneficial use, turning emissions into a source of clean energy.

The TCEC is a major employer and financial contributor to the local community and broader region. The on-going development and operation of the landfill will allow WM to continue to provide this type of economic support to the local community and region over the long term.

WM estimates that the TCEC landfill will reach its currently approved capacity by approximately 2031. By continuing to utilize the existing landfill design and operation,

WM will be able to continue to provide disposal services for residual non-hazardous solid waste to their customers for an additional period of approximately 12 years (i.e., 2043). This facility is a significant component of the provincial waste management network and infrastructure, both now and in the future, serving a broad area and customer base across Southern Ontario. There is limited disposal capacity available within Ontario resulting in an average of 3.4 million tonnes of waste being exported annually from Ontario to the US.

With a lack of sufficient and secure long term disposal capacity available in Ontario, there is an on-going requirement for the TCEC to continue to provide this landfill disposal service to its customers, fulfill long term contractual obligations to municipalities and businesses across Ontario, and support stable operation and growth for municipalities and businesses across Southern Ontario.

4 Description of Existing Conditions

The approved Terms of Reference (ToR) included a preliminary description of the existing conditions within the area surrounding the Twin Creeks Environmental Centre (TCEC), with the commitment that a more detailed description of existing environmental conditions would be prepared as part of the Environmental Assessment (EA). In accordance with the approved ToR, additional investigative studies were carried out as necessary to generate a more detailed description of the existing natural, cultural, socio-economic, and built environments for use in the assessment of the effects of the alternative methods for the Project during the EA.

The description of existing conditions addresses the five aspects of the environment as defined in the *Ontario Environmental Assessment Act* (*OEAA*):

- natural environment;
- built environment;
- cultural environment;
- social environment; and
- economic environment.

For the purposes of this EA, the social and economic environments have been grouped into the socio-economic environment.

This section of the EA Study Report provides a summary of existing conditions based on **Supporting Document 1 – Existing Conditions Reports**.

4.1 Environmental Components and Criteria

For the purposes of the EA, the environmental aspects identified above were subdivided into environmental components and evaluation criteria, as included in the approved ToR and provided in **Table 4-1**, to focus the assessment of effects. The description of existing conditions is organized by environmental component.

Table 4-1. Environmental Aspects, Components, and Evaluation Criteria

Environmental Aspect	Environmental Component	Evaluation Criteria	Existing Conditions Report
Natural Environment	Atmospheric Environment	• Air Quality – Dust • Air Quality – Landfill Gas and Combustion By-Products • Air Quality – Blowing Litter • Odour	• Air Quality
		• Noise	• Noise
	Hydrogeology	• Groundwater Quality • Groundwater Quantity	• Hydrogeology

Environmental Aspect	Environmental Component	Evaluation Criteria	Existing Conditions Report
	Surface Water Environment	• Surface Water Quality	• Surface Water Quality
		• Surface Water Quantity	• Surface Water Quantity
	Ecological Environment	• Terrestrial Ecosystems • Aquatic Ecosystems	• Ecological Environment
Socio-Economic Environment	Social Environment	• Human Health	• Human Health
		• Effects on Local Community	• Socio-Economic Environment
	Economic Environment	• Economic Effects on Local Community	
	Visual Landscape	• Visual Impact of Facility	• Visual Landscape
Cultural Environment	Cultural Environment	• Cultural Heritage Resources	• Cultural Heritage Resources
		• Archaeological Resources	• Archaeological Resources
Built Environment	Transportation	• Traffic Operations	• Transportation
	Current and Planned Future Land Use	• Effects on Current and Future Land Uses	• Land Use

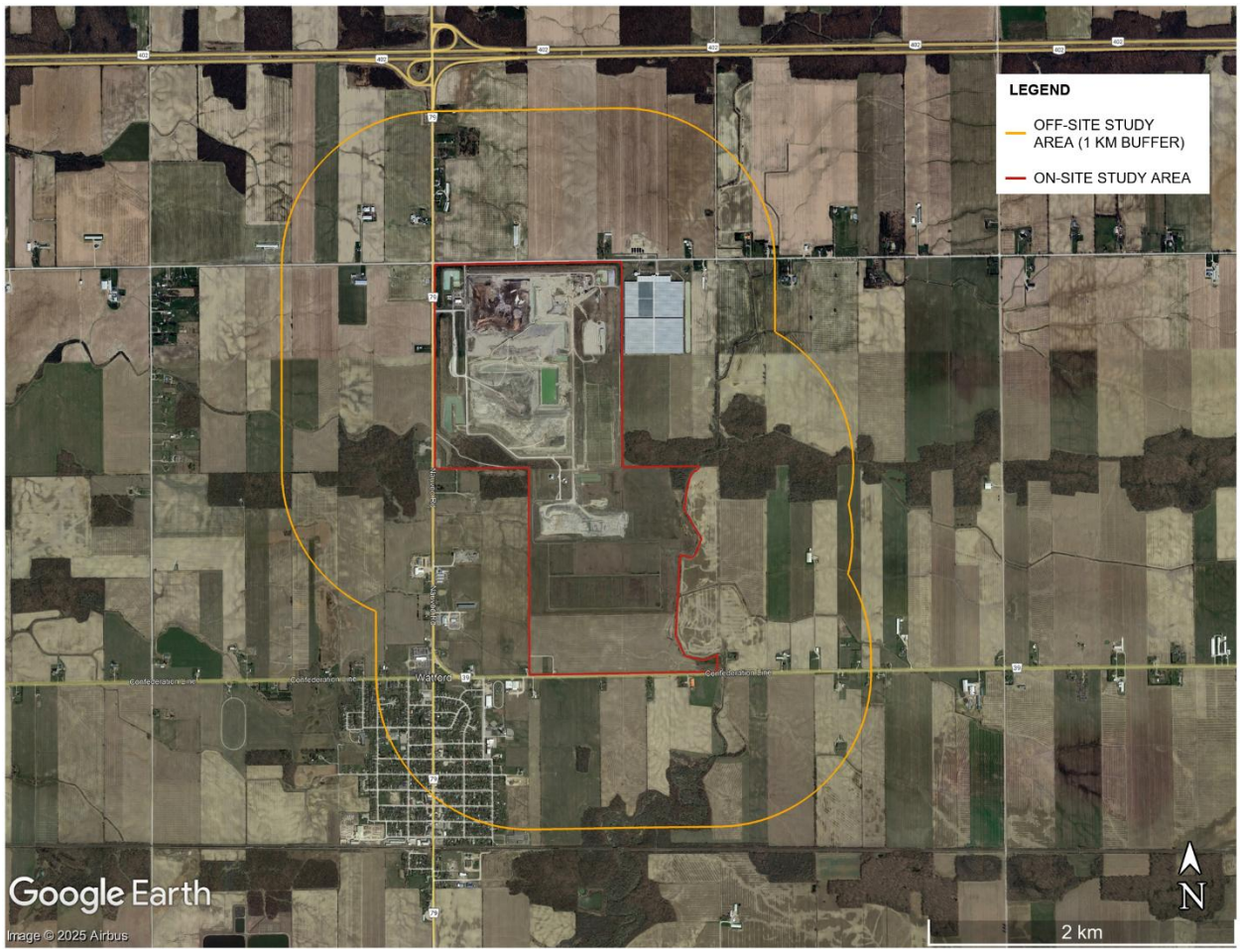
4.2 Study Areas

The TCEC landfill is located within the Township of Warwick, in the County of Lambton, approximately 1 kilometre (km) north of the Village of Watford. The TCEC is situated south of Highway 402 and southeast of the intersection of Nauvoo Road and Zion Line. The municipal street address of the TCEC is 5768 Nauvoo Road, Watford, Ontario. The area being considered for the landfill optimization is the existing 301 hectare (ha) TCEC site area.

The study areas include the existing TCEC site as well as the potentially-affected surrounding areas. The general On-site and Off-site Study Areas identified for the EA in the approved ToR are as follows (**Figure 4-1**):

- On-site Study Area: the existing TCEC;
- Off-site Study Area: the lands within the vicinity of the TCEC extending approximately 1 km out from the On-site Study Area.

Figure 4-1. General Study Areas for the EA



As outlined in the approved ToR, the general study areas identified above were refined during the EA to better suit the requirements of specific environmental components. Modifications to the study areas are outlined in **Table 4-2**.

The general On-site Study Area was adopted for all environmental components. The general Off-site Study Area was modified for the following environmental components:

- Air Quality
- Noise
- Ecological Environment
- Socio-Economic Environment
- Visual Landscape
- Archaeological Resources
- Transportation
- Land Use

Table 4-2. Study Areas by Environmental Component

Environmental Component	Evaluation Criteria	On-site Study Area	Off-site Study Area
Natural Environment			
Atmospheric Environment	• Air Quality • Odour	General On-site Study Area	Extended to include lands within approximately 5 km from the TCEC (**Figure 4-2**)
	Noise	General On-site Study Area	Modified to include an Off-site Haul Route Area, within 1 km of the primary haul route from Highway 402 to the site entrance (**Figure 4-7**).
Hydrogeology	• Groundwater Quality • Groundwater Quantity	General On-site Study Area	General Off-site Study Area
Surface Water Environment	Surface Water Quality	General On-site Study Area	General Off-site Study Area
	Surface Water Quantity	General On-site Study Area	General Off-site Study Area
Ecological Environment	• Terrestrial Ecosystems • Aquatic Ecosystems	General On-site Study Area	Extended to include the Gilliland-Geerts Drain downstream and westward of the TCEC to Underpass Road (**Figure 4-13**).
Socio-Economic Environment			
Socio-Economic Environment	Effects on Local Community	General On-site Study Area	Modified to include the village of Watford (**Figure 4-16**).
	Economic Effects on Local Community	General On-site Study Area	Modified to include the Township of Warwick (**Figure 4-17**).
	Human Health	General On-site Study Area	General Off-site Study Area
	Visual Impact of Facility	General On-site Study Area	Modified to extend approximately 2.5 km further west, approximately 2.5 km further east, and approximately 2.5 km further north (**Figure 4-18**).
Cultural Environment			
Cultural Environment	Archaeological Resources	General On-site Study Area	Excluded, as concern is regarding direct impacts, or those within 50 m of a known archaeological resource, which does not extend beyond the general Off-site Study Area.
	Cultural Heritage Resources	General On-site Study Area	General Off-site Study Area
Built Environment			
Transportation	Traffic Operations	General On-site Study Area	Extended to include haul route intersections (**Figure 4-23**) and of the southerly limit of Watford.
Land Use	Effects on Current and Future Land Uses	General On-site Study Area	Extended to include the entire Settlement Area of Watford (**Figure 4-25**).

The summary of existing conditions (i.e., the existing environment potentially affected) presented herein is organized by environmental component. Detailed descriptions of the existing conditions are provided in the Existing Conditions Reports (**Supporting Document 1**).

4.3 Existing Site Conditions

An overview of the TCEC, the applicable Environmental Compliance Approvals (ECAs), existing infrastructure, and general operations are presented below.

4.3.1 Overview of the TCEC

The TCEC is located at 5768 Nauvoo Road, Watford, Ontario, southeast of the intersection of Zion Line and Nauvoo Road, approximately 1 km north of the Village of Watford in the Township of Warwick and County of Lambton. The site is located on Lots 19 and 20, Concession 3, and Lot 20 and the western half of Lot 21, Concession 4, south of Egremont Road, Warwick.

The TCEC encompasses a site area of 301 ha which includes the Expansion Landfill, the closed Old Landfill (i.e., the original Warwick Landfill), a site office, a maintenance facility, a weigh scale, four stormwater management (SWM) ponds, leachate management infrastructure, landfill gas (LFG) management infrastructure, a popular system for leachate management, a poplar plantation, an excess soil stockpile, and a Renewable Natural Gas (RNG) Facility (refer to **Figure 1-2** in **Section 1**).

The majority of the site is zoned Industrial with the exception of a section of Agricultural land at the south end of the site, a small area of woodland near the centre of the site, and a hazard area that follows the alignment of Brown Creek. The TCEC is bounded to the north by Zion Line, to the east by the Twin Creeks Greenhouse and agricultural lands, to the south by lands owned by WM used for agricultural production and by Confederation Line, and to the west by Nauvoo Road. The setbacks from the Expansion Landfill footprint to the property boundaries are approximately 100 metres (m) to the north, about 205 m to the east, 100 m to 255 m to the south, and 235 m to the west.

The TCEC is framed on its west and north sides by 7 m and 6 m high earthen berms, respectively. The berms are vegetated with coniferous and deciduous trees that provide visual screening in addition to the height of the berms, effectively screening the landfill operation from both Zion Line and Nauvoo Road.

4.3.2 Environmental Compliance Approvals

The TCEC is operated in accordance with three (3) ECAs, listed in **Table 4-3**. The ECAs relate to the regulation of environmental discharges and operations associated with the landfill, leachate and SWM, RNG Facility, and emission control equipment. The primary ECA that covers the operations of the site is landfill ECA A032203.

Table 4-3. TCEC Environmental Compliance Approvals

Approval Type	Approval Number	Issuance Date	Operation
ECA – Waste Disposal Sites	A032203	June 20, 2025	Landfill
ECA – Industrial Sewage Works	8117-CUSNXX	April 29, 2024	RNG Facility, leachate treatment and disposal facility, SWM facility
ECA - Air	6318-CX4NFX	December 13, 2023	Flares, oxidizers, generators, leachate treatment facility, RNG Facility condensate tanks

4.3.3 Existing Infrastructure

The main entrance to the TCEC is the gated entrance at 5768 Nauvoo Road, located approximately 300 m south of Zion Line. The gate is locked after business hours. Access into the site during operating hours is controlled by an employee at the weigh scale.

A secondary gated entrance, located on Zion Line, approximately 200 m east of Nauvoo Road, serves as an emergency entrance.

An additional entrance has been constructed on Confederation Line between the existing Twin Creeks dog park and the landfill western property line to facilitate access to the RNG Facility. This entrance is solely for the use of the RNG Facility.

On-site perimeter roads are hard surfaced and provide access to the landfill and other on-site facilities. Waste haul vehicles travel to the landfill working face via access roads, which are generally gravel and constructed and relocated as necessary.

The site Office and Maintenance Facility are located north of the main entrance. Staff and heavy equipment parking lots and maintenance area are located east of the Office building and north and south of the Maintenance Facility.

A waste and recycling depot (Mini-Transfer Area) is provided for customers and Township residents and businesses. The waste and recycling depot is located south of the scale house. The waste and recycling depot includes bins for waste, single stream recycling materials (i.e., glass, plastic and metal containers, and fibre), cardboard, metal, and yard waste.

4.3.4 Waste Disposal

The service area for the TCEC is the Province of Ontario, with the majority of the waste arriving from Southwestern Ontario, Central Ontario, and the GTA. The landfill is approved to receive municipal, industrial, commercial, and institutional (IC&I) solid non-hazardous wastes, including non-hazardous contaminated soil.

The landfill has total airspace capacity of approximately 26.5 million m^3 over an area of 101.8 ha, and has an approved annual fill rate of 1.4 million tonnes. The TCEC

typically receives between 5,000 to 7,500 tonnes of residual waste, with an average of 200 waste hauling vehicles, per weekday.

4.3.5 Stormwater Management

The stormwater management system is designed for both quality and quantity control. Stormwater is currently managed on site through swales and detention ponds. Swales direct runoff to the ponds and outlets. The four stormwater management ponds, situated at the corners of the Expansion Landfill footprint, collect runoff from the surface of the landfill and release flows through culvert outlets. The system maintains peak site runoff at pre-development levels. There are ten stormwater outlets from the site, four of which receive water from the detention ponds.

4.3.6 Leachate Management

Leachate is produced as precipitation travels through the landfill, absorbing contaminants from the waste as it travels. The volume of leachate generated at a landfill will vary based on precipitation amounts, waste type and cover material in place on the landfill. Generally, the volume of leachate generated at a landfill will increase over time until final cover is installed and then reduce to a steady state.

The current approach to managing leachate generated at the TCEC includes phytoremediation of a portion of the leachate volume generated through irrigation of the on-site Poplar System. The balance of the leachate generated is removed from the site and sent to off-site wastewater treatment plants for disposal. Prior to closure of the TCEC a leachate treatment facility may be constructed. A leachate treatment facility is permitted at the TCEC with a rated capacity to treat 146,000 m³/year (400 m³/day). The facility has not been constructed to-date.

The March 2023 Leachate Management Plan reported that the volume of leachate extracted from the Expansion Landfill remained consistent for the previous four years, at approximately 41,000 to 44,000 m³ per year. Leachate generation volumes increased in 2023 to approximately 70,400 m³. The Expansion Landfill continued to develop including construction of a new stage increasing the amount of open area and reopening previously covered areas for filling, resulting in increased leachate generation. The annual leachate volume is anticipated to continue to fluctuate as landfilling areas are opened and closed each year.

The 9.3 ha Poplar System operate as a phytoremediation system for up to 44,000 m³ of leachate per year. The automated leachate pumping stations allow the leachate to be pumped to the equalization tank (capacity of 2,300 m³) or to the Poplar System irrigation tanks. The irrigation liquid is applied to the Poplar System from May to mid-October and the remaining leachate is hauled for off-site treatment and disposal. The Poplar System refers to the poplar trees planted on the final cover of the closed Old Landfill. The Poplar Plantation is a 28 ha plot of trees situated on native soil south of the excess soil stockpile. While also intended for phytoremediation of irrigation liquid that satisfies the treated leachate effluent criteria, the poplar plantation will not be commissioned until the on-site leachate treatment facility is operational.

4.3.7 Landfill Gas Management

Landfill gas (LFG) is produced as a by-product of the biological decomposition of organic matter within a landfill and typically increases in volume throughout the landfill development and peaks upon site closure.

The majority of the LFG generated at TCEC is collected by the LFG collection system and sent for destruction or for utilization. A small percentage of LFG is released through the landfill surface as fugitive emissions. LFG that is collected but not utilized is destroyed by combustion through on-site LFG flares.

The site LFG collection system has a collection efficiency of approximately 75% for areas without final cover and approximately 90% for areas with final cover. Increased collection efficiency and reduced fugitive LFG loss directly impacts the assessment of effects for LFG contaminants and greenhouse gas (GHG) emissions.

The landfill has four approved LFG flares. Flares 1 to 4 provide a combined capacity of approximately 25,847 m³/hr. The new RNG Facility has the capacity to process up to 13,592 m³/hr of LFG on a dry basis and transform it into RNG, reducing greenhouse emissions over the operating life of the facility. Additionally, Flares 5 and 6 are being constructed as part of the RNG Facility and will provide a capacity of 10,188 m³/hr. In total, the TCEC has an approved combined treatment/flare operational capacity of 49,627 m³/hr. The volume of LFG generated in 2024 was approximately 8,900 m³/hr.

4.3.8 General Housekeeping

WM follows best practices as part of daily operations at the TCEC. Best practices and management plans are in place regarding:

- dust;
- odour;
- noise;
- litter;
- birds;
- complaints;
- emergencies (e.g., fire);
- inspection and maintenance; and
- records.

4.4 Atmospheric Environment

The Atmospheric Environment includes Air Quality, Odour, and Noise.

4.4.1 Air Quality

The existing conditions are summarized from the Air Quality Existing Conditions Report (**Supporting Document 1-1**).

The On-site and Off-site Study Areas for Air Quality are shown on **Figure 4-2**. The On-site Study Area corresponds to the TCEC site boundary, while the Off-site Study Area has been extended to include lands within approximately 5 km from the TCEC, consistent with Ontario Ministry of Environment, Conservation and Parks (MECP) modelling guidelines for Air Quality. The area surrounding the TCEC comprises mostly agricultural lands as well as portions of Hwy 402, Nauvoo Road, and Confederation Line, and the village of Watford including a number of small businesses. Sources of air emissions include on-site operations and activities from the surrounding agricultural operations, as well as traffic on local roads.

The Air Quality discipline evaluates the releases to air from landfill operations and assesses the potential effects on surrounding areas by comparing to standards and guidelines published by government agencies. The Air Quality discipline assesses releases of air quality compounds of interest, namely particulate matter (PM or dust), odour, blowing litter, volatile organic compounds (VOCs), reduced sulphur compounds, and combustion byproducts. Sources of air emissions at the TCEC include:

- On-site equipment and vehicle traffic;
- the landfill mound (interim and final cover areas);
- the active face and associated equipment;
- the final cap construction and associated equipment;
- material storage piles;
- the RNG Facility;
- the approved future leachate treatment plant and leachate collection system;
- LFG flares (as currently planned for end of current operations); and
- emergency generators.

Emissions from these sources were quantified using a combination of on-site sampling, published emission factors, and engineering calculations.

Compounds of interest were assessed at a series of discrete receptors that were identified in the vicinity of the TCEC (**Figure 4-3**) as well as at a grid of receptors at and beyond the property boundary (**Figure 4-4**). The discrete receptors are closest to the landfill area in each compass direction and are expected to provide the worst-case estimate for predicted contaminant concentrations in all directions from the landfill.

The receptor located at the cemetery to the southwest of the landfill has been included in the air quality assessment as a short-term receptor, denoted as STR1, as people are expected to use this location for short periods during daytime only. Therefore, only odour and contaminants with 10-minute or 1-hour averaging period criteria were assessed at this receptor. All other receptor locations represent residences with potential 24-hour occupancy and were assessed for all averaging periods, denoted as R1 to R24. All discrete receptors are modelled using a flagpole height of 1.5 m.

Potential effects at all off-site receptors were assessed using the United States Environmental Protection Agency (EPA) dispersion model AERMOD, version 22112. Dispersion modelling was completed for dust, odour, VOCs, and combustion byproducts. Potential effects related to blowing litter were assessed qualitatively.

The establishment of existing conditions considered the cumulative effects from existing background concentrations and dispersion modelling results. This approach provides a cumulative effect at the receptors from the TCEC and surrounding industrial and agricultural activities, traffic, and other sources of like air emissions. Background concentrations for dust, VOCs, and reduced sulphur compounds were determined through ambient monitoring. Background concentrations for contaminants not included in the ambient monitoring campaign were obtained from representative publicly available data. No background was considered for odour or blowing litter.

Contaminants were compared against criteria from O.Reg. 419/05 and Ambient Air Quality Criteria (AAQC) where available. In the absence of any MECP criteria, contaminants were compared to the Canadian Ambient Air Quality Standards (CAAQS) criteria. These criteria are discussed below.

Ontario Regulation 419/05 (MECP, 2009) sets out air standards which are upper limits on a facility's contribution to ambient air concentrations. The MECP has also established a list of guidelines and screening levels to be used as limits to evaluate a facility's contribution to ambient air concentrations for regulatory approval purposes.

The MECP has established AAQC that are intended to be used to assess general (ambient) air quality resulting from all sources of a contaminant to air. An AAQC is not a regulatory value; rather, it is a concentration of a contaminant in air that is protective against adverse effects on health and/or the environment.

The Canadian Council of Ministers of the Environment (CCME) have established CAAQS. The CAAQS are health and environmental-based air quality objectives to further protect human health and the environment and to provide the drivers for air quality improvement across the country.

A summary of the contaminants and their applicable criteria are provided in **Table 4-4**.

Figure 4-2. On-site and Off-site Study Areas for Air Quality

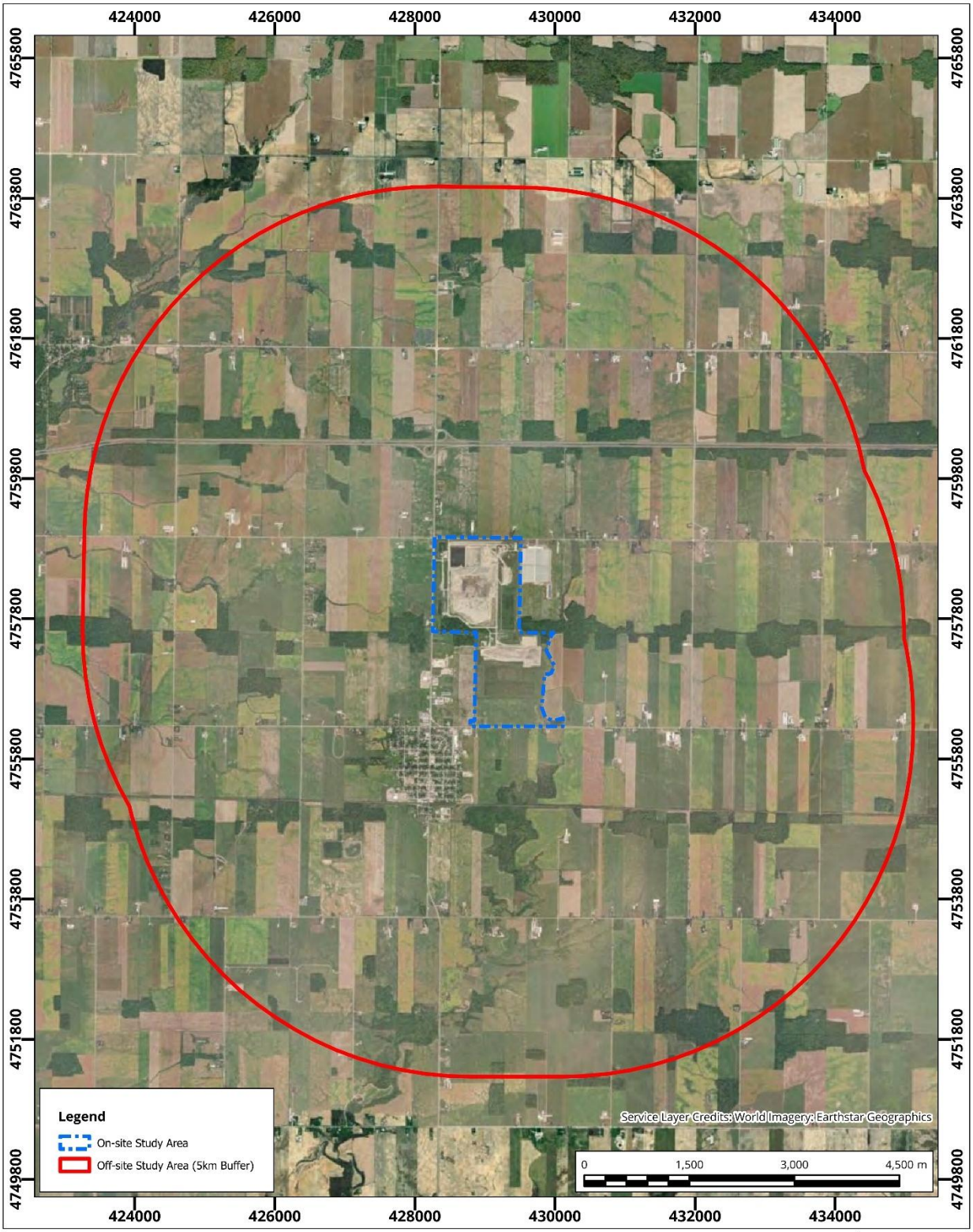


Figure 4-3. Discrete Receptor Locations for Air Quality

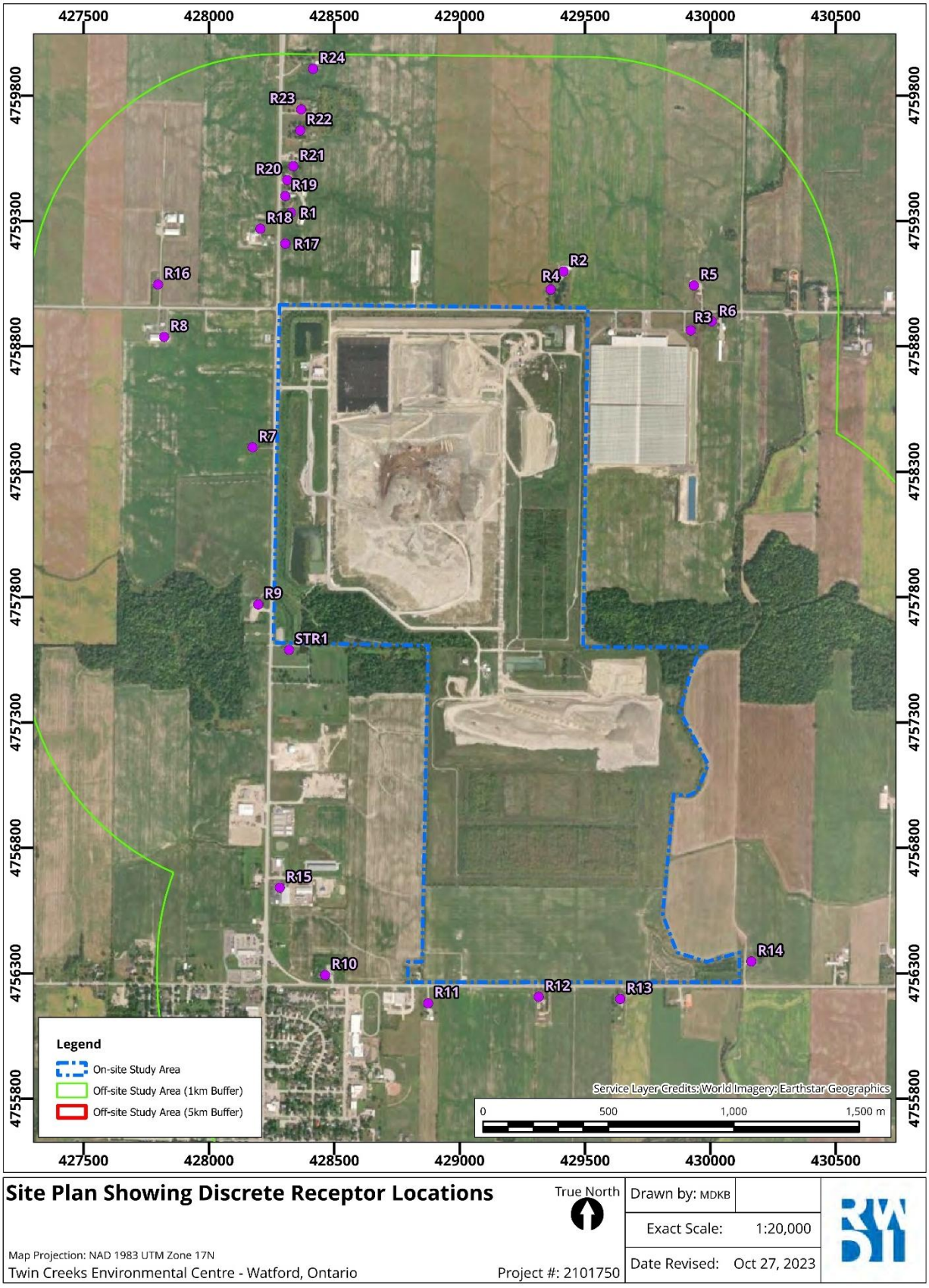


Figure 4-4. Air Quality Receptor Grid

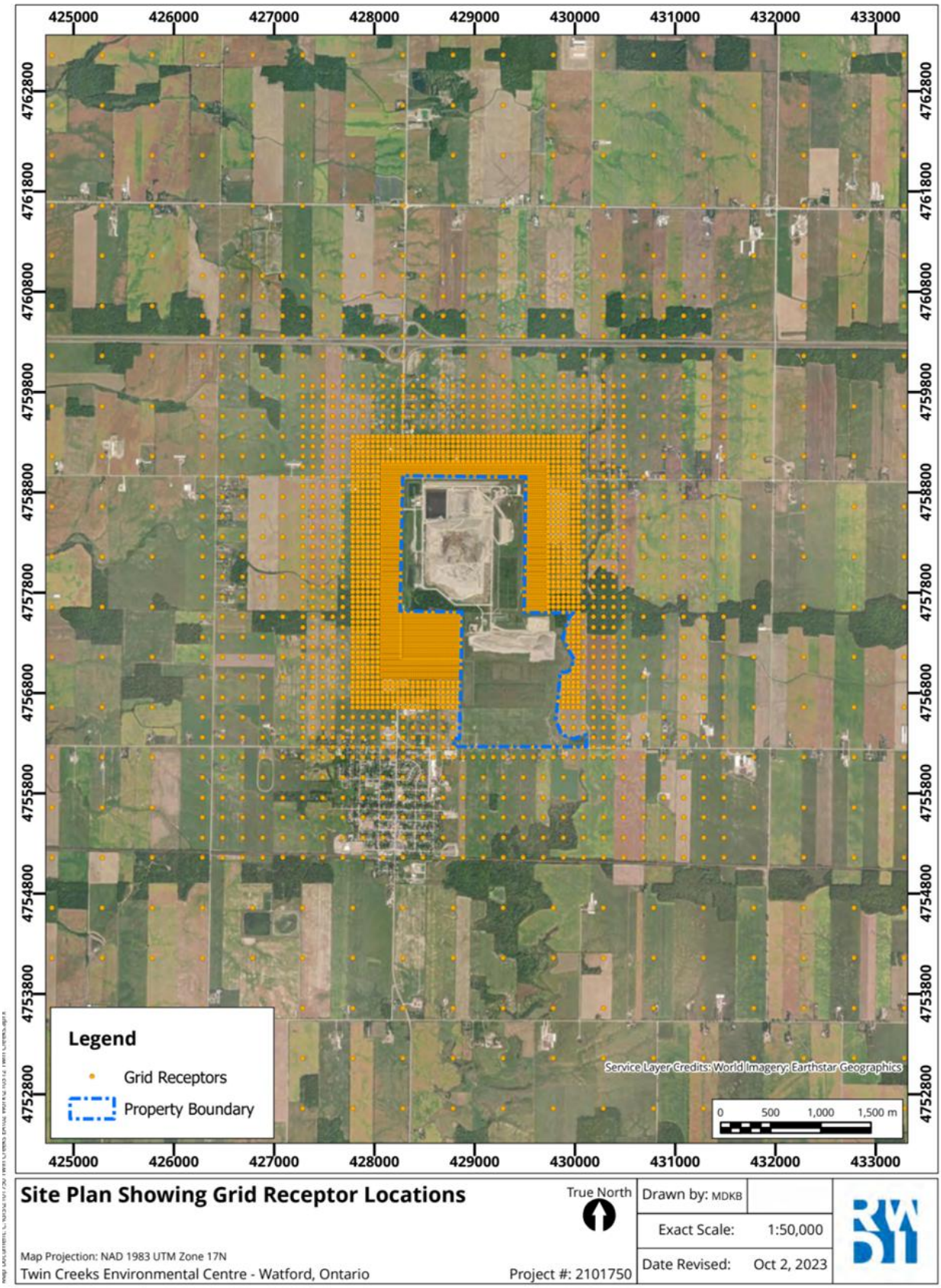


Table 4-4. Assessment Criteria for Key Indicator Compounds for Air Quality

Contaminants	Applicable Sub-Assessment	Averaging Period	Air Quality Criteria (µg/m³)	Source
Total Suspended Particulate (TSP)	Dust	24-Hour	120	AAQC & O.Reg 419/05
		Annual	60	AAQC
Particulate Matter less than 10 µm in diameter (PM_{10})	Dust	24-Hour	50	AAQC
Particulate Matter less than 2.5 µm in diameter ($PM_{2.5}$)	Dust	24-Hour	27[1]	CAAQS
		Annual	8.8[2]	CAAQS
Vinyl Chloride	Landfill Gas	24-hour	1.0	AAQC & O.Reg 419/05
		Annual	0.2	AAQC
Benzene	Landfill Gas	24-hour	2.3	AAQC
		Annual	0.45	AAQC & O.Reg 419/05
1,2-Dichloroethane	Landfill Gas	24-hour	2	AAQC & O.Reg 419/05
		Annual	0.4	AAQC
Ammonia	Landfill Gas	24-hour	100	AAQC
Hydrogen Sulphide (H_2S)	Landfill Gas	10-minute	13	AAQC & O.Reg 419/05
		24-hour	7	AAQC & O.Reg 419/05
Total Reduced Sulphurs (TRS)	Landfill Gas	10-minute	13	AAQC & O.Reg 419/05
		24-hour	7	AAQC & O.Reg 419/05
Odour	Odour	10-minute	1 OU/m³	MECP Guidance
Dioxins and Furans (D&F)	Combustion	24-hour	0.1 pg TEQ/m³[3]	AAQC
Nitrogen Oxides/Nitrogen Dioxides (NO_x/NO_2)	Combustion	1-hour	400	AAQC & O.Reg 419/05
		24-hour	200	AAQC & O.Reg 419/05
Sulphur Dioxide (SO_2)	Combustion	1-hour	100	AAQC & O.Reg 419/05
		Annual	10	AAQC & O.Reg 419/05

Notes:

[1] The 24-hour $PM_{2.5}$ CAAQS criteria is based on the 3-year average of the annual 98th percentile of the daily 24-hour average concentration.

[2] The annual $PM_{2.5}$ CAAQS criteria is based on the 3-year average of the annual average of the daily 24-hour average concentration.

[3] Pico gram toxic equivalency per cubic metre (pg TEQ/m³).

To better understand existing air quality conditions at TCEC, two field studies were conducted including:

- ambient air monitoring; and
- emission source sampling.

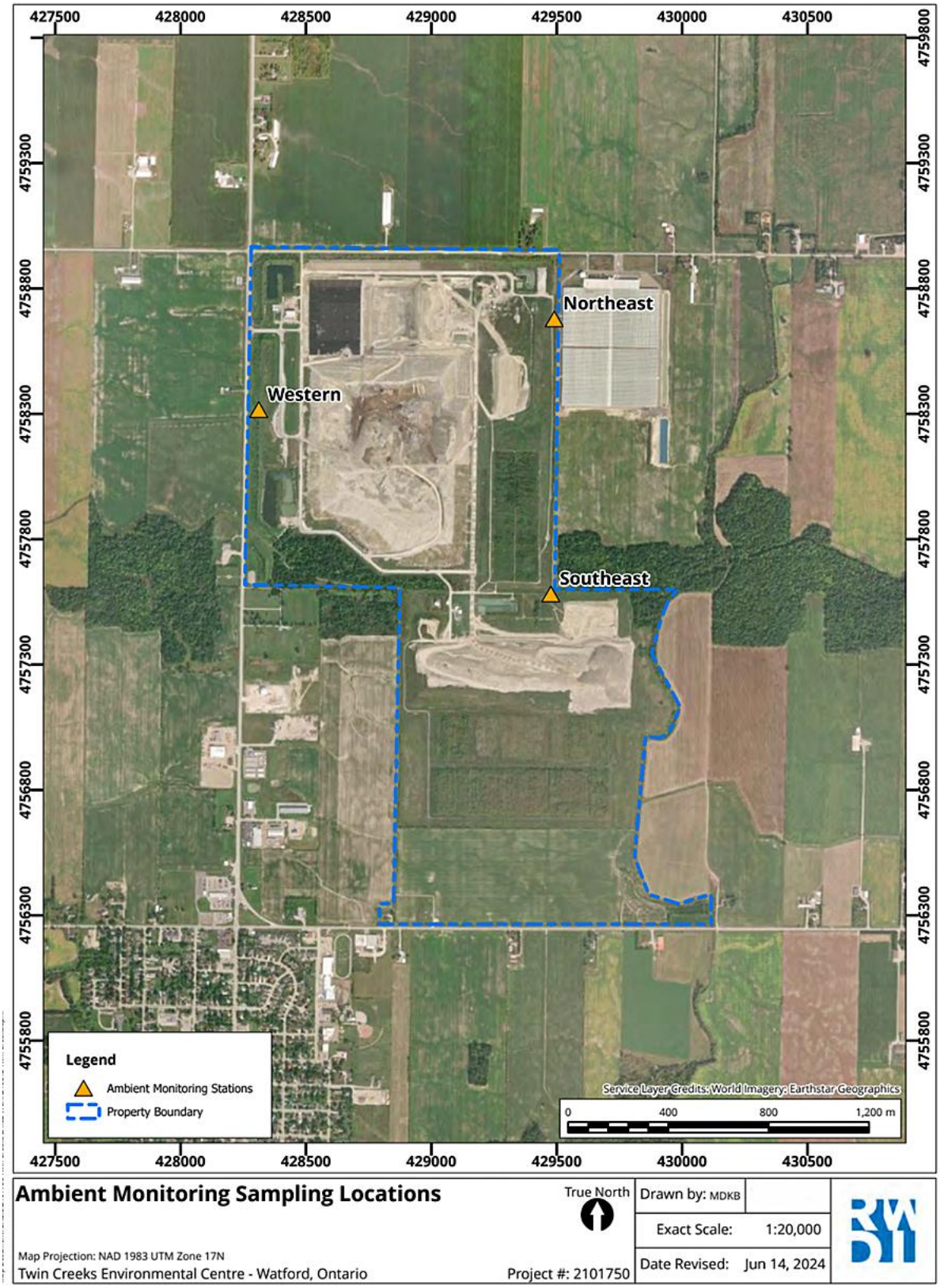
Ambient air monitoring involved measuring concentrations of contaminants such as TSP, PM_{10}, $PM_{2.5}$, VOCs, and TRS at three fixed stations on-site. This data aided the characterization of background air quality and supported the determination of cumulative effects by combining background and landfill-related emissions. Monitoring for PM occurred from January to December 2023, while VOC and TRS sampling ran from June to September 2023. The ambient monitoring sampling locations are shown on **Figure 4-5**.

The TCEC site has been extensively studied through past assessments (e.g., 2005 EA, 2016 Screening Report, and ECA applications). Considering these previously completed studies, key indicator contaminants were selected for evaluation in the current EA, focusing on those with predicted concentrations exceeding 15% of existing criteria in past reports.

Contaminants were grouped into three categories, which correspond to the Air Quality evaluation criteria:

- Dust (TSP, PM_{10}, $PM_{2.5}$);
- LFG and Combustion Byproducts (e.g., vinyl chloride, benzene, TRS, H_2S, ammonia, NOx, dioxins/furans, SO_2); and
- Blowing Litter (qualitatively assessed).

Figure 4-5. Ambient Monitoring Sampling Locations for Air Quality



4.4.1.1 Dust

Dust, or PM, can become a nuisance when it enters homes through open windows, settles on cars and building exteriors, or reduces visibility. In smaller particle sizes, it can also pose health risks. At landfills, dust typically consists of relatively inert particles from native or impacted soils and is released intermittently—mostly during operations or construction activities, and primarily during dry weather. The three main types of dust-related contaminants are total suspended PM (TSP), inhalable PM (PM_{10}), and respirable PM ($PM_{2.5}$).

TSP refers to particles smaller than 44 micrometres (µm) in aerodynamic diameter, which can stay suspended in the air for long periods due to their low settling velocity. These particles mainly cause visibility issues and surface soiling. PM_{10} particles, less than 10 µm in aerodynamic diameter, are small enough to be inhaled into the lungs and, with prolonged exposure at high levels, can lead to adverse health effects. $PM_{2.5}$ particles, less than 2.5 µm, are even smaller and can penetrate deep into the lungs, reaching areas involved in gas exchange. Long-term exposure to elevated levels of $PM_{2.5}$ is associated with more significant health impacts.

Fugitive dust at TCEC can be generated by vehicle traffic on internal haul routes, heavy equipment operations, and wind erosion from exposed areas and material piles, particularly during dry weather. While these sources are typically excluded from regulatory compliance modelling under O. Reg. 419/05, they were included in this assessment to provide a comprehensive view. Key dust sources under normal operations include on-site traffic (on paved and unpaved roads), idling vehicles, wind erosion, material handling (such as waste soils and cover materials), bulldozing, combustion sources, LFG flares, flares at the RNG Facility and thermal oxidizers, and emergency generators. These sources are currently managed under the site's Best Management Practices Plan (BMPP).

Results for TSP, PM_{10}, and $PM_{2.5}$ were compared against their applicable criteria as outlined in **Table 4-4**. Modelling was competed for the 24-hour and annual averaging periods. Predicted concentrations of TSP were assessed at both grid and discrete receptor locations. Predicted concentrations of PM_{10} and $PM_{2.5}$ were assessed at discrete receptors only. Background concentrations were added to the predicted concentrations in order to assess cumulative effects. The 90^{th} percentile background value was used for the 24-hour averaging periods, and the average background concentration was used for annual averaging periods.

Predicted concentrations are conservative, as they are based on maximum operating activity paired with the worst-case dry meteorological conditions over 5 years. In addition, the dispersion modelling does not account for precipitation, snow cover, or vegetation interception of PM, each of which can decrease the concentration observed at the receptor.

TSP

Predicted concentrations of TSP for the annual averaging period are below the 60 micrograms per cubic metre (µg/m³) criteria at all discrete receptors. The maximum

predicted concentration, including background contribution, at a discrete receptor was 39 µg/m³ which occurred at R4.

Predicted concentrations of TSP for the 24-hour averaging period exceeded the 120 µg/m³ criteria at discrete receptors R2, R3, R4, R5, R6, R7, R9, R10, R12, and R13. Since exceedances were predicted at discrete receptors a frequency analysis was conducted to determine the percentage of time that modelled TSP concentrations are predicted to exceed the criteria. The maximum predicted concentration at a sensitive receptor location with background considered was 259 µg/m³ and occurred at R4. The maximum frequency of exceedance occurred at R4 with a frequency of 2.8%, or 49 events over the 5-years of modelling. The frequency of exceedance at other discrete receptors was lower than this maximum amount; of the receptors with exceedances, most were on the order of a day or two per year. Although exceedances are predicted, the frequency of exceedance is low. Of note, concentrations without background are all below the criteria with the exception of receptors R2, R3, and R4.

PM_{10}

Predicted concentrations of PM_{10} for the 24-hour averaging period exceeded the 50 µg/m³ criteria at discrete receptors R2, R3, R4, R5, R6, R9, R12 and R13. Since exceedances were predicted at discrete receptors a frequency analysis was conducted to determine the percentage of time that modelled PM_{10} concentrations are expected to exceed the criteria. The maximum predicted concentration at a sensitive receptor location for the current scenario including background was 103 µg/m³ and occurred at R4. The maximum frequency of exceedance occurred at R4 with a frequency of 2.2%, or 40 events over the 5-years of modelling. Although exceedances are predicted, the frequency of exceedance is low.

$PM_{2.5}$

Predicted concentrations of $PM_{2.5}$ for the annual averaging period are below the 8.8 µg/m³ criteria at all discrete receptors. The maximum predicted concentration occurs at R4 with a predicted concentration of 8.6 µg/m³ or 98% of the criteria.

Predicted concentrations of $PM_{2.5}$ for the 24-hour averaging period exceed the 27 µg/m³ CAAQs objective at discrete receptor R4. The CAAQs criteria specifies that the predicted concentration should be based on the 3-year average of the 98th percentile of the daily 24-hour average concentration, this was applied to the dispersion modelling results. Modelling results adjusted for the 3-year average of the 98th percentile of the daily 24-hour average period predicts exceedances at R4 only with a maximum predicted concentration of 29 µg/m³ with a frequency of 0.3%, or 5 events over the 5-years of modelling. Although exceedances are predicted, the frequency of exceedance is low.

The dust exceedances under existing conditions are summarized in **Table 4-5**.

Table 4-5. Summary of Dust Exceedances

Contaminant	Exceedance Location	Maximum Exceedance	Maximum Frequency of Exceedance
TSP (annual)	—	—	—
TSP (24-hr)	R2, R3, R4, R5, R6, R7, R9, R10, R12, and R13	259 µg/m³ at R4	2.8% 49 events over 5 years
PM_{10} (24-hr)	R2, R3, R4, R5, R6, R9, R12 and R13	103 µg/m³ at R4	2.2% 40 events over 5 years
$PM_{2.5}$ (annual)	—	—	—
$PM_{2.5}$ (24-hr)	R4	29 µg/m³ at R4	0.3% 5 events over 5 years

Note: "—" denotes no exceedance.

Overall, because of the conservatism included in the assessment, the modelling likely over-predicts the impacts from the landfill and impacts from landfill operations are expected to be low. In addition, modelling was completed to assess effects at the monitoring locations, with the modelled results showing more exceedances compared to the monitored data.

Dust Complaints

A review of the TCEC complaints log was conducted in order to determine the current level of dust impacts in the vicinity of the landfill. From 2009 to the end of 2024, a total of ten (10) dust related complaints were received. All ten dust related complaints were related to track out and/or roadway debris in the form of Automobile Shredder Residue (ASR) material and dirt; none of the complaints were related to fugitive dust or soiling. Six of the ten complaints occurred in 2021 when ASR material was used as a daily cover material. Since then, WM has implemented a new ASR material abatement plan to control ASR material track out. The following year in 2022 there was one dust related complaint regarding track out. This suggests the abatement plan has been successful in decreasing the ASR material track out.

When WM received the complaints, the necessary corrective action was applied, which generally involved sending the sweeper to clean the road surface. In general, dust events are isolated incidents and overall dust related complaints are low, with no complaints associated with fugitive dust impacts.

Dust Best Management Practices Plan

In an effort to minimize fugitive dust emissions from the site, WM has prepared and implemented a Dust BMPP to minimize the off-site migration of fugitive dust. The Dust BMPP outlines details on standard operating procedures, mitigation measures, and training to control key operations typically associated with dust emissions. Key control measures outlined in the plan include:

- watering of frequently disturbed or erodible surfaces;

- watering of roadway surfaces;
- sweeping of roadways;
- posting and enforcing paved and unpaved road speed limits;
- inspection and maintenance of internal and external roadways;
- development and use of inclement weather areas;
- ambient monitoring of TSP; and
- training of relevant staff.

4.4.1.2 Landfill Gas and Combustion By-Products

LFG is generated by the decomposition of organic waste and is primarily composed of methane and carbon dioxide (CO_2), with small amounts of VOCs and reduced sulphur compounds. Key indicator contaminants assessed include:

- VOCs such as vinyl chloride, benzene, and 1,2-dichloroethane;
- combustion by-products such as nitrogen oxides (NO_x), sulphur dioxide (SO_2), and dioxins and furans (D&F); and
- ammonia from the proposed leachate treatment facility.

Indicator contaminants were selected based on the results of previous studies completed at the landfill. In general, the contaminants identified as having predicted concentrations greater than 15% of their current criteria in the previously completed 2016 TCEC Screening Report (HDR, 2017) were determined to be the key indicator contaminants. Emissions of sulphur compounds were also considered. This EA focuses on the following sulphur compounds:

- Hydrogen sulphide (H_2S); and
- Total reduced sulphurs (TRS).

TRS represents the cumulative impact from all sulphur compounds including carbonyl sulphide, H_2S, carbon disulfide, methyl mercaptan, ethyl mercaptan, dimethyl sulphide, 1-propyl mercaptan, methyl ethyl sulphide, and dimethyl disulphide. In addition to being assessed as a component of TRS, H_2S was assessed independently as it is the primary contributor to TRS emissions.

The majority of the LFG generated at TCEC is collected by the LFG collection system and sent for destruction or for utilization; however, a portion of the LFG is released through the landfill surface as fugitive emissions. LFG that is collected but not utilized is destroyed by combustion through the LFG flares. Combustion of LFG produces combustion byproducts, including NO_x, SO_2, D&F and PM.

Emissions of NO_x, and SO_2 are commonly associated with other fuel-burning combustion equipment used during landfill activities, such as the LFG flares, on-site vehicles and heavy equipment, and diesel generators. D&F are generated at

extremely high temperatures and therefore are only considered as combustion byproducts from flaring and the thermal oxidizers.

Although it is neither a VOC nor a combustion by-product, ammonia may be released from the proposed leachate treatment facility.

Potential LFG and combustion by-product impacts were assessed through review of mitigation measures, complaints, emission sources, field measurements, and dispersion modelling. Dispersion modelling was used to predict compliance with all criteria at all discrete receptors as well as the property boundary and beyond for benzene, vinyl chloride, 1,2-dichloroethane, ammonia, SO_2, NO_x, D&F, and 24-hour H_2S. The 90th percentile background value was used for the 10-minute, 1-hour and 24-hour averaging periods, and the average background concentration was used for annual averaging periods.

Background concentration for H_2S and TRS were based on the 90th percentile value of all wind direction background data. Considering all wind directions rather than upwind only provides a conservative estimate of the background concentration because downwind and crosswind conditions have the potential to capture emissions from landfill sources which when paired with dispersion modelling could double count landfill emissions.

VOCs, Combustion By-Products, and Ammonia

Benzene, vinyl chloride, 1,2-dichloroethane, ammonia, SO_2, NO_x, and D&F are predicted to be below their applicable criteria at all off-site locations with background included. The maximum predicted concentrations of each contaminant occur at or near the property boundary, and concentrations at discrete receptors are predicted to be lower than these maximum modelled values. A summary of the VOCs and combustion by-product modelling results (maximum ground-level concentrations) are provided in **Table 4-6**.

Sulphur Compounds

Predicted concentrations of 24-hour H_2S are expected to comply at all discrete receptors and at the property boundary and beyond. The maximum predicted concentration occurs at the property boundary with a predicted concentration of 6.5 µg/m³ or 92% of the criteria.

Predicted concentrations of 10-minute H_2S, 10-minute TRS, and 24-hour TRS are predicted to exceed at all discrete receptors and the property boundary; however, these elevated concentrations are the result of high background concentrations with very little contribution coming from landfill activities. Predicted contributions from landfilling activities for all H_2S and TRS averaging periods are low, accounting for less than 10% of the cumulative concentration.

The existing conditions exceedance concentrations for sulphur compounds are summarized in **Table 4-7**.

Table 4-6. Summary of VOCs and Combustion Byproduct Dispersion Modelling Results

Contaminant	Averaging Period	Background Concentration (µg/m³)	Existing Conditions			
			Maximum Modelled Concentration Without Background (µg/m³)	Percentage of Criteria Without Background (%)	Maximum Modelled Concentration with Background (µg/m³)	Percentage of Criteria with Background (%)
Benzene	24-Hour	0.56	0.3	14%	0.9	38%
	Annual	0.4	0.05	10%	0.4	99%
Vinyl Chloride	24-Hour	0.05	0.4	41%	0.5	46%
	Annual	0.1	0.05	24%	0.1	49%
1,2-Dichloroethane	24-Hour	0.10	0.3	15%	0.4	20%
	Annual		0.03	9%	0.1	24%
Ammonia	24-Hour	3.1	8.5	9%	12	12%
Sulphur Dioxide	1-Hour	2.4	75	75%	77	77%
	Annual	1.4	2.0	20%	3.4	34%
Nitrogen Oxides	1-Hour	21.0	278.2	70%	299	75%
	24-Hour	19.1	37.5	19%	57	28%
Dioxins and Furans	24-Hour	0.02	0.001	0.0005%	0.02	21%

Table 4-7. Summary of Exceedance Concentrations of Sulphur Compounds

Contaminant	Exceedance Location[1]	Maximum Exceedance with Background	Maximum Concentration without Background
H_2S (24-hr)	—	—	—
H_2S (10-min)	All Discrete Receptors	23.3 µg/m³ 179% of the criteria at STR1	0.8 µg/m³ 5.9% of the criteria at STR1
TRS (24-hr)	All Discrete Receptors	11.9 µg/m³ 169% of the criteria at property boundary	0.86 µg/m³ 12.2% of the criteria at property boundary
TRS (10-min)	All Discrete Receptors	45.4 µg/m³ or 349% of the criteria at R4	1.2 µg/m³ or 9.0% of the criteria at R4

Notes:
1 Exceedance location including background concentrations.
"—" denotes no exceedance.
Criteria: 24-hr H_2S = 7 µg/m³; 10-min H_2S = 13 µg/m³; 24-hr TRS = 7 µg/m³; 10-min TRS = 13 µg/m³.

Background concentrations of H_2S and TRS were obtained as part of the ambient monitoring campaign. Background TRS is primarily driven by hydrogen sulfide as it is the most abundant sulphur species and therefore, the background value of TRS follows the same trends as H_2S. Monitoring in 2023 showed that most VOC levels were below detection limits, although there were three H_2S exceedances and 38 TRS exceedances, mostly due to high detection limits. Only three TRS exceedances were above the criteria.

Overall, predicted concentrations of H_2S and TRS are dominated by elevated background values results from elevated laboratory detection limits and the predicted concentrations of H_2S and TRS from landfill operations at all discrete receptors and the property boundary are low. Therefore, impacts associated with landfilling operations are expected to be low.

LFG and Combustion By-Product Complaints

A review of the TCEC complaints log was conducted to determine the current level of VOC and combustion byproduct impacts in the vicinity of the landfill. From 2009 to the end of 2024 no VOC or combustion byproduct related complaints were received. However, there were odour-related complaints, as discussed in **Section 4.4.2**. Reduced sulphur compounds such as H_2S and TRS are known to be odourous and can therefore contribute to odour impacts. Although no specific VOC or combustion byproduct complaints were received, it is reasonable to assume that some of the odour related complaints are influenced by emissions of reduced sulphur species. The Odour BMPP is discussed in **Section 4.4.2**.

4.4.1.3 Blowing Litter

A potential issue at the landfill is wind-blown litter, which typically includes lightweight materials like paper, plastic bags, and cardboard that can be picked up by the wind, especially at the active face where fresh waste is exposed. During periods of strong winds, litter may be carried off-site. To reduce this risk, non-active waste areas are covered daily or with interim or final covers.

The assessment of blowing litter involved reviewing current mitigation efforts, examining litter-related complaints and MECP inspection logs, evaluating landfill conditions against relevant literature and local wind patterns, and analyzing local meteorological conditions to understand how weather influences litter events. **Figure 4-6** illustrates the property boundary, sensitive receptors and litter zones identified through the meteorological assessment.

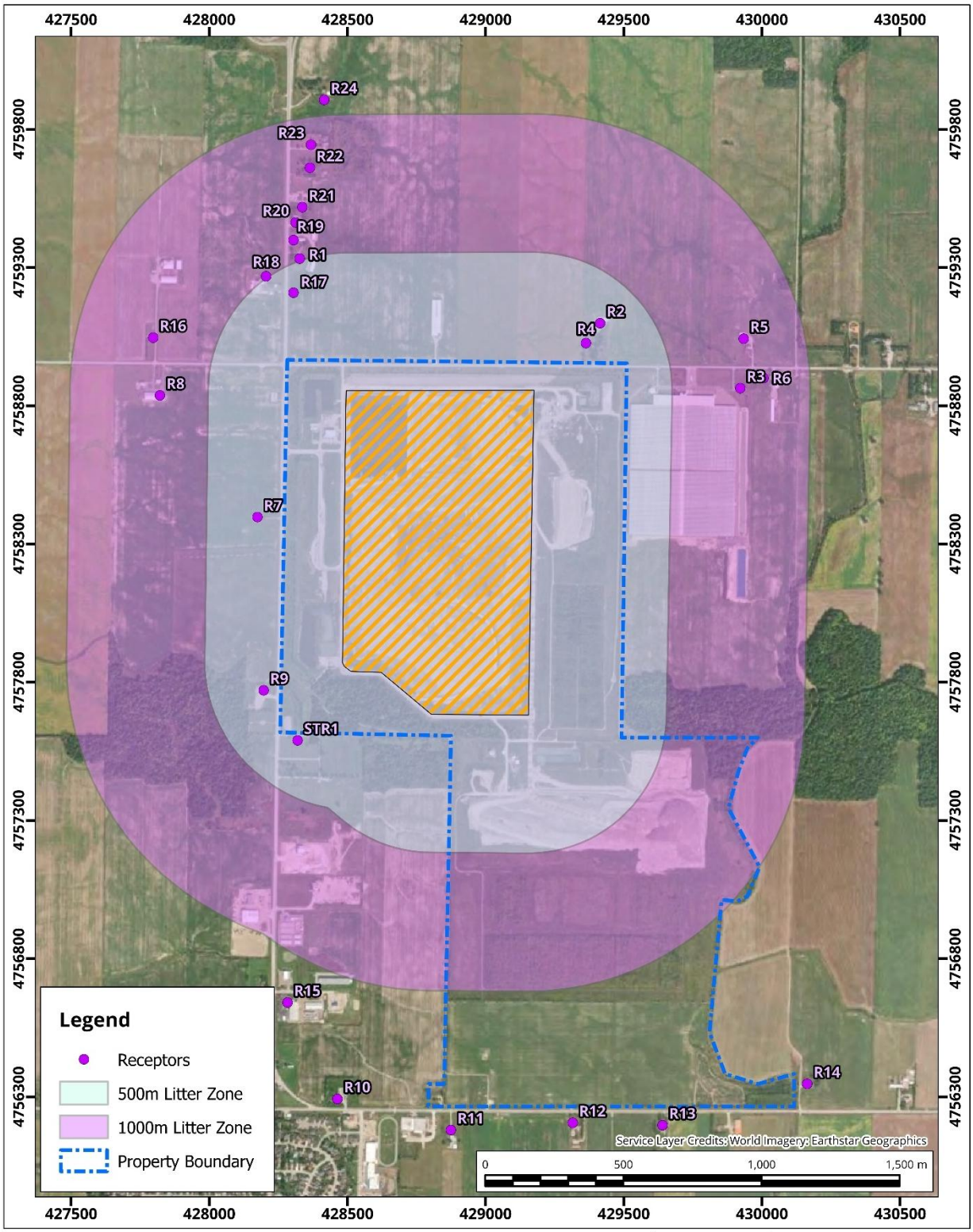
Litter events are highly dependent on meteorological conditions, primarily wind speed and wind direction. Wind speeds ranging from 16 to 24 kilometres per hour (km/h) were considered the minimum wind speeds required for potential litter events. As wind speed increases, more material has the potential to be lifted by the wind which then increases the potential for litter. The predominant wind direction can be used to determine where the litter from these events is most likely to impact. Understanding the zones for litter allows for effective implementation of mitigation measures.

Five rural residences and the cemetery are located within 500 m of the landfill. High winds that could potentially cause litter to blow toward these residences are expected to occur infrequently, less than 2% of the time. R2 and R4 are located to the northeast of the landfill in the predominant wind direction.

Based on review of litter windspeed thresholds, wind speeds in excess of the established litter thresholds are expected to occur approximately 5% of the time in the predominant wind direction (southwest to northeast). WM has installed permanent litter fences along the northern boundary to control the off-site migration of litter, which decreases the potential impacts. Portable wind fences are also utilized at the active face to assist in reducing the potential for wind-blown litter. Overall, litter related impacts from landfill operations are expected to be low.

MECP inspection records noted that although off-site litter was identified, WM was responsive and organized cleanup of the impacted property promptly. WM litter logs provide evidence that litter inspections are being performed and cleanup and maintenance activities are being completed when required. Meteorological data and nearby residence locations help identify litter-prone zones, allowing focused mitigation efforts. Overall, with the BMPP in place, WM effectively minimizes off-site litter impacts, keeping effects on nearby residences low.

Figure 4-6. Property Boundary, Sensitive Receptors and Litter Zones



Litter Complaints

During the operating period between 2009 and the end of 2024, a total of 15 litter related complaints were received with the majority occurring between 2019 and 2024. When complaints were received WM took the necessary corrective action in accordance with their existing Blowing Litter BMPP.

Litter BMPP

Although it is not feasible to completely eliminate blowing litter, litter can be reduced significantly with proper control practices. In an effort to minimize the potential for litter events from the operations of TCEC, WM has developed and implemented a Blowing Litter BMPP. The Blowing Litter BMPP is used to manage the migration of litter off-property. The plan implements mitigation controls such as:

- Inspection of incoming trucks to ensure that loads are secure prior to arriving at the site;
- Inspection of outbound trucks to ensure that the loads have been completely cleared of the material to avoid litter escaping from the vehicles when leaving;
- Application of soil cover to the active tipping area at the end of each working day;
- Continuous movement of the compactor over the new waste throughout the day;
- Identification of loads of waste received at the active face with material noted as being a potential for litter, which are to be covered as soon as possible to reduce the potential for litter events;
- Use of portable litter fences that are moved around the active face area to capture blowing litter on a day-to-day basis based on forecasted meteorological conditions;
- Installation of permanent litter fences, downwind of the current phases to capture the blowing litter for the predominant wind directions;
- Use of inclement weather fill areas, which are utilized during weather events consisting of sustained high winds speeds; and
- Training of relevant staff on these policies.

Even with litter controls in place, litter events do occur from time to time. In order to ensure a thorough and rapid response, the BMPP includes a protocol to dispatch a site crew to the impacted zone for cleanup. This protocol extends to adjacent properties as well as main roadways.

4.4.2 Odour

Solid waste landfills have the potential to produce odour at several locations including the active face and adjacent working areas, within the leachate collection and treatment systems and hydrocarbons from contaminated soils. LFG escaping through the daily and interim covers and final cap are also potential odour sources. The active face and adjacent working area are expected to be the dominant odour source.

The potential for odour-related nuisance effects from landfill operations at sensitive off-site receptors near the TCEC landfill was assessed. The assessment involved reviewing existing odour controls, complaints, sources, field measurements, and the prediction of effects using dispersion modelling. Odours can be a nuisance but do not necessarily pose health risks. Various landfill odour sources, including sources such as LFG, fresh waste, leachate, and waste soil, were evaluated cumulatively.

Typically, O. Reg. 419/05 provides air quality standards used in Ontario; however, the regulation does not include a standard for "odour" as a mixture of compounds. Under the Ontario *Environmental Protection Act*, an odour is deemed to be a nuisance if it is detected and considered to be unpleasant. The MECP (2009) provides guidance in their document, "Methodology for Modelling Assessments of Contaminants with 10-Minute Average Standards and Guidelines under O.Reg, 419/05". This guidance document indicates that odour concentrations need only be assessed at odour-sensitive receptor locations, such as residences, commercial buildings, and outdoor parks and recreation areas. Odour impacts that are greater than 1 odour unit (OU) per cubic metre (m^3) are considered acceptable at sensitive receptor locations, as long as the frequency of exceedance is less than 0.5% of the time.

An OU is defined as the quantity of odourous substance that, when dispersed in 1 m^3 of odour free air, becomes just detectable by a "normal" human observer whose sensitivity to the odorant represents the mean of the population. The average odour detection threshold is 1 odour unit per cubic metre (OU/m^3), although odours at this level are not necessarily a nuisance. Odour concentrations that may cause a complaint due to their ability to annoy typically range from 3 to 5 OU/m^3.

Consequently, odour was assessed at the discrete receptor locations based on a 10-minute averaging period considering three thresholds:

- 1 OU – associated with detection of odour;
- 3 OU – recognition of the odour; and
- 5 OU – nuisance resulting from the odour.

Predicted odour levels were assessed against these thresholds. LFG contaminants such as H_2S have specific odour standards, but these are not applicable to the overall mixture of compounds that form the LFG odours. Odours are generally best evaluated by the human response to smell (olfactory response). The odours from the landfill itself are based on a mixture of compounds contained within the LFG and surface emissions (e.g., active face odour). The odours from other landfill-related sources are based on a mixture of compounds contained in the leachate area sources and in the waste soil piles.

Potential odour sources were identified based on previous assessments of odour from the TCEC site, as well as consultation with local and regulatory stakeholders as outlined in the ToR. Existing conditions were characterized using a combination of emission factors and site-specific odour sampling. The resulting odour emissions were then incorporated into a dispersion model to assess potential impacts at residential receptors. Odours from landfill traffic were considered minor and transient and thus

excluded from detailed analysis. The assessment assumed all approved landfill activities, including the leachate treatment plant (though currently not constructed), to capture potential odour sources comprehensively.

Dispersion modeling predicted that maximum odour levels at most sensitive receptors will exceed the MECP guideline of 1 OU/m³, with exceedances occurring more than 0.5% of the time at receptors R2 through R7. The highest overall frequency of exceedance of 1 OU/m³ is 1.0% which is predicted at R4 and R7. Exceedances of the 3 OU/m³ guideline were predicted at two receptors (R2 andR4); however, the frequency of occurrence is less than 0.5% of the time. The highest overall frequency of exceedance of 3 OU/m³ is 0.007% which is predicted at R4. No exceedances of the 5 OU/m³ guideline were predicted at any of the receptors.

The maximum predicted odour results and frequencies of exceedance of the 1 OU/m³ detection threshold are based on normal maximum operations with the active face of the landfill in a worst-case position relative to the nearest residential receptor locations. The modelling considers a five-year set of hourly meteorological data for the period, 2011 to 2015, and maximum predicted concentrations are based on the worst-case conditions within this data set. Frequencies are calculated based on the use of the entire dataset. Therefore, odour related impacts are likely overpredicted.

These results indicate that landfill-related odours may be detectable and occasionally noticeable at certain receptors. The main sources of odour under normal conditions are the landfill's interim and final cover areas and the active face. To minimize emissions, WM will continue routine maintenance of the landfill cap, LFG, and leachate collection systems.

Odour Complaints

A review of the TCEC complaints log was conducted in order to determine the level of odour impacts in the vicinity of the landfill. From 2009 to the end of 2024 a total of 233 odour-related complaints were received; the majority (213) of these odour-related complaints have been logged since 2019. There has been a decrease in odour complaints over time with the exception of those received in 2022, when the Township solicited public complaints via a notice on their website (the Township posted a similar notice on their website starting in July 2025 which is still in place as of November 2025). The summary of odour complaints from 2019 onwards is as follows:

- 2019: 51 odour complaints
- 2020: 30 odour complaints
- 2021: 26 odour complaints
- 2022: 68 odour complaints
- 2023: 23 odour complaints
- 2024: 15 odour complaints

Where complaints were received, WM completed the required steps as outlined in the Odour BMPP in response. This included logging the complaint, completing the

appropriate investigations into the potential source of the complaint, implementing required corrective action or mitigation, following up with the complainant, and filing a formal complaint log.

Upon investigation, it was determined that some of the complaints were a result of upset conditions (power outages, upgrades to the gas collection system), some were determined to not be landfill-related (wind direction not consistent with complaint location, observations of manure odours), and some were determined to be related to landfill operations, sometimes occurring with weather conditions associated with poor odour dispersion. Based on a review of the 2024 complaints, approximately 33% of the odour complaints were related to abnormal conditions (e.g., power interruptions causing shutdown of LFG collection system).

Odour BMPP

In an effort to minimize odour emissions from the site, WM has prepared and implemented an Odour BMPP to minimize the off-site impacts associated with odour. The Odour BMPP outlines details on standard operating procedures, mitigation measures, and training to control key operations typically associated with odour emissions. Key control measures outlined in the plan include:

- Screening of incoming loads to identify highly odourous loads and applying cover material immediately once placed in the active face;
- Applying a minimum of 0.15 m of daily cover or an alternative cover system to the active face on a daily basis;
- When required, applying tear resistant tarping capable of odour and vapour suppression to the active face (when daily cover is unavailable);
- Providing interim cover areas with 0.3 to 0.45 m of cover, graded to promote precipitation run-off;
- Including 2.0 m of material in the final cap;
- Installing and maintaining a LFG collection system;
- Destruction of LFG through LFG flares;
- Completion of “walkabouts” using total hydrocarbon (THC) analyzers by trained employees to identify odourous areas;
- Routine inspection of interim and final cap areas to ensure damage or erosion areas can be remediated as soon as possible; and
- Training of relevant staff.

The BMPP includes robust record keeping programs including the results of walkabouts (locations of sampling, field measurements, and remedial actions), employee training, vacuum testing of the collection system, composition of gas, and temperature of combustion.

Although it is impossible to eliminate odour from landfills, these mitigative measures and operating procedures help to minimize odours associated with landfill activities.

4.4.3 Noise

The existing conditions are summarized from the Noise Existing Conditions Report (**Supporting Document 1-2**).

The general On-site Study Area was adopted for Noise, and the general Off-site Study Area was extended to include the Off-site Haul Route Area within 1 km of the primary haul route from Highway 402 to the site entrance (**Figure 4-7**).

The Noise Existing Conditions study consisted of data review and field studies. A series of site visits were conducted to assess the acoustic environment and potential noise impacts associated with TCEC operations. The site visits included off-site noise monitoring, spot measurements, and observations to characterize both the surrounding environment and on-site noise sources. Annual noise monitoring reports were reviewed to evaluate trends and the number of noise complaints. MECP guidelines (NPC-300 and the Landfill Noise Guideline) were consulted to ensure compliance with regulatory standards (MOE, 2013; MOE, 1998). Aerial mapping and field reconnaissance, including data from the Lambton County GIS, helped confirm zoning and property boundaries.

Noise modeling of landfill operations and related sources was conducted using ISO 9613 algorithms in Cadna/A software, factoring in sound levels, topography, barriers, and meteorological effects. Input data came from past assessments and site audits, with berms and topography confirmed using aerial imagery and previous reports.

Off-site Points of Reception (POR) were identified within the Off-site and Haul Route study areas, which represented potential worst-case noise-sensitive locations. The key representative POR locations are shown on **Figure 4-8**.

The acoustic environment is mainly influenced by road traffic, with higher background noise at POR locations R5 to R10 near Nauvoo Road, and lower levels at other locations (R1 through R4, and R11 through R13) farther from busy roads.

Background sound was modelled using ORNAMENT (MOE, 1998) following the requirements of Publication NPC-206 Sound Levels Due to Road Traffic (MOE, 1995). The background road traffic noise includes only the contribution of vehicles from non-landfilling activities. The haul route traffic is not included in the traffic noise modelling for background sound.

Figure 4-7. On-site and Off-site Study Areas for Noise

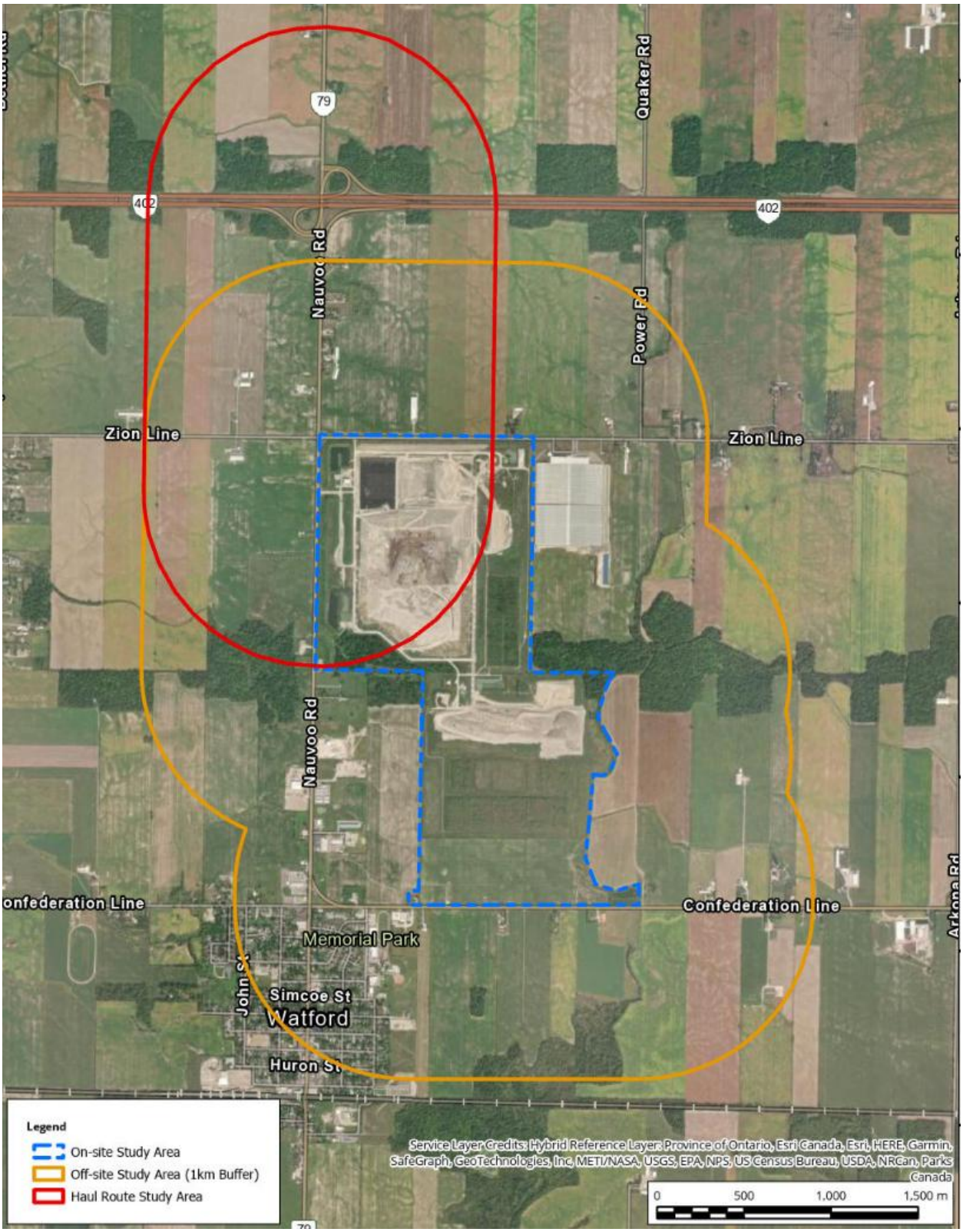
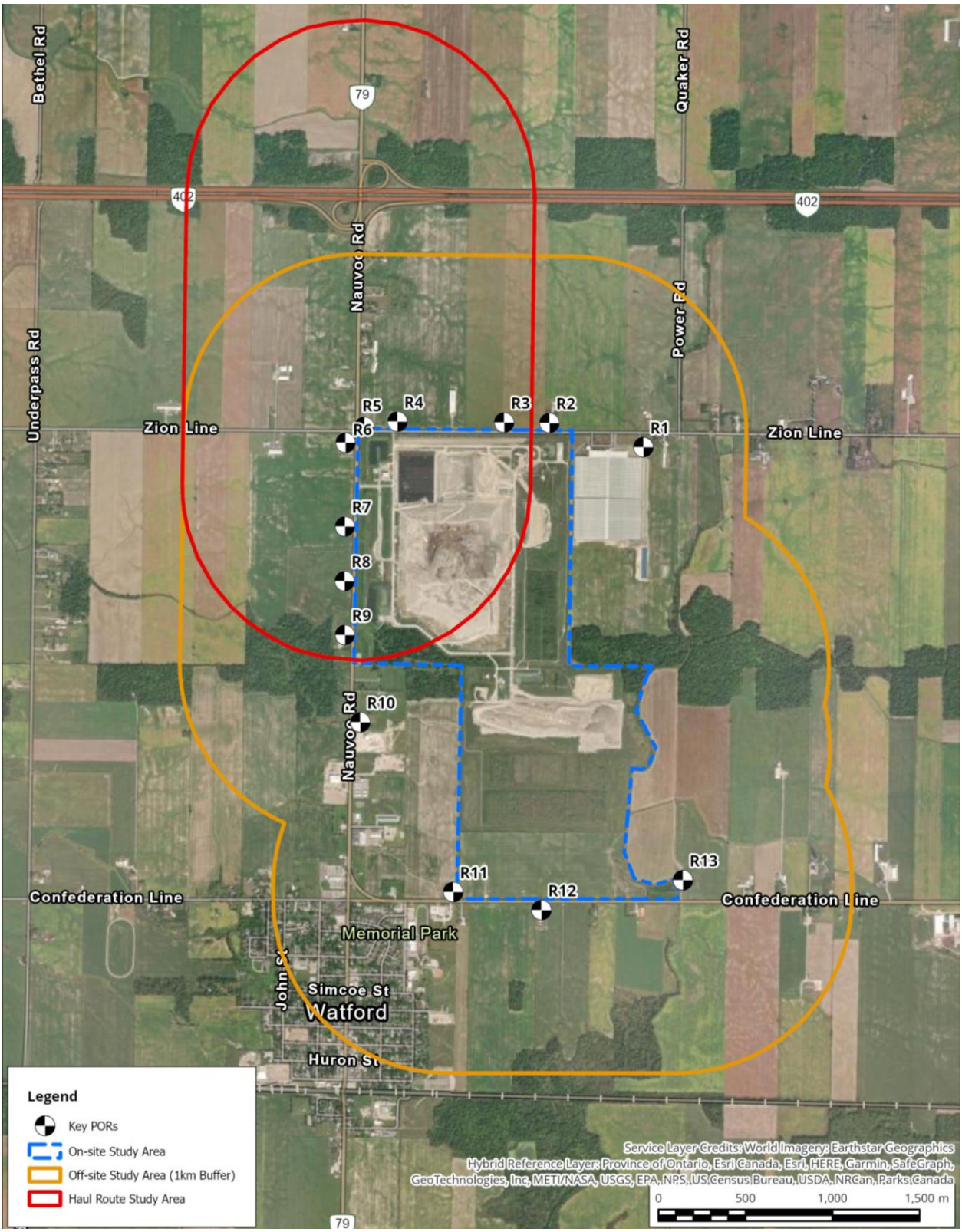


Figure 4-8. Key Representative Noise Sensitive POR Locations



The sound level criteria identified for the assessment of existing conditions follow the requirements of the MECP's Landfill Noise Guideline and NPC-300 (MOE, 2012; MOE, 2013). Landfilling, Pest Control Devices, and the Haul Route are addressed in the Landfill Noise Guideline. The Landfill Noise Guideline reference guidelines have been superseded by NPC-300 for assessment of ancillary facilities, including the use of emergency equipment in testing and maintenance situations. Sound level limits were identified for landfilling activities, pest control devices, ancillary facilities, and emergency sources. No maximum limits were identified for haul route noise, as there are no mandated criteria in the Landfill Noise Guideline. Existing conditions were modelled for the worst-case scenario for the final landfill phase of the currently-approved Expansion Landfill.

Sources of landfilling noise include the use of construction equipment and conveyances. Ancillary facilities include the public waste drop-off, generators used for non-emergency purposes, flares, and the RNG Facility. Emergency sources of noise include the emergency generators. Pest control devices relevant to noise can include a propane cannon, and pyrotechnics described as bangers, crackers, whistlers and screamers.

The acoustic environment at POR locations during daytime is generally dominated by road traffic, while sounds of nature are more prominent during the evening and nighttime. The modelled existing sound levels at the POR locations resulting from TCEC operations were as follows:

- Landfilling activities: 36 to 55 dBA[10] (limit 55 dBA)
- Ancillary facilities: 29–42 dBA (limits 45 to 57 dBA)
- Emergency sources: Less than 25 dBA (limits 50 to 61 dBA)
- Pest control devices: 20 to 55 dBAI[11] (limit 70 dBA)

Haul route modelling of existing sound levels was also completed. At the nearest residences, the haul route modelled sound levels ranged from 62 to 66 dBA.

Noise Complaints

WM documents public complaints related to noise at the TCEC in the site's annual monitoring reports. The annual monitoring reports show that there have not been any noise complaints since 2012.

4.5 Hydrogeology

Hydrogeology includes groundwater quality and quantity. The existing conditions are summarized from the Hydrogeology Existing Conditions Report (**Supporting Document 1-3**).

[10] Decibel, weighted to reflect human sensitivity to sound using the A-weighting scale.
[11] A-weighted sound pressure level of an impulsive sound measured with a sound level meter set to "impulse" response corresponding to a rising slope time of 35 ms.

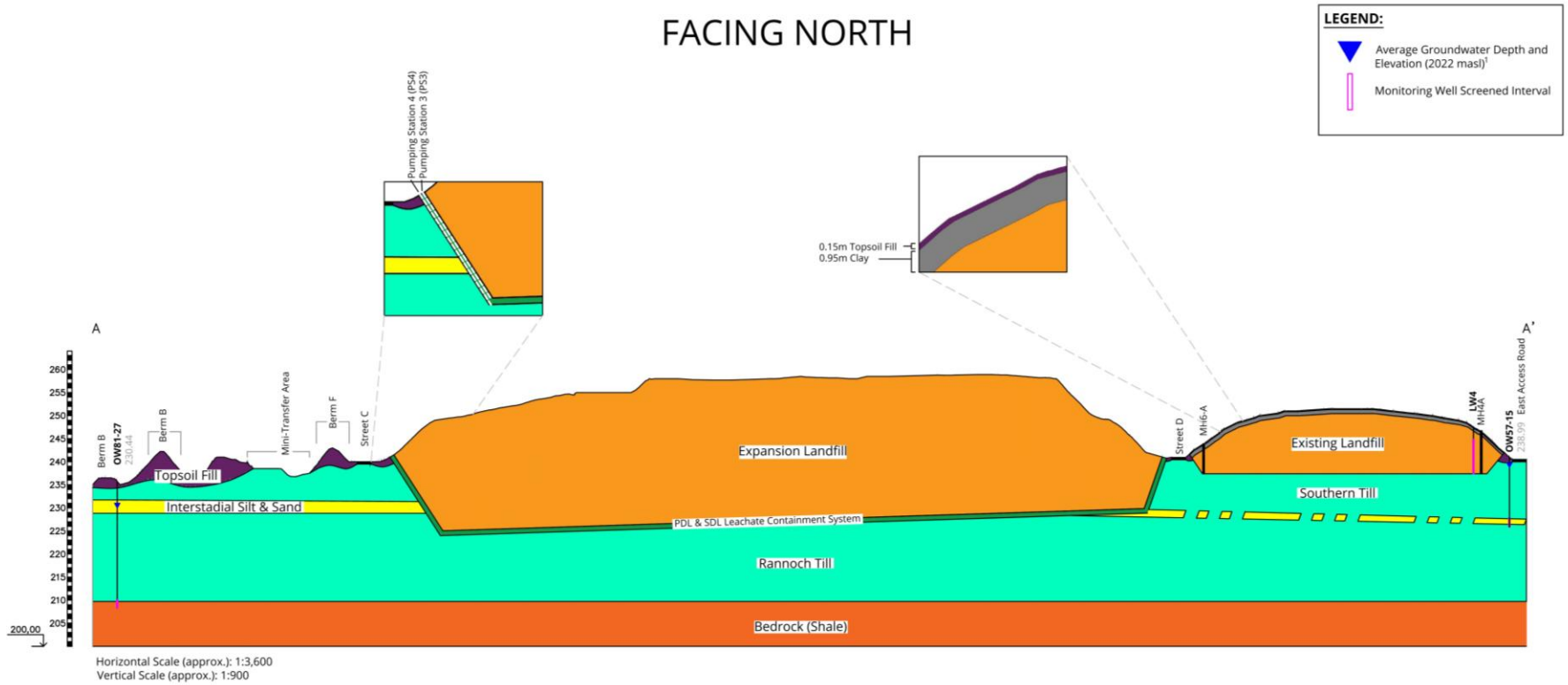
The general On-site and Off-site Study Areas (**Figure 4-1**) were adopted for Hydrogeology. The regional geologic area (5 km to 10 km from site) is documented to provide context; however, the potential hydrogeologic effects of the landfill are not expected to extend beyond the general Off-site Study Area.

The On-site and Off-site Study Areas are located within till plains, with the remains of a shoreline scarp situated to the west near County Road 79 (Nauvoo Road). The regional landscape within 5 to 10 km of the TCEC falls within the southeastern section of the Horseshoe Moraines physiographic region. This region features a large horseshoe-shaped landform composed of a series of moraines running roughly parallel to the Lake Huron shoreline. The area around the TCEC is characterized by gently rolling terrain shaped by Bear Creek to the west and Brown Creek/Kersey Drain to the east, with this undulating landscape further defined by local tributaries and drainage swales. Surrounding the site to the south, east, and west lies the St. Clair Clay Plain physiographic region, known for its fine-grained clay and silt soils that typically exhibit poor drainage.

A cross-section of the on-site geological conditions is provided on **Figure 4-9**. In areas of the TCEC not affected by construction activities, the natural subsurface geological conditions have remained stable and unchanged for thousands of years. The variability in drift thickness is largely influenced by the underlying bedrock and surface topography—thicker along the northwest-southeast trending central topographic divide, and thinner in areas of lower elevation such as near the Kersey and Van Kessel Drains. The site's geologic stratigraphy consists of a thin layer of topsoil or imported fill, underlain by four major naturally occurring geological units: the Southern Till, Interstadial Deposits, Rannoch Till, and basal sand overlying bedrock.

The TCEC is situated within the St. Clair Region Source Water Protection Area within the Thames-Sydenham Regional Drinking Water Source Protection Area. Based on available Source Water Protection mapping provided by the St. Clair Region Conservation Authority (SCRCA), the eastern portion of the southern half of the TCEC's lands are located within an area designated by the SCRCA as a Significant Groundwater Recharge Area (SGRA) where groundwater recharge rates are predicted to be typically greater than that of the surrounding areas. The outlined SGRA coincides with lands that border Brown Creek/Kersey Drain. Although Source Water Protection mapping identifies this southeastern portion of the TCEC lands as a 'significant groundwater recharge zone', its designation is 'NA', which indicates that the area cannot be defined as a significant groundwater recharge zone as there is insufficient data available to justify its designation. Notwithstanding, the SCRCA has conservatively designated these lands as a potentially significant groundwater recharge zone. There are no other identified source water protection zones as defined within the St. Clair Region Source Water Protection Assessment Report at or nearby the TCEC.

Figure 4-9. Geologic Cross-Section of TCEC Site



Note:
1. Groundwater elevations presented are mean averages of 2022 data.
2. Locations are approximate and provided for illustrative purposes only.

Although a portion of the TCEC is identified within a SGRA, there are no identified on-site activities within the SGRA as defined by SCRCA mapping that have the potential to cause adverse effects to the underlying aquifer (i.e., groundwater takings). Moreover, the TCEC is adequately monitored such that any potential threat to drinking water resources as a result of the site would be identified and drinking water protection is thus inherently achieved at the TCEC.

Based on the prevalent clayey soil overburden, groundwater is not expected to significantly contribute to the Kersey Drain and this area is not a key location for groundwater infiltration and recharge.

The review of hydrogeologic existing conditions at the TCEC incorporates historical data and recent borehole investigations to update and confirm previously defined site conditions. It evaluates groundwater flow within each hydrostratigraphic unit in relation to landfill operations, analyzes chemical trends in leachate and groundwater quality, and assesses the contaminating lifespan (CLS) of the Expansion Landfill.

Chemical data from 2003 to 2022 was compiled and analyzed using historical concentration ranges, geometric means, and trend evaluations. This assessment provides a baseline understanding of current groundwater quality and quantity, which will support the evaluation of potential impacts from the Project.

4.5.1 Groundwater Quality

The site's leachate and groundwater quality monitoring programs are central to assessing the landfill's environmental performance. Leachate quality monitoring provides insight into waste cell conditions. In the Existing Landfill (closed Old Landfill), leachate quality has remained stable and consistent with historical trends. In the nearby Expansion Landfill, leachate quality shows anticipated increases in several parameters as the waste cells mature; however, concentrations remain below peak values predicted in the 2008 Design & Operations (D&O) Report.

Groundwater monitoring confirms that water quality across all three hydrostratigraphic units (the active aquitard, interstadial silt and sand, and interface aquifer) remains within acceptable limits and is not adversely affected by landfill operations. The Primary and Secondary Leachate Indicator Lists (PLIL and SLIL) outlined in the site's Environmental Monitoring Program (EMP) remain relevant and appropriate for current site conditions. Likewise, the existing trigger concentration mechanisms are effective for early detection of potential impacts. The establishment of surface water leachate indicator lists are further explained in Section 4.3.1.4 in the Surface Water Quality Existing Conditions Report (**Supporting Document 1-4**).

Under current operating conditions, the potential CLS of the Expansion Landfill is projected to be 69 years. As the landfill reaches its full permitted capacity, the CLS could extend to 99 years, reflecting current waste volumes, leachate generation rates, and the effectiveness of the site's hydrogeological controls.

4.5.2 Groundwater Quantity

Groundwater levels near the closed Old Landfill are well documented, with long-term trends established. In newer monitoring locations near the Expansion Landfill, data collection is on-going. Seasonal fluctuations in groundwater elevations are observed, particularly within the active aquitard, influenced by climatic variations. There is a north-south divide in shallow groundwater flow through the Poplar Plantation, with easterly flow on the east side and westerly flow on the west side. Site features such as Sedimentation Pond 2 and the Van Kessel Drain also affect localized flow patterns.

In the interstadial silt and sand unit, groundwater exhibits similar seasonal variation and follows the same north-south flow divide. The hydraulic trap created by the Expansion Landfill influences this unit by drawing groundwater inward towards the waste to prevent outward movement of leachate. In the deeper interface aquifer, a consistent southwesterly flow is observed beneath the TCEC. As landfill construction removes overburden, pressure in this aquifer is expected to decrease initially but may increase later due to the weight of deposited waste.

Leachate levels in the Expansion Landfill are actively managed to maintain an inward hydraulic gradient as a containment strategy to prevent outward leachate migration. Leachate generation rates have remained below the 2008 D&O Report predictions and are expected to stay lower over the next five years. For the Existing Landfill, leachate is managed primarily through the on-site Poplar Tree Evapotranspiration System, reducing the need for off-site disposal.

A Water Well Survey of MECP-documented wells in the Off-site Study Area contacted 25 well owners; only one responded, reporting minimal water use and no domestic consumption. Based on available data, off-site water users are neither impacting nor impacted by landfill operations concerning groundwater quantity.

4.6 Surface Water Environment

The Surface Water Environment includes surface water quality and quantity.

4.6.1 Surface Water Quality

The existing conditions are summarized from the Surface Water Quality Existing Conditions Report (**Supporting Document 1-4**).

The general On-site and Off-site Study Areas (**Figure 4-1**) were adopted for Surface Water Quality. The On-site Study Area encompasses the TCEC, where surface water is managed through drainage features such as ditches, swales, and four sedimentation ponds. Runoff from the footprint of the waste fill areas is directed to these sedimentation ponds for management.

The characterization of existing conditions consisted of data collection, review of historical surface water quality data, on-site/off-site surface water quality monitoring and field studies review. A review of historical surface water quality data at the TCEC from 2003 to 2022 analyzed chemical trends, soil erosion impacts, and findings from

a 12-month ASR study, using compiled analytical and precipitation data to interpret chemical data concentration ranges, geometric means, and long-term trends. Surface water monitoring stations for the Sedimentation Ponds and Poplar Plantation were established at different times during previous landfill expansion construction, and surface water data was compared with landfill leachate data to assess current monitoring adequacy and potential impacts from landfilling, soil erosion, and ASR-related pollutants on on-site and off-site water quality. The TCEC also conducts routine quarterly to annual on-site surface water monitoring, increasing frequency if needed based on trigger criteria, including chemical and biological sampling.

Surface water quality at the TCEC is evaluated for compliance with established MECP-approved site-specific criteria. A monitoring program was developed to monitor off-site surface water quality within the eastern roadside ditch of Nauvoo Road for a 12-month period in concert with the current surface water quality monitoring program. Surface water quality was evaluated toward its Existing Conditions as it relates to the potential for Polycyclic Aromatic Hydrocarbon (PAH) effects from ASR track-out material. The surface water system at the TCEC and in the surrounding area, including surface water monitoring locations, is shown on **Figure 4-10**.

Stormwater from the northern portion of the TCEC, inclusive of discharge water from Sedimentation Pond 4 and a component of discharge flow from Sedimentation Pond 3, flows northerly from the TCEC along the eastern roadside ditch of Nauvoo Road toward Highway 402. Along this ditch are: two drainage features that form part of the Auld-Redmond Drain Branch; and one drainage feature that forms part of the Morris Drain. Stormwater from the On-site Study Area just west of the transfer area flows westerly through a culvert and beneath perimeter screening berm C (Berm C) into the off-site eastern roadside ditch adjacent to Nauvoo Road, where it then flows southerly into the Gilliand-Geerts Drain. Stormwater from the Nauvoo Road eastern roadside ditch that is south of the Gilliand-Geerts Drain flows northerly and into the Gilliand-Geerts Drain.

The Off-site Study Area includes the drainage ditch along the northbound lane of Lambton County Road 79 (Nauvoo Road), extending approximately 1 km north and 500 m south of the TCEC entrance. Field monitoring was carried out in 2022 to evaluate potential effects on surface water quality from ASR track-outs along the road allowance. PAHs were identified as contaminants of concern (COC) with the potential to negatively impact off-site surface water quality near the TCEC.

The TCEC operates two surface water monitoring programs:

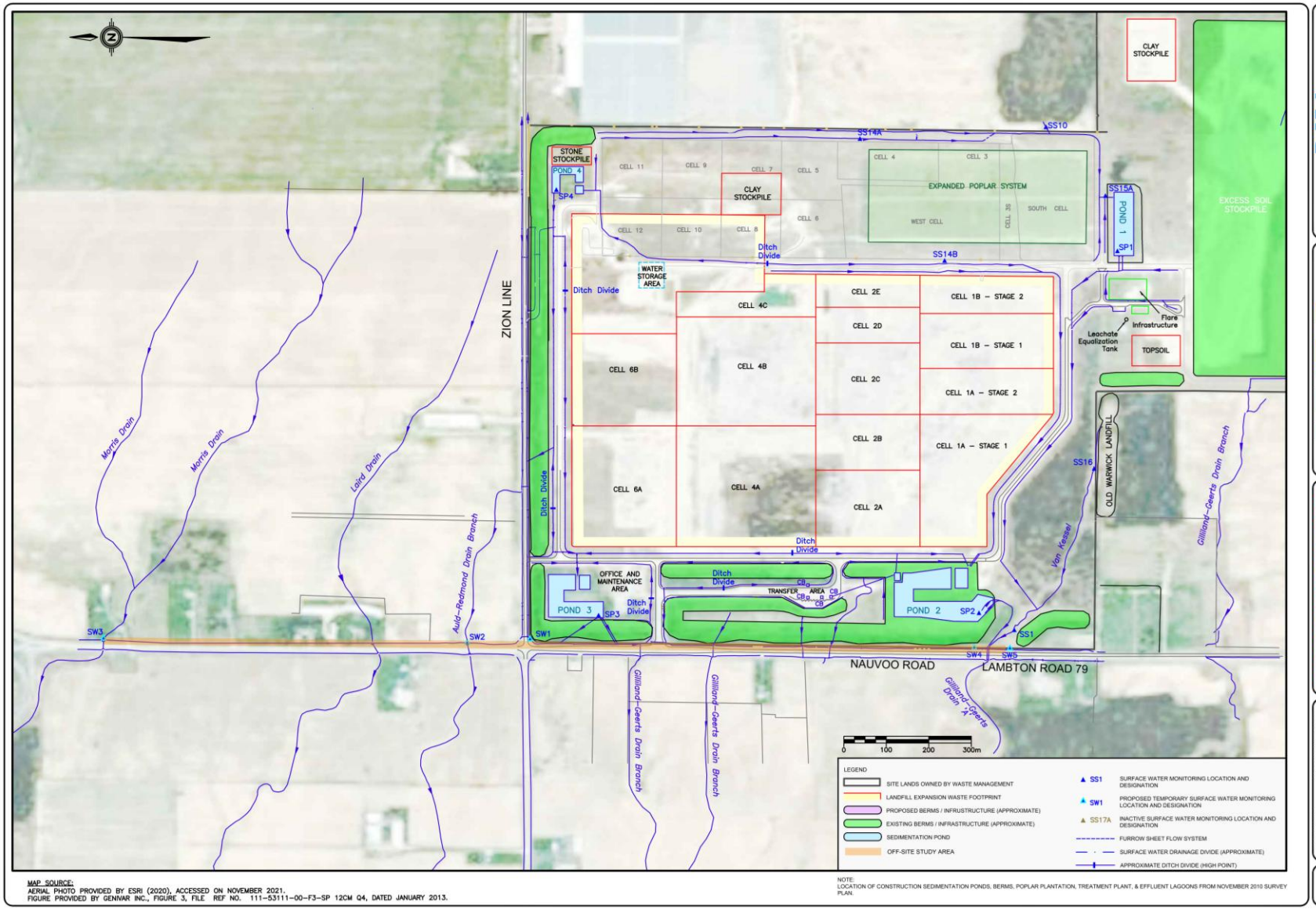
1. A Compliance Monitoring Program that includes three open-ditch surface water monitoring stations and four sedimentation ponds; and
2. A Monitoring Program focused on three open-ditch stations used to assess the potential effects of Poplar System irrigation liquid on surface water quality within the perimeter ditch along the southern half of the closed Old Landfill.

Surface water quality data collected at the TCEC was evaluated to establish baseline conditions prior to off-site discharge, with a focus on the On-site Study Area, which includes both the closed Old Landfill and the Expansion Landfill.

Primary findings from the assessment of existing surface water quality conditions at the TCEC are as follows:

- Both the Compliance and Poplar System Surface Water Monitoring Programs effectively assess potential impacts of landfill leachate on surface water quality, based on existing surface water conditions. The leachate indicator parameters selected for assessing potential leachate impacts on surface water quality, as outlined in the 2007 EMP, remain appropriate. This is supported by leachate constituent concentrations staying below the predicted peak values listed in the 2008 D&O Report, as well as by current surface water quality conditions. Accordingly, the existing trigger concentration mechanism continues to be effective for identifying potential landfill leachate impacts on surface water quality.
- PLIL parameter concentration trends in surface water at the TCEC have remained relatively stable. Minor fluctuations in surface water quality over time are primarily attributed to erosion from exposed soil surfaces during construction activities (e.g., infrastructure development, waste cell excavation, and soil or material handling) since 2008.
- On-going monitoring data indicates that surface water quality is generally not adversely affected by the TCEC. Concentrations of the PLIL parameters typically remain within the established trigger thresholds used in the surface water quality evaluation process. Consequently, surface water quality consistently meets the criteria for acceptable off-site discharge.
- TSS concentrations understandably influence heavy metal levels in the surface watercourse.
- The temporary off-site supplemental surface water monitoring program conducted in 2022 detected a low-level presence of one PAH parameter during one of four monitoring events at two of the five off-site stations in the first quarter of the year. No other PAH parameters were detected at any of the off-site surface water monitoring stations throughout the remainder of the one-year monitoring period in 2022. ASR may be used as daily cover at the TCEC under Waste ECA Condition 6.51, with semi-annual spring and fall sampling for analysis against O.Reg. 347 Schedule IV criteria as required by Condition 6.52 of the Waste ECA.

Figure 4-10. Surface Water System and Monitoring Locations

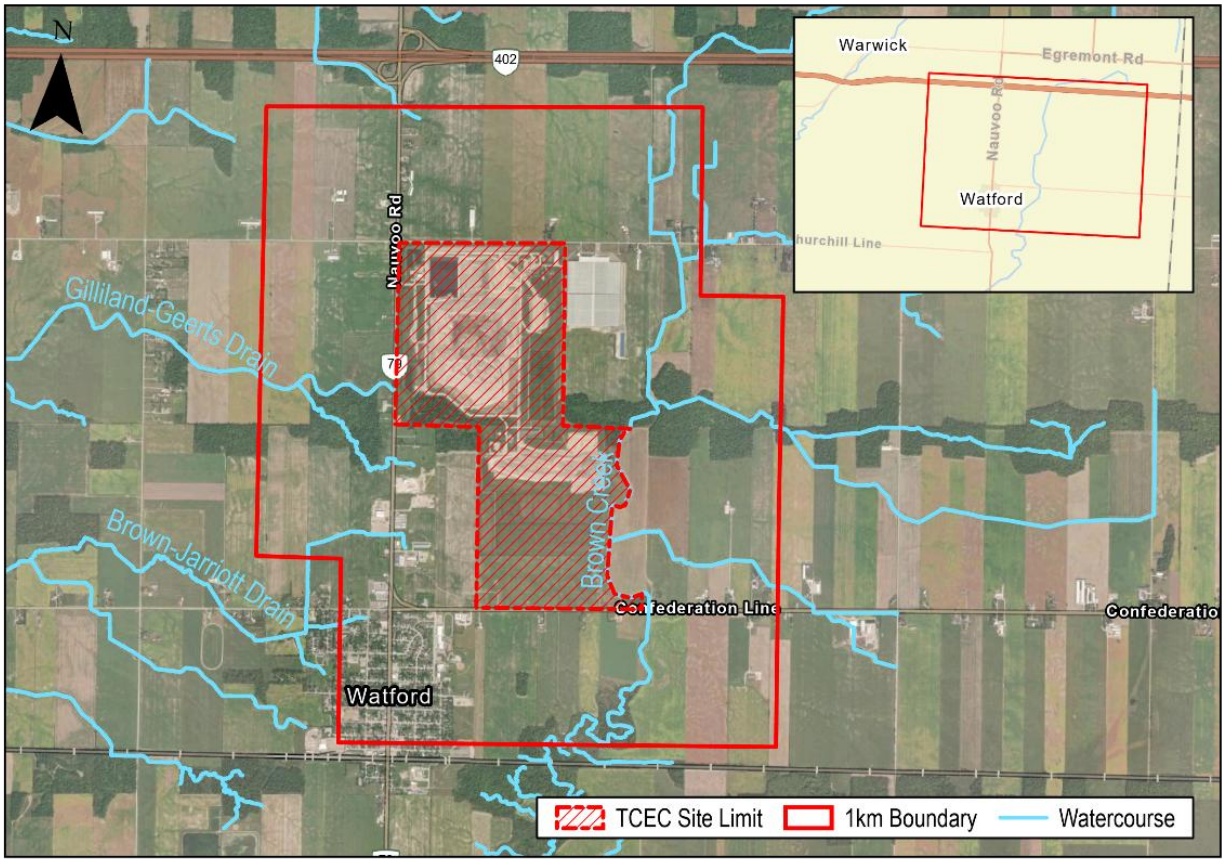


4.6.2 Surface Water Quantity

The existing conditions are summarized from the Surface Water Quantity Existing Conditions Report (**Supporting Document 1-5**).

The general On-site and Off-site Study Areas were adopted for Surface Water Quantity. The study areas, along with the surrounding drains and watercourses, are shown on **Figure 4-11**.

Figure 4-11. On-site and Off-site Study Areas for Surface Water Quantity



The characterization of existing conditions consisted of data collection via survey, site reconnaissance, review of design and operations report, review of aerial imagery, hydrologic modelling regarding peak flows and pond performance comparison and field studies review.

The current surface water quantity conditions at the TCEC site and in the Off-site Study Area were characterized. Using updated survey data from September 2022, seventeen catchment areas were identified and modeled in Visual OTTHYMO to analyze pond function and peak flow rates, as summarized in **Table 4-8**. The catchment areas and site outlets are shown on **Figure 4-12**.

Table 4-8. Existing Surface Water Quantity Conditions in Catchment Areas

Outlet ID	Catchment ID	Drainage Area (ha)	100-year Peak Flow (m^3/s)	Ultimate Flow Receiver
A	A	0.94	0.26	Auld-Redmond Drain
	AB	31.84		
B			1.01	Gilliland-Geerts Drain
	B	6.99		
C	C1A	6.77	0.64	Auld-Redmond Drain
	C1B	15.77		
D	D	2.10	0.33	Gilliland-Geerts Drain
E	E	1.31	0.30	Gilliland-Geerts Drain
F	F	1.89	0.23	Gilliland-Geerts Drain
G	G1A	12.45	1.63	Gilliland-Geerts Drain
	G1B	32.91		
	G2A	19.40		
	G3A	18.71		
	G4A	10.64		
	G4B	40.21		
H	H	8.60	0.77	Gilliland-Geerts Drain
I	I	22.13	0.81	Brown-Jarriott Drain Extension and Gilliland-Geerts Drain
J	J	1.93	0.19	Brown Creek

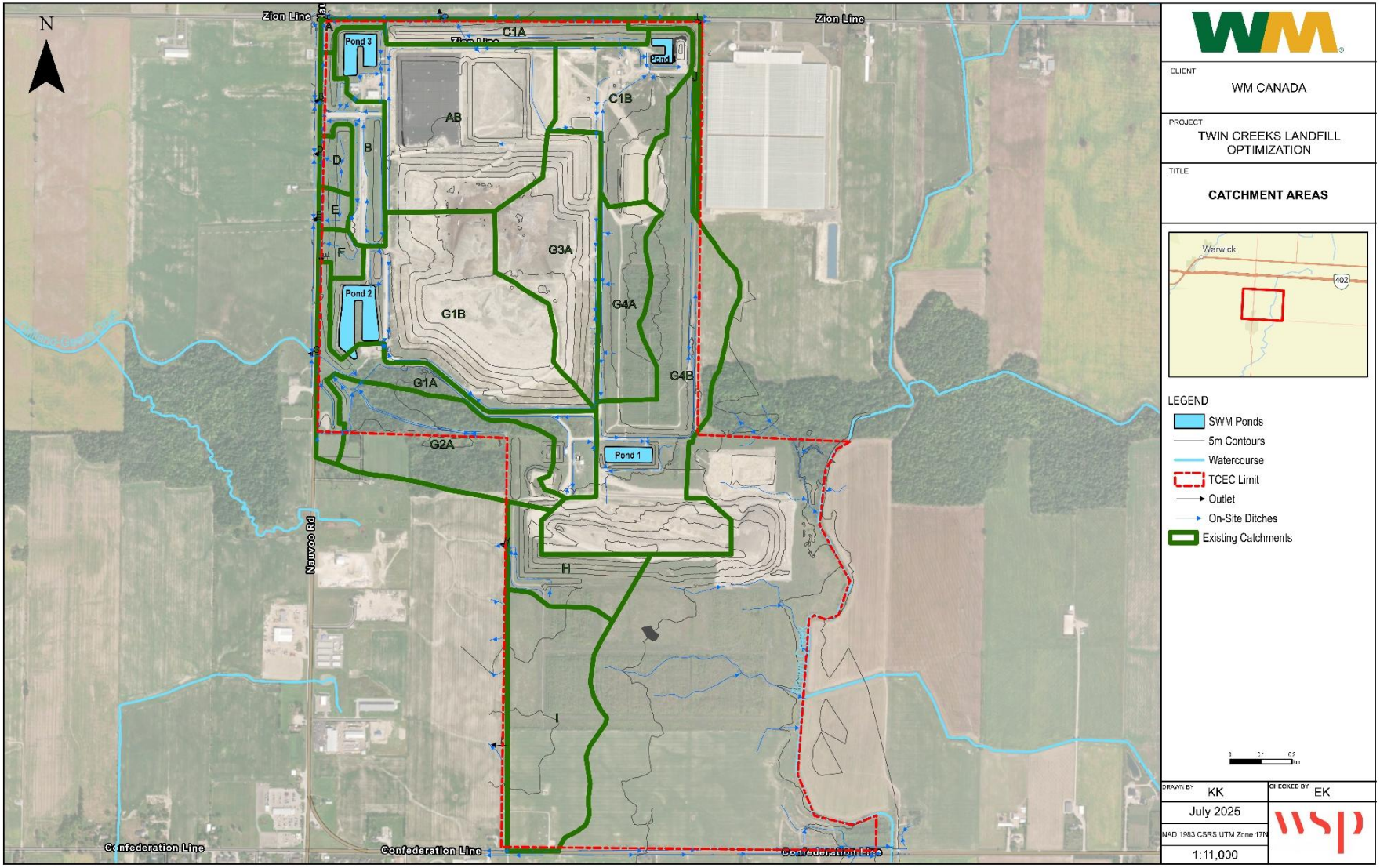
A site reconnaissance was conducted on September 28, 2022, during which the current condition of the SWM infrastructure was assessed. The four SWM ponds and ten outlet locations were identified and reviewed.

Based on the existing conditions analysis, the ponds are functioning properly. SWM Pond 1 has the highest peak outflow of 0.704 cubic metres per second (m^3/s) according to the hydrologic modeling for the 100-year design storm. SWM Ponds 2, 3, and 4 have peak outflows of 0.529 m^3/s, 0.671 m^3/s, and 0.372 m^3/s, respectively, for the same storm event. The peak outflow from the site to the Gilliland-Geerts Drain was 4.68 m^3/s for the 100-year design storm.

Further factors to consider during construction, there is a risk of short-term sediment runoff from the site. To protect downstream receiving systems and natural features, on-site sediment control measures must be implemented and maintained until the site is fully stabilized at the end of construction.

Construction should be phased to minimize the area and duration that soils remain exposed to weathering. To prevent erosion during construction at TCEC, WM uses intermediate cover materials, silt fences, and hydraulic seeding to stabilize soils and control runoff, with these measures continuing as new landfill cells are developed.

Figure 4-12. Catchment Areas



4.7 Ecological Environment

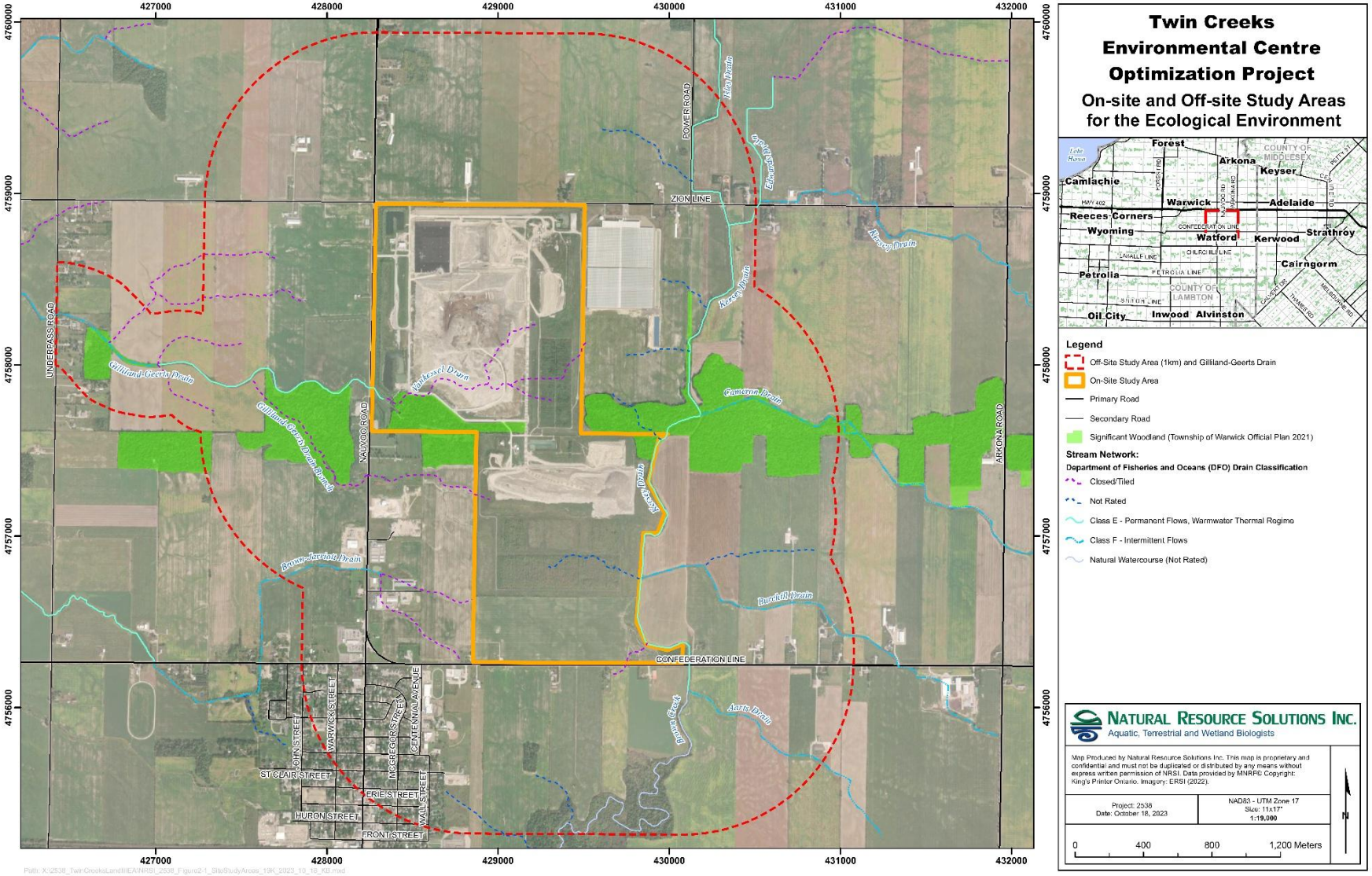
The Ecological Environment includes terrestrial and aquatic ecosystems. The existing conditions are summarized from the Ecological Environment Existing Conditions Report (**Supporting Document 1-6**).

The On-site Study Area for the Ecological Environment is consistent with the general On-site Study Area (**Figure 4-1**). The Off-site Study Area was extended to include the Gilliland-Geerts Drain downstream and westward of the TCEC to Underpass Road (**Figure 4-13**). The Off-site Study Area includes a 'primary zone of influence' extending 120 m from the existing TCEC, consistent with the definition of 'adjacent lands' provided in the Natural Heritage Reference Manual (MNRF, 2010).

Existing background ecological and biological information for both the On-site and Off-site Study Areas was compiled from a range of reputable sources, which included provincial and federal Species at Risk (SAR) listings, conservation authority reports, official land use plans, wildlife atlases, and community biodiversity databases, and formal information requests submitted to relevant regulatory agencies.

In addition, comprehensive field surveys were completed between late March and early December 2022 to document the existing conditions for the Ecological Environment within the On-site and Off-site Study areas. Additional bat habitat assessments were completed in June 2025 to address additional SAR bat species.

Figure 4-13. On-site and Off-site Study Areas for Ecological Environment



4.7.1 Terrestrial Environment

The terrestrial ecosystems within the On-site and Off-site Study Areas of the TCEC play a vital role in supporting biodiversity and sustaining key ecological functions at both local and regional landscape scales. Despite being influenced by historical land use and ongoing human activities, these areas continue to provide habitat for a variety of species and maintain ecological processes such as primary and secondary production, energy and nutrient cycling, and groundwater recharge.

The On-site Study Area is primarily characterized by active landfill infrastructure, including sedimentation ponds, poplar tree phytoremediation systems, soil and leachate management facilities, and agricultural fields. Although natural vegetation is limited, the site supports small patches of forest, swamp, marsh, and culturally influenced meadow communities.

In contrast, the Off-site Study Area (extending approximately 1 km from the TCEC and encompassing areas such as the Gilliland-Geerts Drain corridor) exhibits a more diverse terrestrial landscape. This includes agricultural lands, rural residential properties, commercial areas, woodlots, and riparian zones.

The On-site and Off-site Study Areas contain unevaluated wetlands, areas identified on Lambton County and Warwick Township Official Plans (OPs) as Significant Woodland, and several species of vascular flora considered ‘Rare’ in Lambton County.

In 2022, 28 terrestrial field visits were conducted across the study areas. Vegetation communities were mapped using the Ecological Land Classification (ELC) system, and three-season botanical inventories were completed. Wetland and woodland boundaries were delineated on-site and verified by MNRF agency staff. Terrestrial surveys included:

- Breeding bird surveys at 19 locations, with incidental observations of raptor nests.
- Amphibian and reptile assessments, including frog call surveys and habitat evaluations for Eastern Hog-nosed Snake and Snapping Turtle.
- Turtle basking surveys and general reptile searches, with Eastern Hog-nosed Snake assumed present due to typical detection challenges.
- Insect surveys, conducted concurrently with plant and bird inventories, targeting butterflies, dragonflies, damselflies, and Monarch butterflies and their milkweed host plants.
- Bat habitat assessments (2022) and a leaf-on follow-up survey (2025), using plot-based methods to document roosting features for SAR bat species within significant woodlands.
- General mammal surveys, recording direct sightings and signs of mammal activity, particularly predator species.
- Driving surveys and incidental observations were used to assess habitat connectivity and identify potential ecological linkages.

All findings contributed to a robust characterization of terrestrial ecosystems and helped identify sensitive or significant habitats requiring consideration during project planning.

A preliminary screening identified 17 Species at Risk (SAR) and Species of Conservation Concern (SCC) with the potential to inhabit the On-site and Off-site Study Areas, based on habitat suitability. These findings guided targeted terrestrial wildlife surveys conducted in 2022 and 2025. Similarly, a preliminary screening for Significant Wildlife Habitat (SWH), based on the *Significant Wildlife Habitat Technical Guide*, identified 14 candidate SWH types (MNRF, 2015a). These were further assessed through the field surveys, with final screening results incorporated into the ecological assessment and used to refine the overall survey scope.

Several SWH types were confirmed within both Study Areas, including Amphibian Breeding Habitat (Woodland), Terrestrial Crayfish Habitat, and breeding habitat for the SCC Western Chorus Frog.

Within the On-site Study Area, potential (but unconfirmed) breeding habitats may also be present for two other SCCs: Eastern Wood-Pewee and Wood Thrush. Within the Off-site Study Area, breeding habitat for Eastern Wood-Pewee was confirmed, and potential habitat was identified for three additional SCCs: Wood Thrush, Canada Warbler, and Tufted Titmouse. Candidate Amphibian Breeding (Wetland) habitat and Bat Maternity Colony SWH may also be present within the Off-site Study Area, but not within the On-site Study Area.

Natural features within the On-site and Off-site Study Areas have the potential to support habitat for SAR listed as Threatened or Endangered and protected under the provincial *Endangered Species Act, 2007* (*ESA*), including: Eastern Hog-nosed Snake; Little Brown Myotis; Northern Myotis; Eastern Small-footed Myotis; Tri-colored Bat; Eastern Red Bat; Silver-haired Bat; Hoary Bat; and Bobolink (MECP, 2007).

Potential SAR habitats and SCC habitats are shown on **Figure 4-14** and **Figure 4-15**, respectively.

Figure 4-14. Species at Risk – Potential Habitats

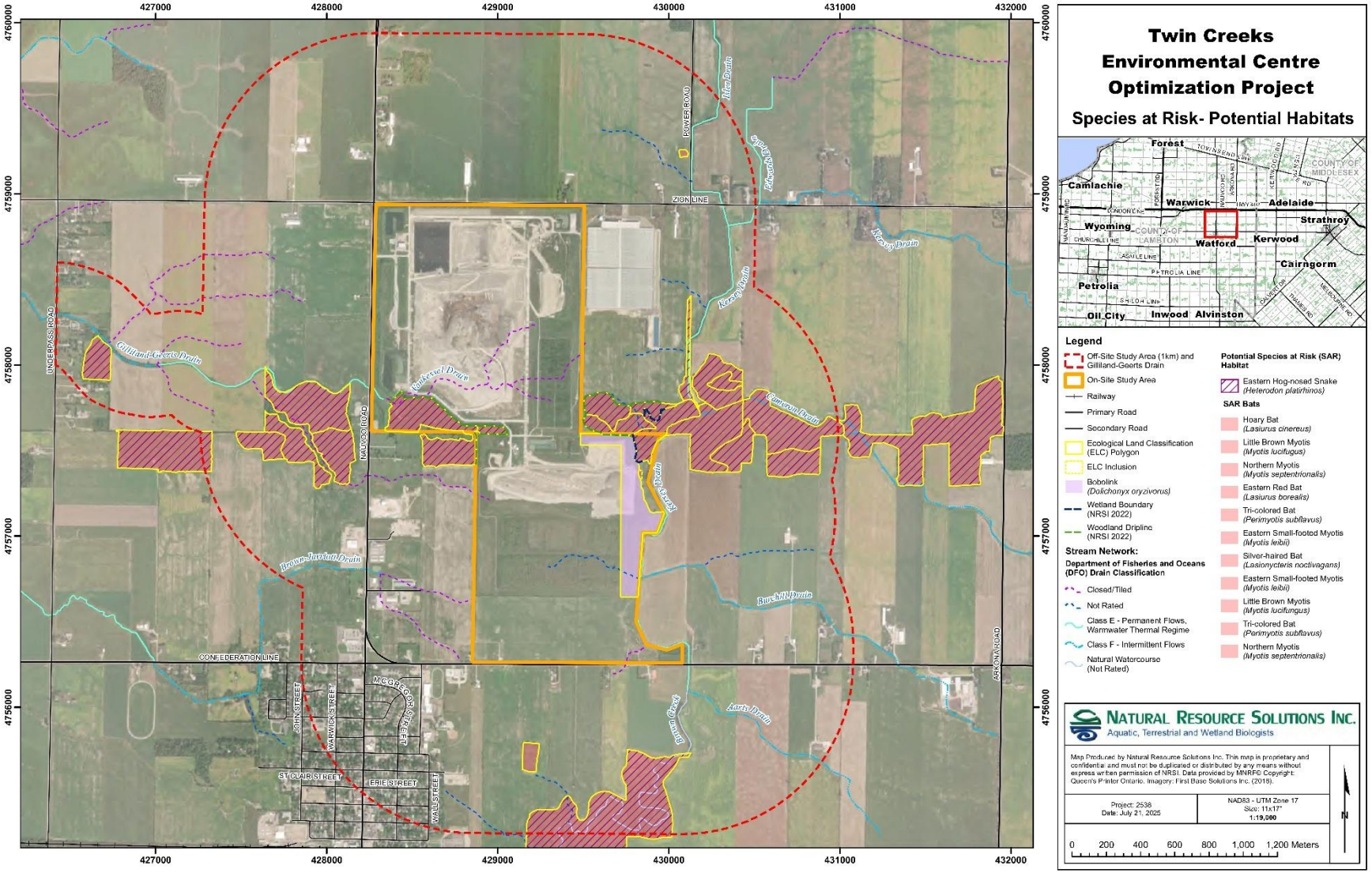
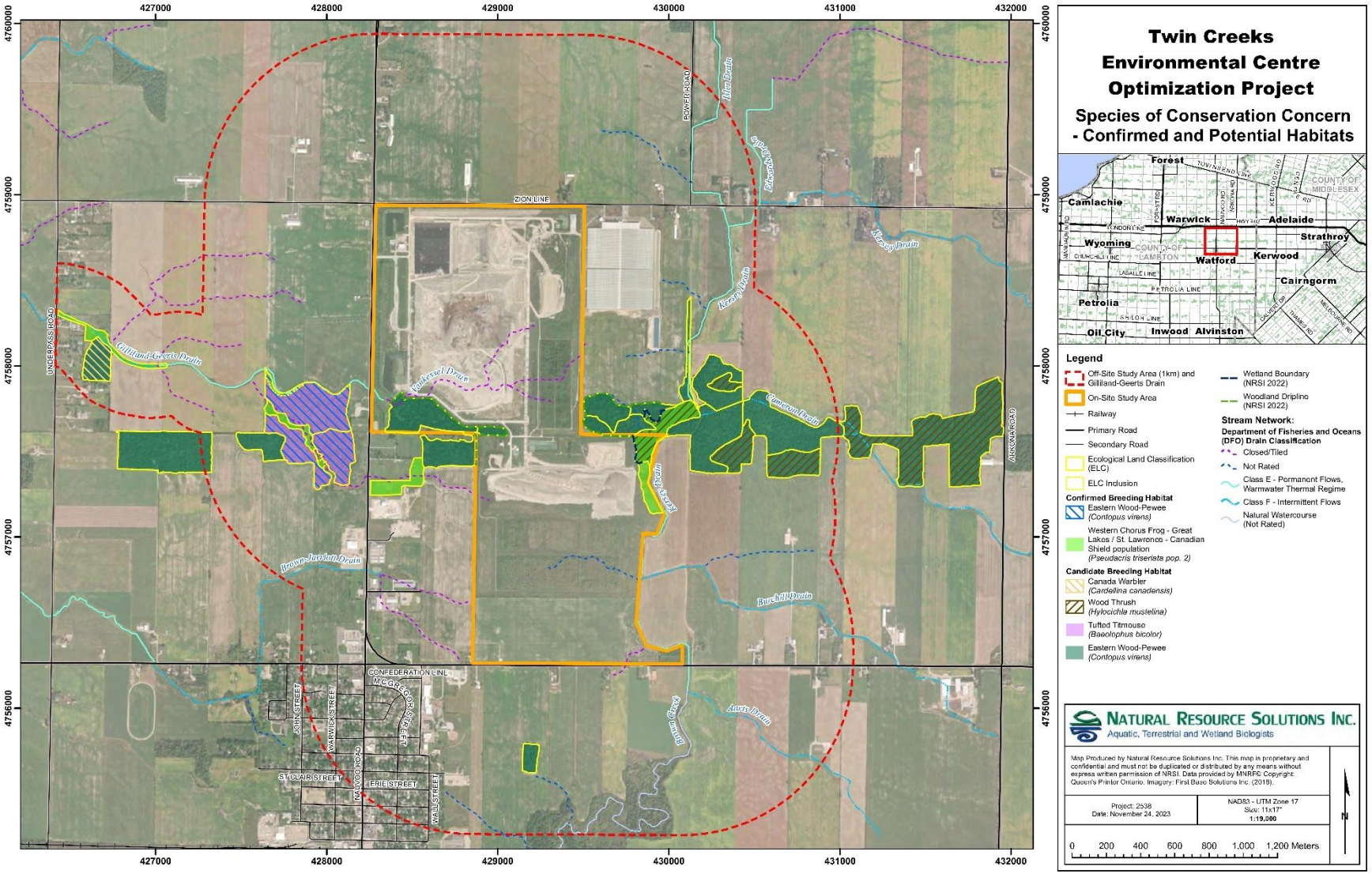


Figure 4-15. Species of Conservation Concern – Confirmed and Potential Habitats



4.7.2 Aquatic Environment

The aquatic ecosystems within the Study Areas are equally important, also contributing to a range of essential environmental functions. These systems, shaped by both natural and anthropogenic influences, support habitat for aquatic species and facilitate critical processes such as surface water storage, groundwater-surface water interaction, nutrient cycling, and water filtration. Together, these aquatic functions contribute significantly to the ecological health and hydrological balance of the surrounding landscape.

Aquatic features are more prevalent within the Off-site Study Area, comprising a network of constructed and naturalized municipal drains. These include the Kersey, Cameron, Burchill, Gilliland-Geerts, and Brown-Jarriott Drains. Although many of these drains have been historically modified through channelization, they continue to provide seasonal or permanent aquatic habitat that supports various fish communities. Aquatic ecosystems are mainly found within the Off-site Study Area; however, lands within the On-site Study Area drain to aquatic features within both the Brown Creek and Bear Creek Headwaters subwatersheds.

The quality of aquatic habitat varies among the drains. Perennial or seasonal direct fish habitat of moderate to good quality is present within all features except for Gilliland-Geerts Drain Branch and Burchill Drain (which were determined to provide indirect fish habitat only). Kersey Drain was determined to provide the best quality habitat and support the most diverse fish community when compared with other assessed features. All assessed watercourses support fish species associated with both coolwater and warmwater conditions.

Electrofishing surveys were conducted in 2022 to assess fish community composition and abundance within the study watercourses. These surveys provided essential data for characterizing aquatic biodiversity and identifying potential habitat for fish species. Electrofishing surveys did not identify any aquatic SAR or SCC within the watercourses. Nevertheless, the functional role of these aquatic systems within the broader ecological landscape was recognized as an important consideration.

Benthic invertebrate surveys were not conducted as they were not identified as being necessary to characterize existing conditions, which focused on characterizing natural heritage features and functions.

4.8 Socio-Economic Environment

A summary of the existing conditions for the Socio-Economic Environment is provided below. The Socio-Economic Environment includes Human Health, the Social Environment, the Economic Environment, and Visual Landscape. The existing conditions are summarized below from their respective Existing Conditions Reports in **Supporting Document 1**.

4.8.1 Human Health

Human Health considers the effects of construction and operations at the TCEC on human health through various exposure pathways based on the evaluation criteria and indicators outlined in the approved ToR. The existing conditions are summarized from the Human Health Existing Conditions Report (**Supporting Document 1-7**).

In 2005, a detailed Human Health Risk Assessment (HHRA) for the proposed Warwick Landfill expansion was undertaken to evaluate potential adverse health effects from exposure to contaminants. An HHRA assesses the relationship between contaminant concentrations, exposure routes, and toxicity to estimate health risks to nearby communities. Using MECP-approved air dispersion models, the HHRA analyzed predicted contaminant concentrations, concluding that the landfill expansion posed no significant health risk.

For Human Health, the general On-site and Off-site Study Areas, shown on **Figure 4-1**, were adopted. The Off-site Study Area used in the 2005 HHRA extended to 3.5 km from the site boundary consistent with the air quality study completed at the time, while the current Air Quality Existing Conditions Report (**Supporting Document 1-1**) extended the Off-site Study Area to approximately 5 km from the TCEC. However, the focus of the modelling for the Air Quality Existing Conditions Report was on identified residential receptors in the immediate vicinity (within approximately 1 km) of the TCEC, which corresponds with the general Off-site Study Area.

No field studies were undertaken specifically for Human Health. The results of field studies to determine existing baseline conditions completed for the air quality, surface water quality, and groundwater quality disciplines were examined to aid in the characterization of Human Health existing conditions.

To characterize existing conditions for Human Health, the following data collection and review was undertaken:

- A review of assumptions from the 2005 HHRA;
- A review of results from recent WM TCEC Annual Monitoring Reports;
- A review of field studies and existing conditions from the air quality, surface water quality, and groundwater quality disciplines including off-site receptors;
- A comparison of the results of the chemical analyses from the recent TCEC annual monitoring program against assumptions made in the 2005 HHRA;
- An assessment of new chemicals identified for potential health risks, and the reassessment of chemicals detected in recent annual compliance monitoring at concentrations higher, or lower than those considered in the 2005 HHRA; and
- A review of recent toxicological literature (WHO, 2021; MECP, 2022) for changes to the exposure limits applied to chemicals described in the 2005 HHRA, and to identify exposure limits for new chemicals of concern (COCs).

The 2005 HHRA followed the standard assessment framework and initially focused on 17 priority non-methane organic compounds, later expanded to include combustion by-products, PM, and metals based on peer review and leachate considerations. **Table 4-9** shows the COC for human health included in the 2005 HHRA.

Table 4-9. Contaminants of Concern for Human Health (2005 HHRA)

COC Group	COC Source	COC
Landfill Gases	LFGs produced by decomposition of landfill wastes	• 1,1-dichloroethane • 1,2-dichloroethane • Butan-2-ol • 1,1,2-trichlorethane • 1,1,2,2-tetrachloroethylene • 1,1-dichloroethylene • Methylene chloride • Methyl mercaptan • Trichloroethylene • Bromodichloromethane • Vinyl chloride • Octane • Dimethylsulphide • Chloroethane • Hydrogen sulfide • Benzene • Ethyl mercaptan
Combustion Gases and Products of Incomplete Combustion	Landfill flare and leachate treatment options (evaporation/ incineration)	• Sulphur dioxide • Hydrogen chloride • Nitrogen dioxide • Benzo(a)pyrene-TEQ (representing carcinogenic PAH group) • Carbon monoxide • Dioxin/Furans (TEQ)
Particulate	Crustal sources (i.e., soil) due to on- and off-site activities; contaminated soils; and various combustion sources including motor vehicle exhaust	• TSP • PM_{10} • $PM_{2.5}$
Metals	Leachate treatment option (evaporation/ incineration)	• Arsenic • Mercury • Cadmium • Nickel • Lead

A review of the assumptions and conclusions from the 2005 HHRA was undertaken to determine if the original findings remained valid. The review confirmed that the assumptions used in 2005 are still appropriate and the results of the original HHRA remain valid.

Updated risk predictions were generated by applying revised exposure limits derived from recent toxicological literature. These updates showed that some chemicals had an increased estimated inhalation or oral risk compared to those in the 2005 assessment; however, for chronic exposures to landfill combustion gases such as carbon dioxide (CO_2), carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen oxides (NO_x), and hydrogen chloride (HCl), the annual concentration ratios (CR) were all below 1.0, indicating exposures were within acceptable health risk thresholds. A CR of 3.0 is 3-fold above the 24-hour AAQC. This suggests no measurable long-term adverse health impacts are expected from these combustion gas emissions.

Short-term exposure assessments also showed that 30-minute and 1-hour CR values at the landfill's maximum fence-line location were below the threshold of concern, except for the 24-hour hydrogen sulphide (H_2S) CR value. The inhalation risk estimate for H_2S increased approximately 21-fold compared to the 2005 HHRA; however, this was based on more conservative toxicological benchmarks. Despite this, H_2S concentrations measured during 2023 air quality monitoring (109 valid samples out of 123 collected between June and September) exceeded criteria only three times, with levels of 27.0, 9.2, and 8.2 µg/m³ (**Supporting Document 1-1**). These elevated concentrations appear to be influenced by background values and laboratory detection limits, with landfill-related H_2S and total reduced sulfur (TRS) concentrations generally low at receptors and property boundaries. Occasional elevated H_2S and TRS levels may contribute to off-site odour events but are expected to have low health impacts. To manage emissions, on-going routine maintenance of the LFG system and cover areas is recommended.

Given the small magnitude and low frequency of exceedances predicted for PM_{10} and $PM_{2.5}$ under assumed worst-case conditions at the maximum residential receptor location, and the level of conservatism used in the HHRA, the likelihood of adverse health effects occurring as a result of exposure to PM_{10} and $PM_{2.5}$ was predicted to be very low. The dominant source of PM at the site was crustal material (soil and dust), which has lower toxicity than combustion-related particles. No exceedances of annual average PM_{10} or $PM_{2.5}$ guidelines were predicted, and short-term exceedances were small in magnitude, infrequent, and limited to areas close to the facility. The low toxicity of the PM and the conservative nature of the modeling led to the conclusion that PM exposures do not pose significant health concerns.

From 2019 to 2022, monitoring conducted as part of the Annual Monitoring Program showed that TSP levels occasionally exceeded provincial air quality criteria, prompting dust control measures such as watering roads and construction sites. Metal concentrations measured during this period were consistently below applicable standards, and VOCs remained low and within regulatory limits.

Cancer risk assessments reviewed as part of the assessment showed that most inhalation and oral incremental lifetime cancer risk (ILCR) values were below the one-in-a-million threshold, except for benzo(a)pyrene (a PAH) bromodichloromethane, 1,1,2,2-trichloroethane, and vinyl chloride, which slightly exceeded this conservative benchmark. However, bromodichloromethane and 1,1,2,2-trichloroethane were below detection limits in recent monitoring, and vinyl chloride levels were low and variable,

indicating minimal risk. No current measured or modelled data exist for benzo(a)pyrene, but its presence is likely related to diesel vehicle emissions rather than landfill operations.

Overall, based on the review of results from the recent annual monitoring programs, the review of existing conditions for air quality, groundwater quality and surface quality, and the review of assumptions as well as the conclusions from the 2005 HHRA, no measurable long-term or short-term adverse health effects are expected from exposure to LFG emissions, with the exception of a cautious consideration of H_2S under worst-case scenarios. The recommendation was made to include benzo(a)pyrene as an indicator of PAHs in future air quality monitoring to better assess potential risks from PAHs.

In summary, the combined evidence from the original HHRA, updated toxicological data, and recent monitoring supports the conclusion that landfill operations at the TCEC pose a low risk to human health when properly managed. Regular monitoring and maintenance are key to ensuring emissions remain within safe limits and minimizing any potential health impacts.

4.8.2 Social Environment

The social environment around the TCEC was assessed across several key areas including population and residences, local businesses, community satisfaction, use and enjoyment of property, nuisance-related effects, and confidence in TCEC operations. The existing conditions are summarized from the Socio-Economic Environment Existing Conditions Report (**Supporting Document 1-8**).

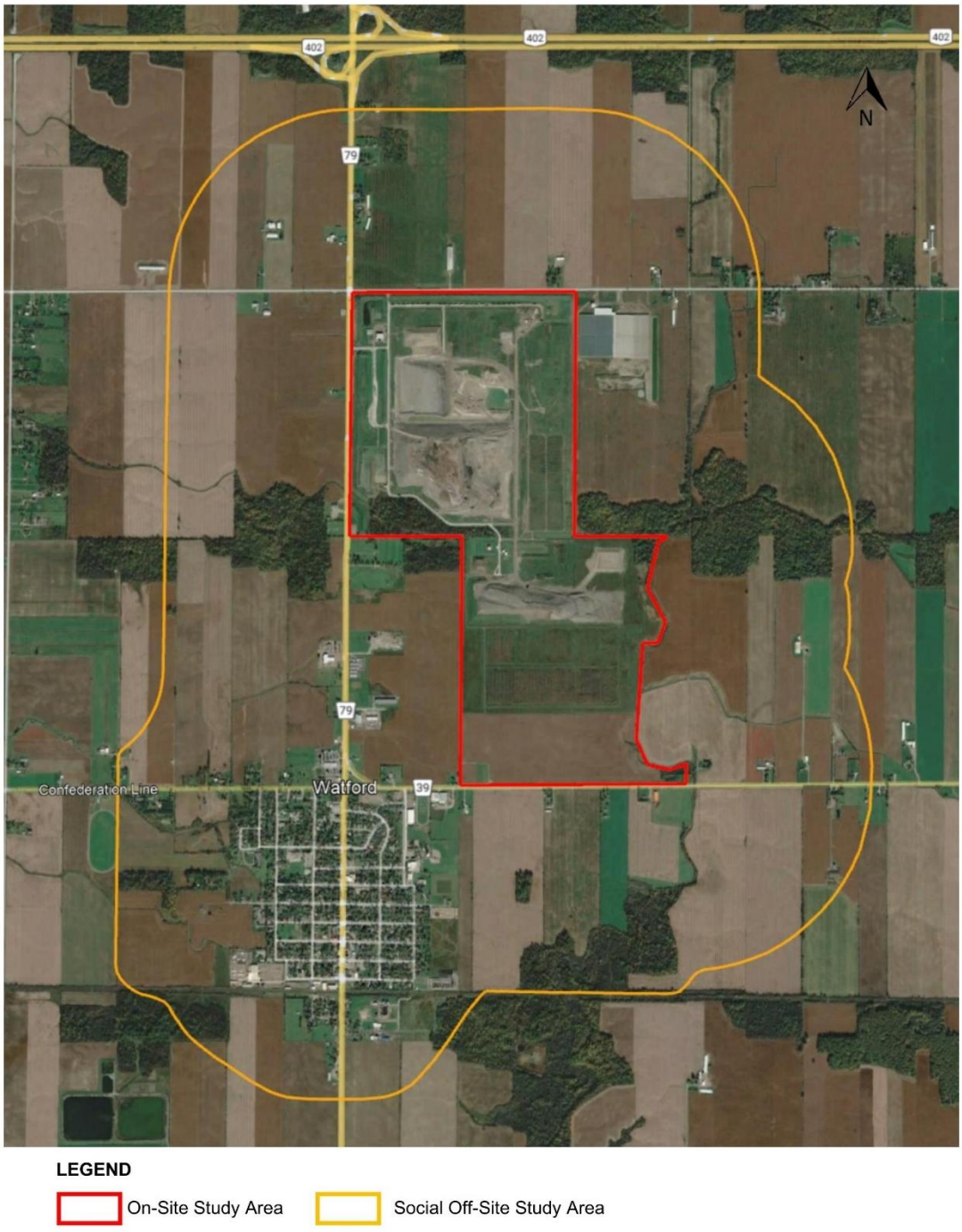
The On-site and Off-site Study Areas for the Social Environment are shown on **Figure 4-16**. The On-site Study Area corresponds to the general On-site Study Area, while the Off-site Study Area was expanded to encompass the village of Watford.

The existing social environment assessment focused on the community of Watford and residents within 1 km of the TCEC. Key tasks included:

- Reviewing census and municipal data to understand population, housing, and community services.
- Identifying local businesses and receptors near the site.
- Analyzing historical nuisance complaints (odour, dust, litter, etc.).
- Incorporating findings from air quality, noise, visual, and transportation studies.
- Conducting a Community Survey, distributed to 1,794 households. A total of 136 responses (7.6% response rate) provided insights into satisfaction with living conditions, use of local amenities, and confidence in TCEC operations.

Additionally, community profiles were developed for five Indigenous communities with Aboriginal or Treaty rights in the area, based on publicly available information.

Figure 4-16. On-site and Off-site Study Areas for the Social Environment



4.8.2.1 Population & Residences

Watford has a population of 1,563 residents, which comprises approximately 43% of the population of the Township of Warwick. Watford has experienced a minor population growth of 1.8% since 2016, while the Township of Warwick has experienced a minor population decline of 1.4%; both are below the corresponding growth rate for Ontario of 5.8%. There are no residences located within the On-site

Study Area. Within the Social Off-site Study Area, there are 648 residences located within Watford and approximately 33 residences located outside of Watford. Three planned residential developments and other identified residential lands in Watford will allow for a significant population increase in the area, which has not been experienced in at least two decades.

4.8.2.2 Local Businesses

Canada Post's Precision Targeter tool identified that there are 133 businesses in the Township of Warwick, with 110 located in Watford. The Sarnia-Lambton Economic Partnership (SLEP), in cooperation with the Township, manages a list of businesses within the Township and currently lists 87 businesses with an address in Watford and 9 businesses with an address in the Township of Warwick, for a total of 96 businesses. Since 2009, 22 new businesses have started in the Township, mostly within the Social Off-site Study Area.

A large industrial park, the Warwick Industrial Park, is planned to the west of the southern portion of the TCEC site, and the Township of Warwick OP identifies currently vacant lands, including the Warwick Industrial Park, for commercial and industrial use to the north, south, and east of Watford. Together, the identified lands in Watford will allow for commercial and industrial growth in the area.

4.8.2.3 Level of Satisfaction with Living and Working in the Community

A Community Survey and an Economic Survey were distributed to all residents and businesses, respectively, in the Township of Warwick in September 2023 to aid in the characterization of existing socio-economic conditions. A total of 136 responses were received to the Community Survey, and 6 responses were received to the Economic Survey[12]. Overall, residents are satisfied with living in the Township of Warwick and are likely to stay and retire within the Township, and recommend the Township to others as a place to live. Based on survey results, the likelihood of younger residents staying in the community will be dependent upon the availability of employment opportunities and housing in the area. Watford was the most common shopping location for residents in the Township according to the Community Survey. Businesses are somewhat satisfied with conducting business in the Township of Warwick. Based on survey results, satisfaction appears to be tied to proximity to home, access to surrounding cities, and low development charges.

[12] The Township of Warwick conducted a community survey in 2021 in support of the development of their Parks, Recreation, Tourism, & Culture Master Plan (PRTCMP). According to the Township of Warwick's PRTCMP (October 2021), "A total of 124 responses were received and analyzed; this is an acceptable response rate based on other surveys undertaken by the Township of Warwick that involved public consultation."

4.8.2.4 Use and Enjoyment of Property

The Township of Warwick's Parks and Recreation Department (PRD) aims to provide inclusive and accessible parks, recreation, tourism, and cultural opportunities that meet local needs. To support this vision, the PRD developed the Parks, Recreation, Tourism & Culture Master Plan (PRTCMP) in 2021, which includes an analysis of local recreational facilities and their usage. The results of the PRD's 2021 survey showed high participation in activities like walking/hiking (80%), ice sports (61%), parks and playgrounds (53-58%), and other sports like baseball, yoga, and swimming. According to the 2023 Community Survey, the most frequently used facilities are the East Lambton Community Complex and the baseball diamonds and running track at Centennial Park. The least used include horseshoe pits, BMX park, Bluebird Parkette, and Nauvoo Park. Overall, recreational facility use was relatively low.

The Social Off-site Study Area includes various community amenities: two elementary schools, four churches, and two retirement/long-term care facilities, all within a few kilometers of the Expansion Landfill area. Parks serve multi-generational needs and community centres act as social hubs. The area hosts several parks, trails, and a community complex, supporting local recreation and social activities.

4.8.2.5 Nuisance Effects

Various nuisance-related effects are typically associated with landfills (e.g., odour, dust, litter, noise, traffic, and visual impact) and mitigation measures are in place to address these issues at the TCEC. Based on the results of the Community Survey, residents are most concerned about odour and are least concerned about noise. Based on the results of the Economic Survey, businesses are most concerned about odour, air quality, groundwater quality, and are least concerned about noise and dust.

From 2009 through 2024, a total of 233 odour-related complaints were received. A review of odour complaints shows a decrease over time with the exception of those received during the Township's incentive program in 2022, with 23 odour complaints received in 2023, and 15 received in 2024, down from 51 in 2019. Based on a review of the 2024 complaints, approximately 33% of the odour complaints were related to abnormal conditions (e.g., power interruptions causing shutdown of LFG collection system). WM has a BMPP for odour to address odour issues.

A total of 15 litter-related complaints were received from 2009 through 2024, with none received in 2024. Generally, there are only a few litter complaints each year. In accordance with TCEC's wind-blown litter BMPP, WM responded immediately to each complaint and applied the necessary corrective action.

A total of 10 dust-related complaints were received from 2009 through 2024, with none received in 2024. Typically, no more than one complaint is received per year; however, there were 6 complaints received in 2021 when ASR material was used as daily cover material. These dust-related complaints were associated with track out. WM implemented a new ASR material abatement plan to control ASR material track out in 2021 and the following year only received one complaint regarding track out, suggesting the abatement plan was successful in decreasing ASR material track out.

The Dust Management Plan implemented at the TCEC, which includes road sweeping and watering of on-site roadways and construction sites as well as a number of other practices, is effective for controlling dust at the site.

No noise complaints have been received for the TCEC since 2012, showing that noise mitigation is effective. WM documents public complaints related to noise at the TCEC, and a record of complaints is provided in the annual monitoring reports, which are posted on the TCEC website.

Regarding site traffic, the majority (approximately 80%) is destined to/from the north and accesses Highway 402. There are no TCEC-related issues regarding intersection operations, collisions, or cyclist and pedestrian safety.

Regarding the visual impact of the existing landfill, the berms and plantings at the TCEC provide effective visual mitigation under existing conditions along with surrounding woodlands and buildings. Visual landscape conditions will change gradually over time, affording people the opportunity to slowly adjust to the change in views. A Property Value Protection (PVP) plan was developed for the original landfill expansion to mitigate the potential effects from changes to the visual landscape resulting from the landfill; however, none of the eligible property owners have had to make use of the plan to-date, indicating that the real estate market has been good, and residents have been able to achieve their desired sale price.

4.8.2.6 Confidence in TCEC Operations

As part of the Community Survey, residents were asked about their level of confidence in current landfill operations at the TCEC. Based on the results of the Community Survey, 30% of residents responded that they are confident or somewhat confident in current landfill operations, while 33% are neither confident nor unconfident, and 37% are somewhat unconfident or unconfident. Reasons provided for being confident or somewhat confident included knowledge of the landfill being tightly monitored by several agencies. Key reasons provided for being unconfident or somewhat unconfident included concern regarding the long-term ramifications on the residents of Watford, suggestion for more testing and monitoring and more communication, feelings that the landfill has a lack of benefit to the community, and concerns about environmental impacts and odour management.

Based on the results of the Economic Survey, 60% of businesses responded that they are confident in current landfill operations, while 20% are neither confident nor unconfident, and 20% are somewhat unconfident. Reasons provided for being somewhat unconfident included odour, birds, traffic, and low host community fees.

4.8.2.7 Indigenous Communities

TCEC lies within the traditional territories of five Indigenous communities identified by the MECP. These include:

- Aamjiwnaang First Nation;
- Walpole Island First Nation (WIFN);

- Chippewas of Kettle and Stony Point First Nation (CKSPFN);
- Chippewas of the Thames First Nation (COTTFN); and
- Oneida Nation of the Thames.

These Indigenous communities are all located between 25 km and 64 km from the TCEC.

Aamjiwnaang First Nation is an Indigenous community of about 2,500 people, with 900 people living on the Sarnia No. 45 Reserve near Sarnia, 44 km west of the TCEC. The reserve covers 1,280 hectares and has 278 dwellings. Governed by a Chief and eight councillors, the community adopted its own Constitution in 2017. In 2021, the workforce was 245, with 39% employed and 18% unemployed. Key jobs are in health care, public administration, construction, retail, and transportation. Several businesses operate on the reserve.

WIFN has about 1,589 people on a 13,740-hectare reserve, 64 km southwest of the TCEC. Governed by Chief Leela Thomas and 12 Councillors, it has 782 dwellings (2016). The community monitors landfill operations and was involved in EAs. In 2016, 30% of the 470 workforce were employed, mainly in health care, public administration, education, and retail. Several businesses operate on the reserve.

CKSPFN is an Indigenous community of about 1,900 people, with 1,000 living on the 932-hectare Kettle Point 44 Reserve, located 25 km northwest of the TCEC. The reserve has 775 dwellings (2021 Census). Led by Chief Kimberly Bressette and eight councillors, the community has over 20 departments. In 2021, the workforce was 415 with a 33% employment rate and 19% unemployment. Key employment sectors include health care, public administration, construction, and retail. Several businesses operate on the reserve.

COTTFN is an Indigenous community on a 4,249-hectare reserve about 30 km southeast of the TCEC and 17 km southwest of London, Ontario. The registered population is 3,225. The community is governed by Chief Joe Richard Miskokomon and 12 councillors, with 13 departments and 11 committees. Many Indigenous-owned businesses are promoted through the community's website.

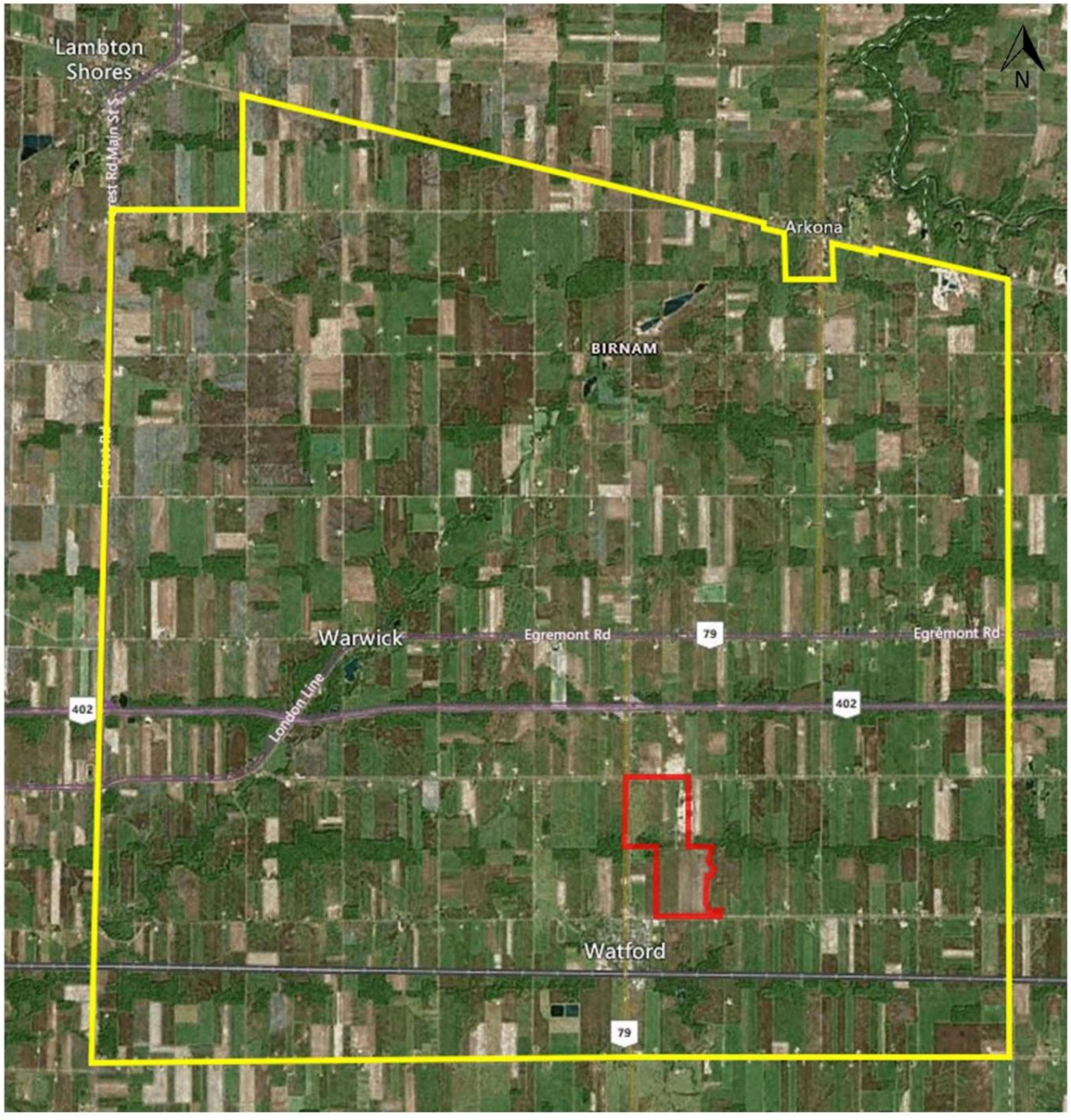
Oneida Nation of the Thames is an Indigenous community on the 2,214-hectare Oneida No. 41 Reserve, about 37 km southeast of the TCEC and 12 km southwest of London. The reserve has over 2,000 residents. The community is led by Chief Todd Cornelius and 11 councillors, with 10 governing departments.

4.8.3 Economic Environment

The assessment of the existing economic environment focused on labour force characteristics (local employment and employment at the TCEC), host community contributions (community initiatives and municipal support), and local procurement of goods and/or services. The existing conditions are summarized from the Socio-Economic Environment Existing Conditions Report (**Supporting Document 1-8**).

The On-site and Off-site Study Areas for the Economic Environment are shown on **Figure 4-17**. The On-site Study Area corresponds to the general On-site Study Area, and the Off-site Study Area was expanded to include the Township of Warwick.

Figure 4-17. On-site and Off-site Study Areas for the Economic Environment



The economic assessment focused on the Township of Warwick and the Village of Watford, particularly businesses that may be affected by or interact with the TCEC. Key tasks included:

- Reviewing census and municipal data for employment trends and industry sectors.
- Analyzing TCEC employment levels and contributions to the local labour force.
- Assessing host community contributions.
- Reviewing tax contributions, procurement of local goods/services and WM's support for community projects.
- Conducting an Economic Survey, distributed to 133 businesses, with six responses received. These helped identify how local businesses view and interact with the TCEC.

4.8.3.1 Labour Force

The TCEC provides economic benefits to the local community through primary and secondary employment and the future development will likely provide further work opportunities for the local community. The unemployment rates for Watford and the Township of Warwick increased from 2016 to 2021. These increased unemployment rates may have resulted from the effects of COVID-19 starting in 2020. The local unemployment rates are higher than that for Ontario.

The proximity of Watford and the Township of Warwick to major employment centres such as Sarnia and London makes it easy for residents in the Township to commute to other locations for work. According to the 2021 Census, 67% of employed residents in Watford commute outside of the Township of Warwick for work, while 72% of employed residents in the Township do the same.

The top three industry sectors in the Township of Warwick are agriculture, forestry, fishing and hunting, construction, and manufacturing, providing 40.9% of the total employment. Waste management is included within the administrative and support, waste management and remediation services industry, which comprises approximately 1.8% of employment within the Township. The top three industry sectors in Watford are construction, manufacturing, and health care and social assistance providing 35.5% of the total employment. Administrative and support, waste management and remediation services industry comprise approximately 1.4% of employment within Watford.

According to the 2021 Census, 26.8% of the labour force in Watford works in trades, transport and equipment operators and related occupations, followed by sales and service occupations at 24.6%. Based on information available from the SLEP, the top three major employers in Watford, with 100+ employees each, are McCann's Redd-Mix, Watford Roof Truss Limited, and Schouten. The TCEC is not a significant source of employment in the off-site study area due to the scale of its operations and its proximity of the Township of Warwick to other major urban centres. The TCEC provides stable employment for 35 staff, the majority of which are operators.

4.8.3.2 Host Community Contributions

WM entered into a Host Community Agreement with the Township of Warwick, which helps alleviate tax burdens to local residents, reduces the Township's reliance on residential tax assessment, and offsets net increases in the Township's operating costs associated with residential development. From 2009 through 2024, WM has contributed over $41.3 million in host community fees to the Township. The average annual payment of host community fees to the Township under the current host community agreement is approximately $4.1 million, which amounts to approximately 24% of the Township's gross annual operating budget and approximately 36% of the Township's total municipal revenue. The majority of survey respondents indicated that they are aware that WM pays host community fees to the Township; however, less than 20% were aware of the amount of the fees.

Municipal taxes levied on the TCEC form a portion of the tax base for the Township of Warwick, thus alleviating tax burden on the local residents and reducing the Township's reliance on residential tax assessment. Based on the data from Township of Warwick, WM has contributed between 1.7% and 3.5% of the Township's property tax revenue over the past 5 years.

Over the past 10 years, WM has provided additional support for community projects such as walking trails, soccer fields, arena upgrades, dog park, yard waste and recycling depots, and local festivals and events. Since 2009, WM has contributed over $800,000 to important projects across the County of Lambton.

4.8.3.3 Local Procurement

WM supports local businesses by spending up to approximately $2.5 million annually on goods and services to maintain TCEC operations, benefiting the local economy. The landfill serves various sectors across Ontario by safely managing non-hazardous waste.

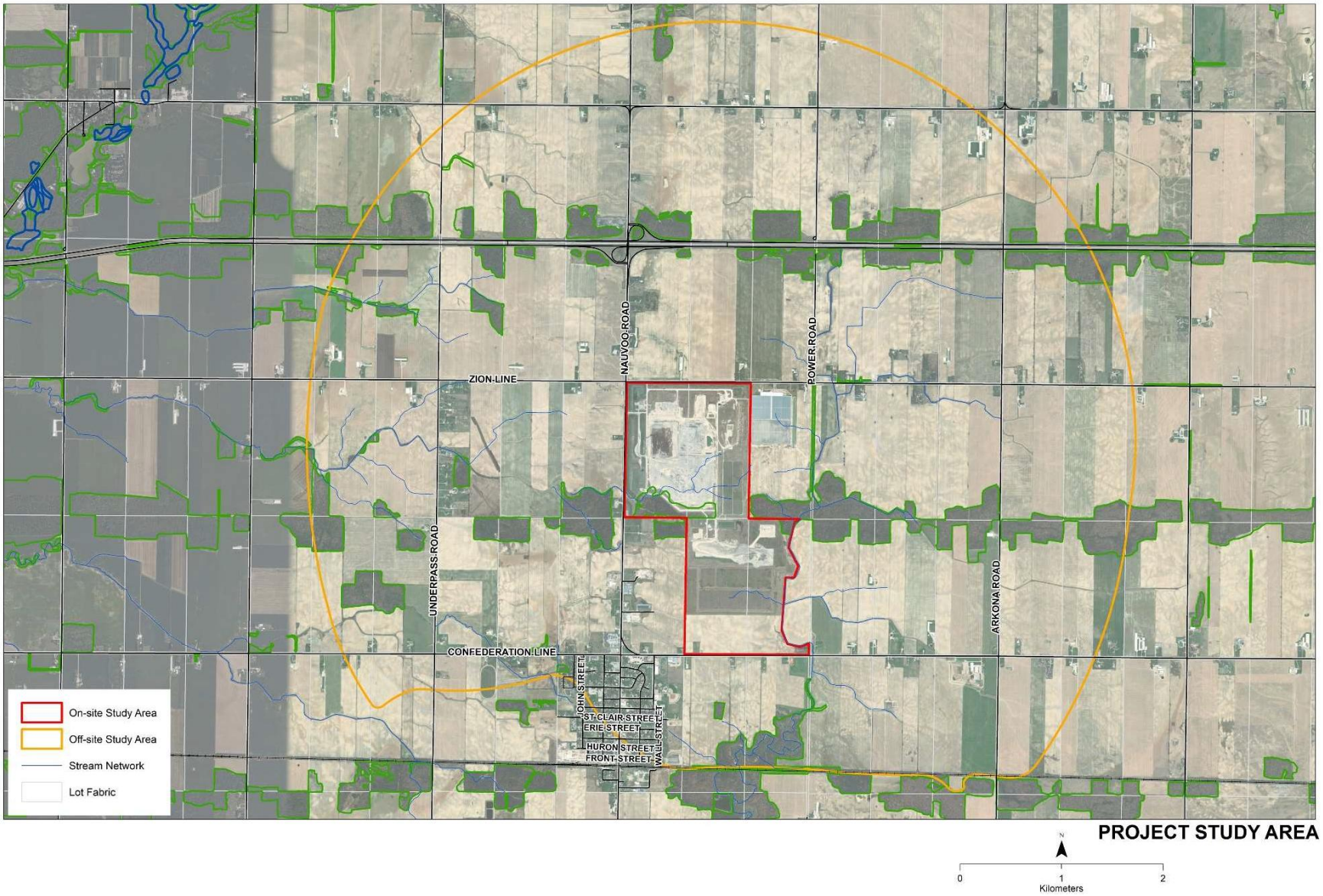
An Economic Survey found limited responses about business interactions with TCEC, but two businesses provide construction services to TCEC and one receives products from it, all considering the landfill important to their operations.

4.8.4 Visual Landscape

Visual Landscape examines the visual impact of the TCEC. The existing conditions are summarized from the Visual Landscape Existing Conditions Report (**Supporting Document 1-9**).

The On-site Study Area for Visual Landscape corresponds to the general On-site Study Area, while the Off-site Study Area was expanded by approximately 2.5 km in three directions: westward to include receptors near Underpass Road and Confederation Line; eastward to include those along Arkona Road; and northward to capture receptors north of Highway 402. The On-site and Off-site Study Areas for Visual Landscape are shown on **Figure 4-18**.

Figure 4-18. On-site and Off-site Study Areas for Visual Landscape



The characterization of existing visual conditions consisted of data collection and review including topographic base mapping, aerial photography, review of natural heritage features data and mapping, cultural heritage features inventory and mapping, review of local and regional OPs and land use maps, and field studies.

The visual landscape surrounding the TCEC is predominantly rural, characterized by gentle terrain with little topographic variation. To the south and southwest lies the Village of Watford, which includes residential, commercial, and institutional areas. Due to the density and height of buildings in the village, the TCEC is only visible from the northern area of the village near Confederation Line.

The areas to the north, west, and east of the TCEC are mostly agricultural lands and rural residential properties. Significant Woodlands located to the east and west of the site restrict views of the TCEC from Arkona Road and adjacent areas to the east, as well as from Underpass Road to the west.

Community facilities such as the East Lambton Community Complex (Watford Arena), YMCA, and local parks are situated south of the TCEC, from where the facility is visible. Berms and landscaping installed during the TCEC's construction provide effective visual screening under current conditions.

The north and west perimeters of the TCEC site comprise high berms with established coniferous and deciduous trees that perform an effective visual screening function. The recently constructed Twin Creeks Greenhouses complex is effective in screening views from the areas that are located northeast of the TCEC. The portions of the east and west sides of the TCEC are partially screened from view by the existing woodlots that are located east and west of the TCEC. To the south of the TCEC, a soil stockpile functions as an effective visual barrier for the receptors that are located along Confederation Line and within the Village of Watford.

The Visual Assessment carried out in 2005 noted the TCEC would remain visible from various vantage points. As such, the characterization of existing conditions evaluated the potential visual impact of the facility under future conditions. Changes in the viewshed of the TCEC are expected between the present day and when the Expansion Landfill reaches its approved design contours in approximately 2031. The characterization of the future existing condition was derived from the visual assessment for Year 26, Phase 11 as set out in the 2005 Warwick Landfill Expansion Project Visual Assessment (Baker Turner Inc., 2005). **Figure 4-18** illustrates the existing visual conditions and viewshed, while **Figure 4-20** illustrates viewsheds to the TCEC under the future existing conditions.

Figure 4-19. Existing Visual Conditions and Viewshed

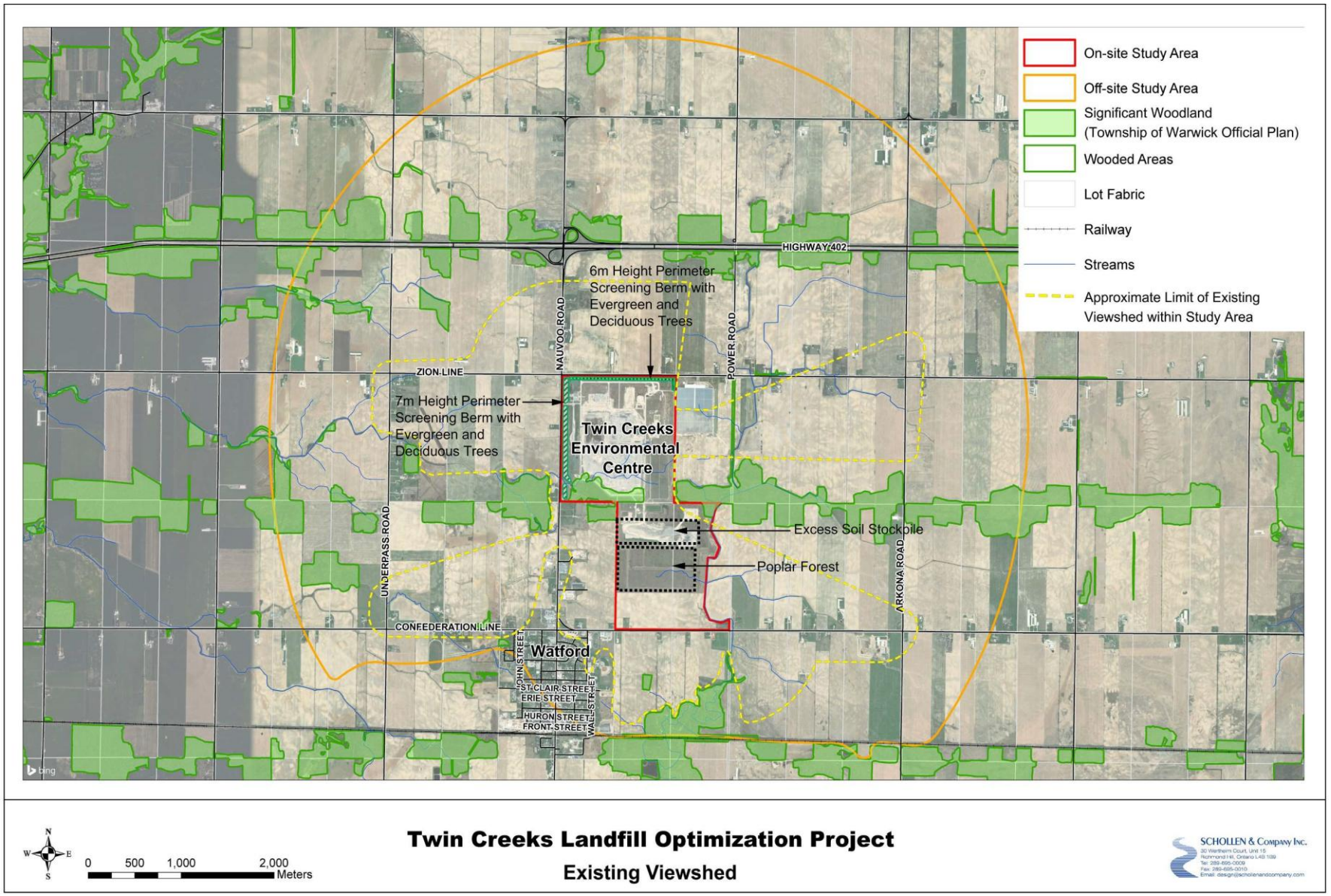
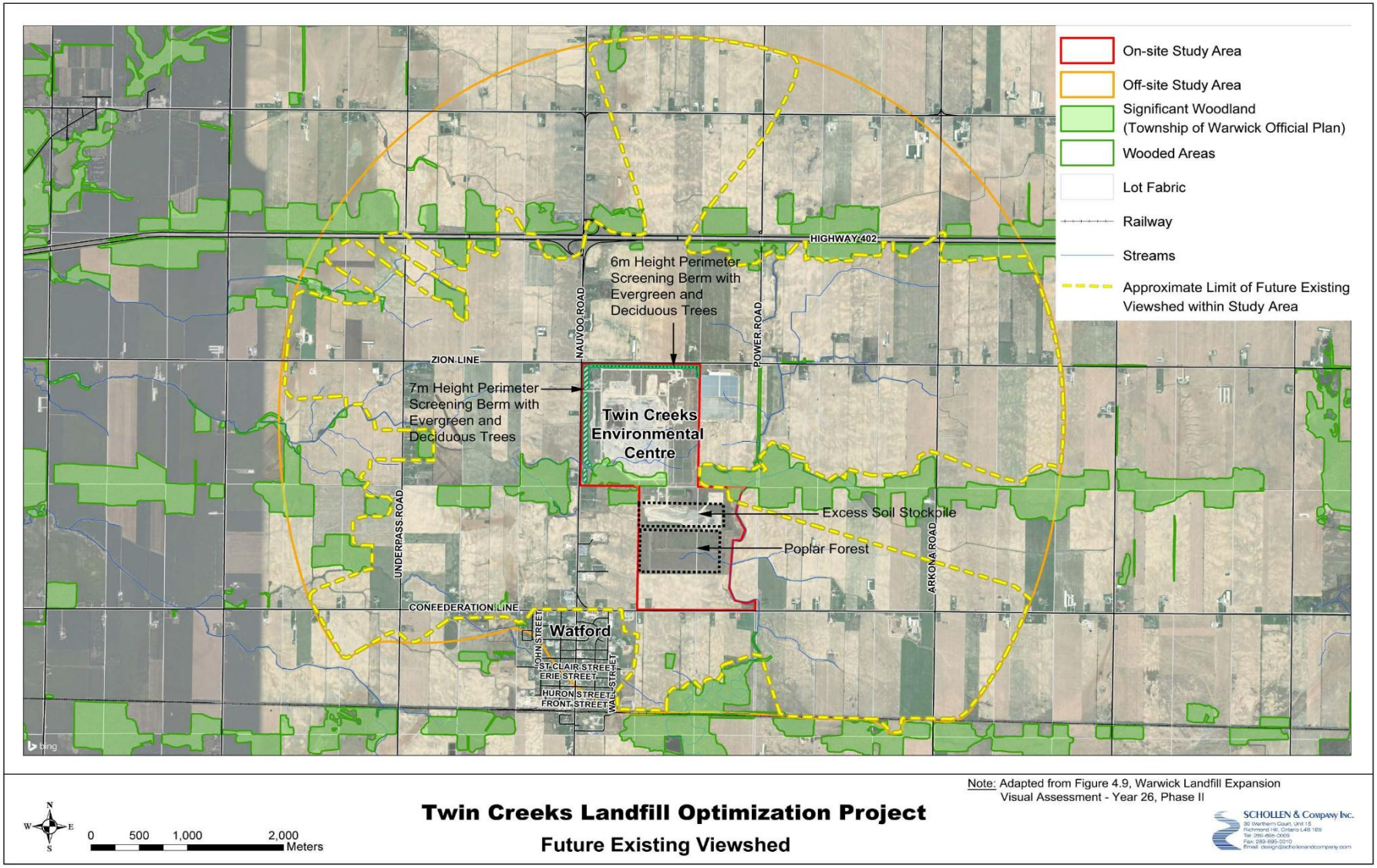


Figure 4-20. Future Existing Visual Conditions and Viewshed



Existing mitigation features (such as woodlands, berms, and tree plantings) already help reduce visual impacts for some receptors and are expected to continue serving this function. By 2031, future landscape changes will further influence visibility; for example, new industrial buildings may obstruct more views from the southeast, while the screening vegetation will continue to mature, increasing in height and density. These changes are expected to occur gradually, allowing local viewers to adjust to the evolving visual landscape over time.

4.9 Cultural Environment

A summary of the existing conditions for the Cultural Environment is provided below. The Cultural Environment, as defined for the EA, includes Cultural Heritage Resources and Archaeological Resources.

4.9.1 Cultural Heritage Resources

The existing conditions are summarized from the Cultural Heritage Resources Existing Conditions Report (**Supporting Document 1-10**). The general On-site and Off-site Study Areas shown on **Figure 4-1** were used for Cultural Heritage Resources.

The existing cultural heritage resources within the On-site and Off-site Study Areas were characterized through a multi-step process involving heritage inventory reviews, stakeholder consultation, historical research, and fieldwork. Municipal, Provincial, and Federal databases were examined to identify known Built Heritage Resources (BHRs) and Cultural Heritage Landscapes (CHLs), including previous cultural heritage studies from the 2005 EA.

The Ministry of Municipal Affairs and Housing (MMAH) defines BHLs as “a building, structure, monument, installation or any manufactured or constructed part or remnant that contributes to a property’s cultural heritage value or interest as identified by a community, including an Indigenous community”, and CHLs as “a defined geographical area that may have been modified by human activity and is identified as having cultural heritage value or interest by a community, including an Indigenous community. The area may include features such as buildings, structures, spaces, views, archaeological sites or natural elements that are valued together for their interrelationship, meaning or association” (MMAH, 2024).

Consultation with municipal and provincial heritage staff, Indigenous communities, and other stakeholders helped identify heritage features of significance. Historical research was conducted to trace Indigenous and Euro-Canadian settlement patterns, using records such as historical maps, aerial photos, land ownership, and census data. A field review was carried out to confirm the presence of known BHRs and CHLs and to identify new potential heritage features based on provincial criteria.

The Study Areas are located within an area that borders the Long Woods Purchase (Treaties No. 21 and 25 of the Upper Canada Land Surrenders) and the Huron Tract

Purchase (Treaty 29). The area is the traditional territory of WIFN, COTTFN, Aamjiwnaang First Nation, CKSPFN, Caldwell First Nation, and the Oneida Nation of the Thames..

Implications relating to un-surrendered harvesting and gathering rights on these "surrendered" treaty lands still plays a large part in duty to consult processes today, as well as concerns over cumulative effects impacting unceded reserved lands and un-surrendered fishing rights in Lake Huron that these First Nations continue to hold jurisdiction upon. As Anishinaabe peoples place significant cultural value on lands and water, and the animals that inhabit them, the ecology of the Study Areas and surrounding area is considered to be an important cultural concern.

Historically, the Study Areas are located in the Township of Warwick, County of Lambton in parts of Lots 17-22, Concession 2 South of Egremont Road; Lots 18-22 and parts of Lots 17 and 23, Concession 3 South of Egremont Road; Lots 19-22 and parts of Lots 17, 18, and 23, Concession 4 South of Egremont Road; and parts of Lots 18-23 Concession 5 South of Egremont Road.

A total of 16 potential CHLs and three (3) potential BHRs were identified within the Off-site Study Area during review of background research and historical mapping as shown on **Figure 4-21**. One CHL (CHL 1) was identified within the On-site Study Area. All CHLs and BHRs were previously identified in consultant reports or in background research. Three CHLs identified in the 2005 EA (CHL 10, CHL 14, and CHL 16) are not shown on **Figure 4-21** because one or more key structures have since been demolished. The numbering of the remaining CHLs is consistent with the 2005 EA.

CHL 1 is located on the north side of Confederation Line, east of Nauvoo Road within the southern portion of the TCEC site. CHL 1 contains active agricultural lands suspected of being in continuous operation since the late nineteenth century.

A summary of the identified CHLs and BHRs within the Study Areas is provided in **Table 4-10**.

Figure 4-21. Cultural Heritage Resources within the Study Areas

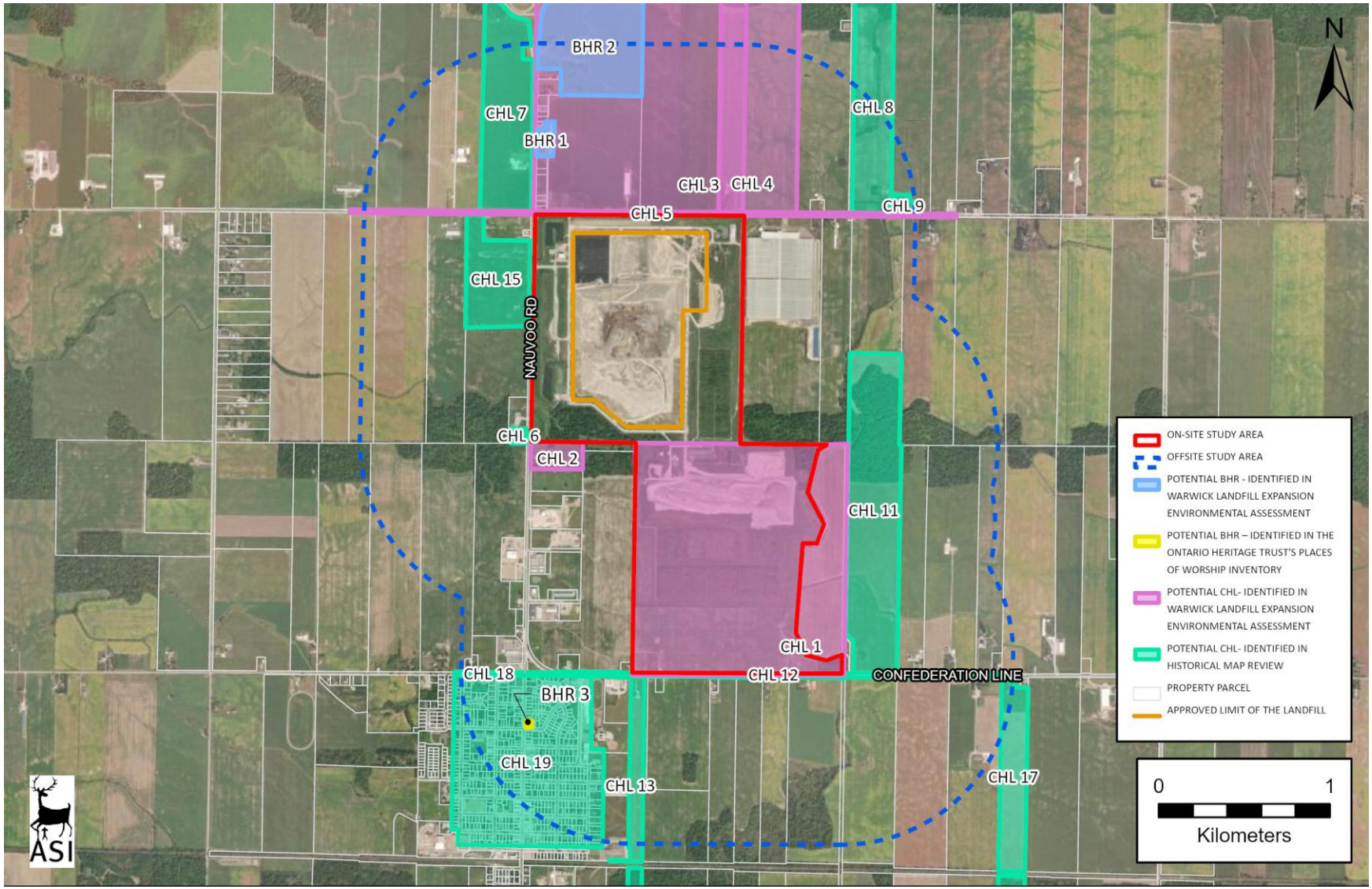


Table 4-10. Summary of Identified BHRs and CHLs within the Study Areas

Feature ID	Type of Property and Address	Description
Built Heritage Resources		
BHR 1	Farmhouse 5876 Nauvoo Road	• East side on Nauvoo Road, north of Zion Line. • Vernacular Italianate buff brick residence, c. 1890 (ASI 2005). Potential heritage attributes include the building's height and massing, fenestration, buff brick construction, and hipped roof.
BHR 2	Farmhouse 5966 Nauvoo Road	• East side of Nauvoo Road, south of Highway 402. • Vernacular residence, of frame or brick construction, built in the late nineteenth century (ASI 2005). Potential heritage attributes include the buildings height and massing, fenestration, front verandah with decorative pillars, and hipped roof.
BHR 3	Church 5378 Nauvoo Road	• Northeast corner of Victoria Street and Nauvoo Road. • Gothic Revival Church with a gabled roof and steeple. Potential heritage attributes include the building's height and massing, fenestration, buff brick construction, buttresses, and steeple.
Cultural Heritage Landscapes		
CHL 1	Agricultural Lot 20-21, Concession 4	• North side of Confederation Line, east of Nauvoo Road. • Contains active agricultural lands suspected of being in continuous operation since the late nineteenth century. • Since the 2005 EA there have been changes to land use on this property, and only areas that remain under active agricultural cultivation are considered to retain potential cultural heritage value or interest.
CHL 2	Cemetery 5606 Nauvoo Road	• East side of Nauvoo Road, south of the TCEC. • Contains Watford Cemetery. Watford Cemetery was established in 1888, although it contains some markers dating to the 1860s (ASI 2005). Potential heritage attributes may include the cemetery plots and grave markers, landscaping, entry gates, and pathways. • The boundaries for Watford Cemetery are based on mapping provided by the Bereavement Authority of Ontario (BAO).
CHL 3	Agricultural Lot 19 and 20, Concession 2	• Northeast corner of Nauvoo Road and Zion Line. • Contains active agricultural lands suspected of being in continuous operation since the late nineteenth century.
CHL 4	Farmscape 8060 Zion Line	• North side of Zion Line, west of Power Road. • Contains a farmscape featuring a vernacular farmhouse with Edwardian influence, constructed c. 1901-1939, a gable barn with vertical wooden boards and concrete foundation, constructed c.1901-1939 and active agricultural fields. Potential heritage attributes include the farmhouse, barn, agricultural lands, and mature trees.
CHL 5	Roadscape Zion Line	• Zion Line is a historically surveyed roadway in a rural agricultural setting that has retained a similar context since the late nineteenth century. Several BHRs and CHLs are located on Zion Road. • Potential heritage attributes include the roadway, viewscapes over agricultural fields, and the presence of historic farmscapes along the road.
CHL 6	Cemetery 5621 Nauvoo Road	• West side of Nauvoo Road, across from the south side of the TCEC. • Our Lady Help of Christians Roman Catholic Cemetery, located in Lot 18, Con. 3. A cemetery is depicted in this location in the 1911 topographical map. Potential heritage attributes include the cemetery plots and grave markers, landscaping, entry gates, and statuary. • The boundaries for Our Lady Help of Christians Roman Catholic Cemetery are based on legal property parcel boundaries.

Feature ID	Type of Property and Address	Description
CHL 7	Farmscape 5859 Nauvoo Road	• West side of Nauvoo Road, north of Zion Line. • Contains an early twentieth century single-storey residence, gable roofed barn with concrete foundations. The residence is in a similar location to a structure depicted in the 1911 topographical map. Potential heritage attributes include the residence, barn, outbuildings, and agricultural fields.
CHL 8	Farmscape 8210 Zion Line	• North side of Zion Line, east of Power Road. • Contains a two-storey buff brick farmhouse, a gravel drive, outbuildings, and agricultural fields. The residence is in a similar location to a structure depicted in the 1911 topographical map. Potential heritage attributes include the residence, driveway, outbuildings, treed windbreaks, and agricultural fields.
CHL 9	Farmscape 8234 Zion Line	• North side of Zion Line, east of Power Road. • Contains a two-and-a-half storey buff brick farmhouse, mature treelines, and agricultural fields. The residence is in a similar location to a structure depicted in the 1911 topographical map. Potential heritage attributes include the farmhouse, outbuildings, treed windbreaks, and agricultural fields.
CHL 11	Farmscape 8190 Confederation Line	• North side of Confederation Line, approximately halfway between Nauvoo Road and Arkona Road. • Contains a two-storey frame residence, outbuildings, and silos. Residence is in a similar location to a structure depicted in the 1911 topographical map. Potential heritage attributes include the residence, driveway, mature trees, and agricultural fields.
CHL 12	Race Course Confederation Line east of Nauvoo Rd.	• South side of Confederation Line, east of Centennial Avenue. • Contains a running track. A racecourse was depicted in this location in historical mapping from 1880 and throughout the twentieth century. Potential heritage attributes include the running track in a similar location as the historical racecourse.
CHL 13	Farmscape 7985 Confederation Line	• South side of Confederation Line, east of Centennial Avenue. • Contains a residence that appears to be a frame residence behind a newer brick residence, with outbuilding and a long drive. Residence is in a similar location to a structure depicted in the 1911 topographical map. Potential heritage attributes include the residence, outbuilding, gravel drive, and mature trees.
CHL 15	Farmscape 5737 Nauvoo Road	• West side of Nauvoo Road, across from the TCEC. • Contains a small single storey frame residence, an outbuilding, and agricultural fields. Residence is in a similar location to a structure depicted in the 1911 topographical map. Potential heritage attributes include the residence, outbuilding, agricultural fields, driveway, and mature trees.
CHL 17	Farmscape 8337 Confederation Line	• South side of Confederation Line, west of Arkona Road. • Contains a single storey frame residence, outbuildings, fenced-in pastures, and agricultural fields. Residence is in a similar location to a structure depicted in the 1911 topographical map. Potential heritage attributes include the residence, outbuildings, pastures, agricultural fields, driveway, and mature trees.
CHL 18	Cemetery Confederation Line west of Nauvoo Rd.	• South side of Confederation Line, east of John Street. • Contains Watford Pioneer Cemetery Cairn. The cairn is brick with original grave markers. In the location of a cemetery depicted in 1880 Historical Atlas Mapping. Potential heritage attributes include the grave markers and brick cairn.

Feature ID	Type of Property and Address	Description
CHL 19	Settlement Village of Watford	• Consists of the historic Village of Watford. The Village of Watford was established in the 1850s, and is depicted in the 1880 Historical Atlas. • The Village of Watford contains an assembly of nineteenth and early twentieth-century commercial, residential, and institutional properties that form the historical core of the village and reflect its growth and development. The commercial buildings along Nauvoo Road feature similar scale, massing, and setbacks from the roadway. The residential buildings on Nauvoo Road as well as on the side streets also feature similar scale, massing and setbacks. The variety of architectural styles demonstrate the continued use and development of the Village of Watford from the mid-nineteenth century founding of the village.

4.9.2 Archaeological Resources

The existing conditions are summarized from the Archaeological Resources Existing Conditions Report (**Supporting Document 1-11**). Because archaeological assessments (AAs) are concerned with direct impacts or impacts within 50 m of an archaeological resource, only the general On-site Study Area, shown on **Figure 4-1**, was included as the Study Area for Archaeological Resources.

Archaeological resources are non-renewable cultural resources such as Indigenous hunting camps and villages, battlefields, burial grounds and cemeteries, and other evidence of past human activity, which can be destroyed through direct disturbance from construction activities such as excavation.

Data collection was completed through background research, review of existing archaeological data and historical data (which included Indigenous land use and settlement as well as post-contact settlement), updating a database of known archaeological sites within the Study Area, reviewing provincial government files (Ontario Archaeological Sites Database) and searching historical and archival sources (e.g., Archives of Ontario), aerial and orthoimagery review, geography and map reviews. Field studies were conducted to verify the archaeological potential identified through background research and to assess how recent construction activities may have impacted that potential.

A Stage 1 AA was undertaken, which involved a review of archaeological sites located within the On-site Study Area. The purpose of a Stage 1 AA is to identify known archaeological sites that may be affected by the project, and to describe the potential for the presence of archaeological resources throughout the Study Area where potential disturbance may occur. The entire Study Area was previously assessed for archaeological resources between 1999 and 2008.

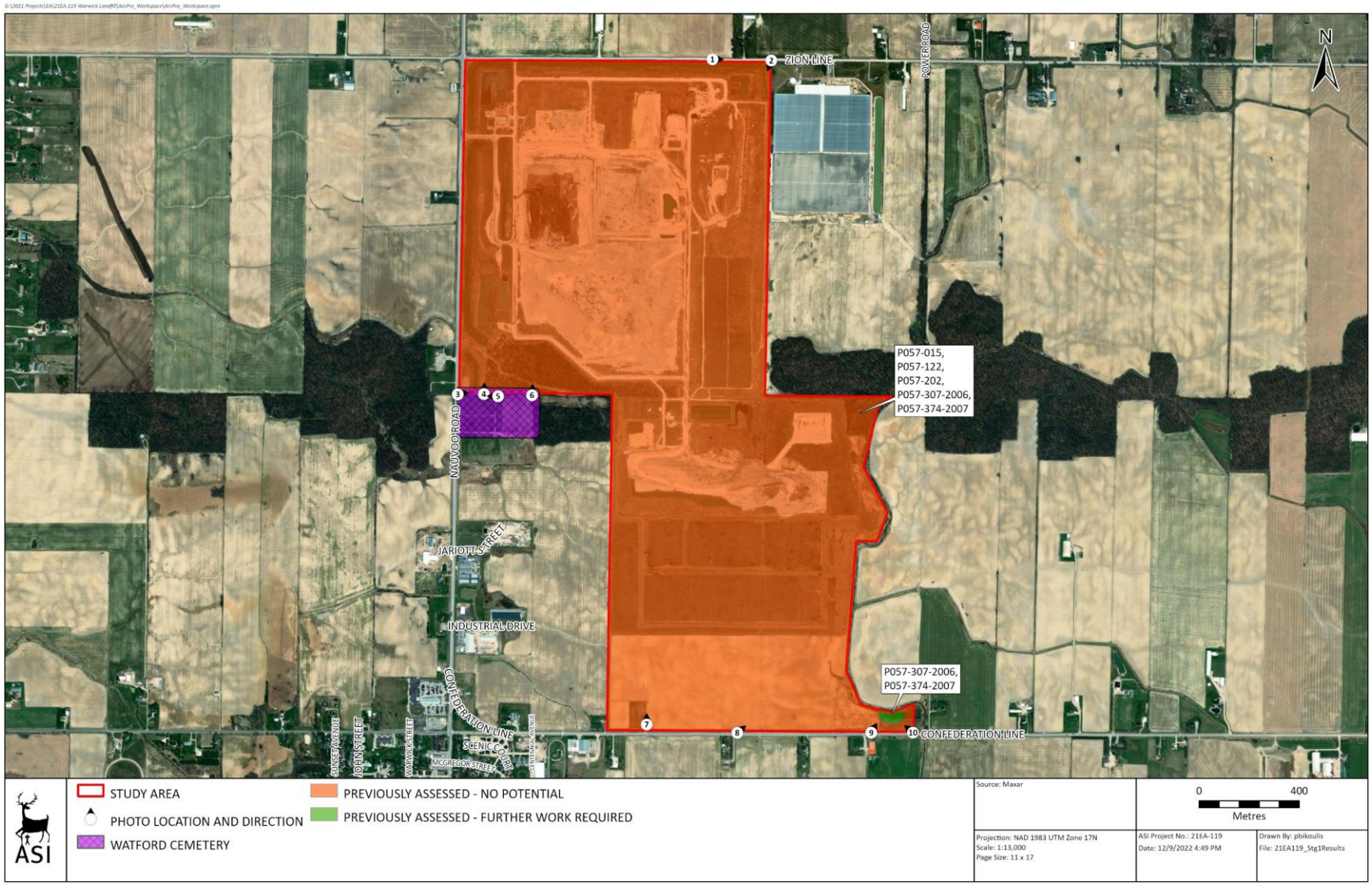
The Stage 1 AA determined that 37 previously registered archaeological sites are located within one kilometre of the Study Area. Site AfHl-14 is the only site relevant to the Project since it is located within the On-site Study Area (**Figure 4-22**). Site AfHl-14 is considered to have further cultural heritage value or interest and has been protected in perpetuity with the establishment of a protective 10 m buffer and surrounding conservation area at the completion of Stage 3 AA site-specific assessment in 2007

(P057-307-2006 and P057-374-2007). The background research determined that the remainder of the Study Area beyond the protected area of AfHl-14 has been previously assessed and has no further archaeological concern.

The northern section of Watford Cemetery lies directly next to the On-site Study Area, over 200 m from the approved Expansion Landfill footprint. This cemetery is well defined and has low potential for unmarked burials outside of the cemetery boundary and into the On-site Study Area, as confirmed during the Stage 1 AA property inspection and by the information gathered from the BAO. Consequently, no cemetery investigation is required for this project.

Should any potential work extend beyond the current study area, further Stage 1 AA should be conducted to determine the archaeological potential of the surrounding lands.

Figure 4-22. Archaeological Resources Within the Study Areas



4.10 Transportation

The existing conditions are summarized from the Transportation Existing Conditions Report (**Supporting Document 1-12**).

The On-site Study Area corresponds to the general On-site Study Area shown on **Figure 4-1**, whereas the general Off-site Study Area was extended to include the intersections that are used by facility vehicles to serve the local and broader areas based on known haul routes and typical origin-destinations for site traffic (**Figure 4-23**). These intersections are shown on **Figure 4-24**.

Figure 4-23. On-site and Off-site Study Areas for Transportation

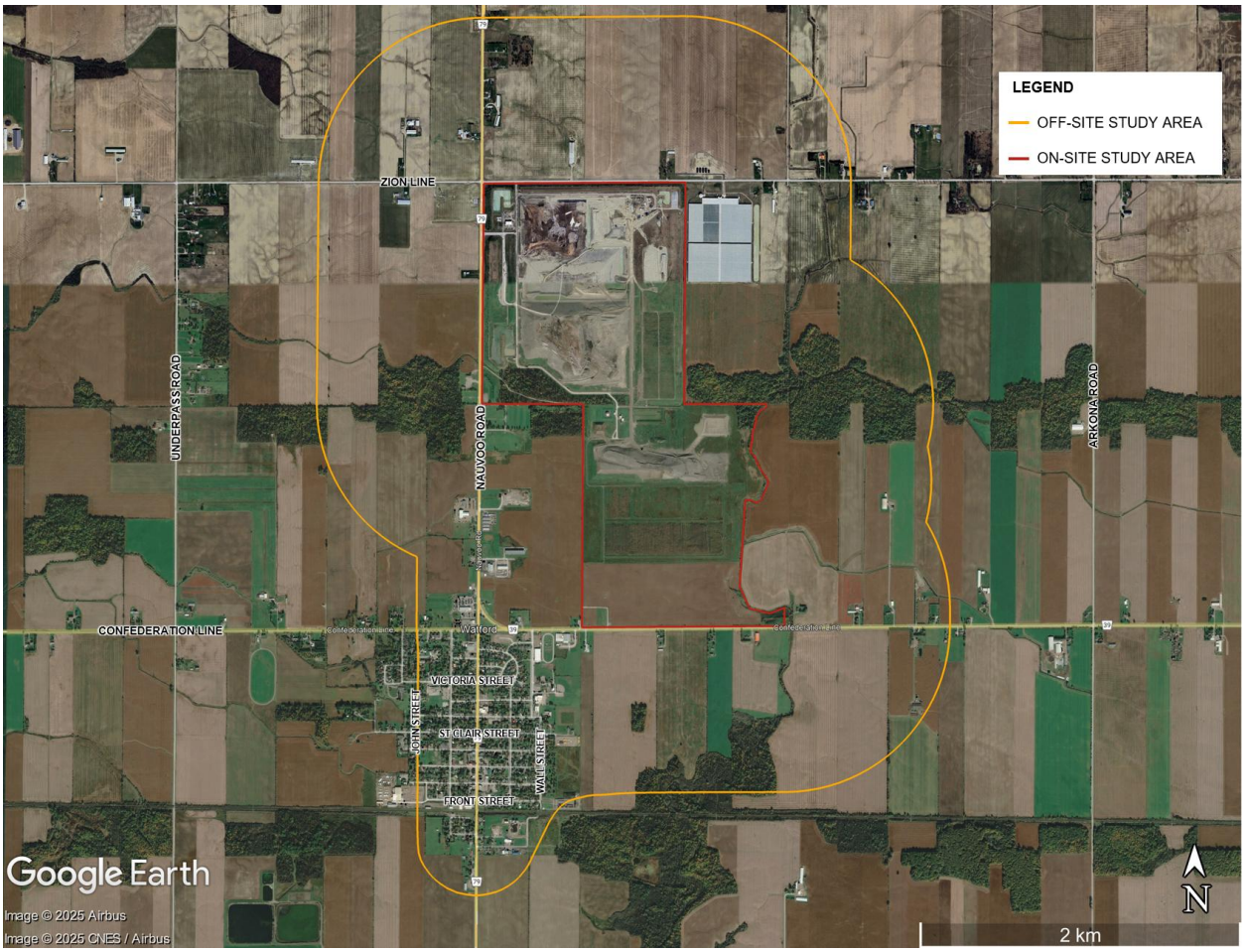
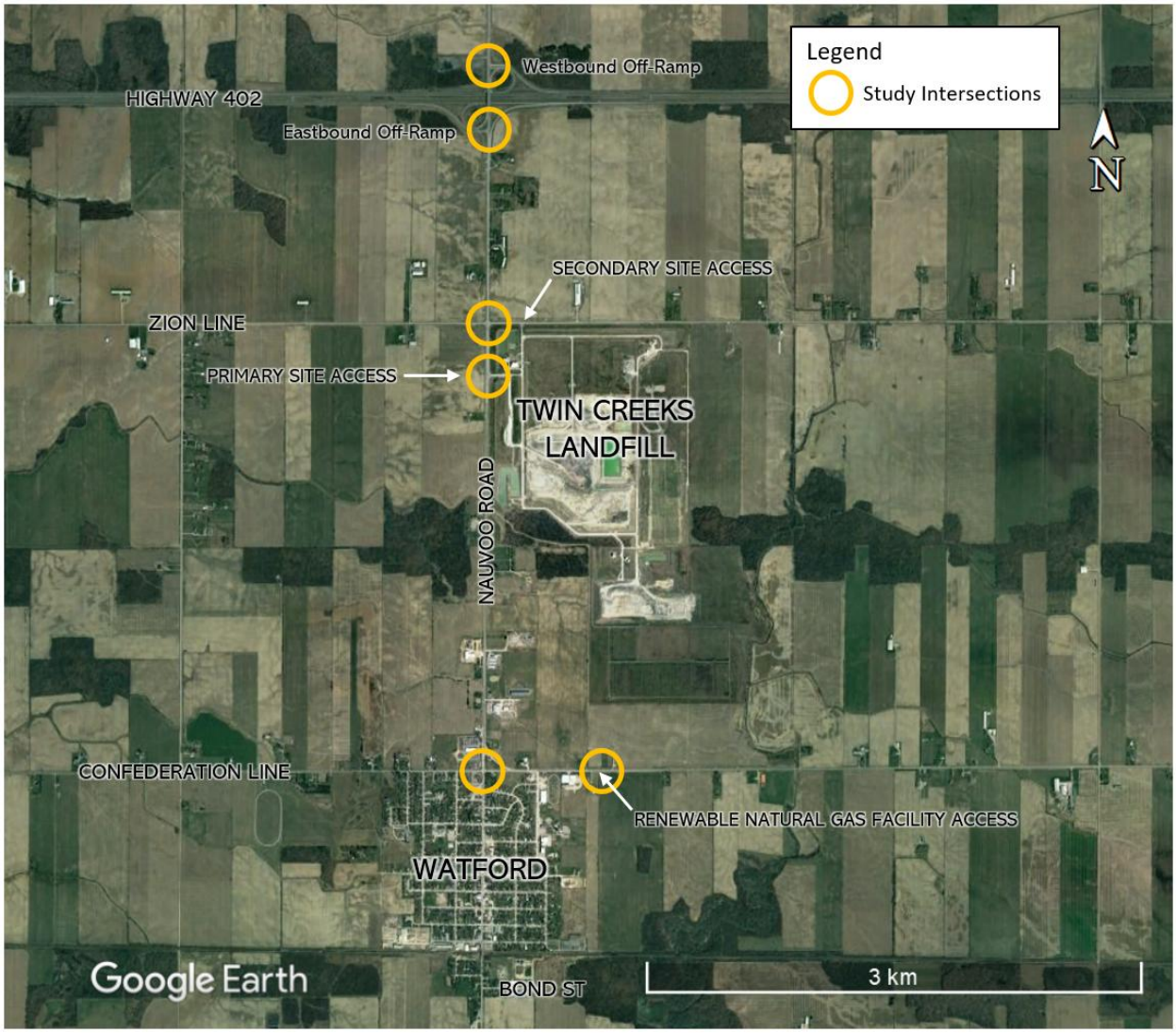


Figure 4-24. Off-site Study Area Study Intersections for Transportation Environment



Most traffic to and from the TCEC accesses the site via Highway 402 to the north. Five intersections were assessed including the Highway 402 ramps and Nauvoo Road intersections. The access point for the RNG Facility on Confederation Line will only serve RNG Facility-related traffic and is expected to have minimal effect on traffic operations.

A detailed traffic and road safety assessment was conducted for the TCEC to evaluate existing and future traffic characteristics. Using weigh scale data and turning movement counts, Synchro and SimTraffic software modelled existing traffic conditions and peak activity scenarios to estimate intersection delays, queue lengths, and volume-to-capacity ratios. The models were calibrated using field data and will inform future traffic forecasting.

A Road Safety Assessment was also completed, including a five-year collision history review at study intersections and road segments, with a focus on potential impacts to

vulnerable users as well as truck-related collisions. Field investigations assessed pavement conditions, signage, pavement markings, and sightlines along Nauvoo Road and Zion Line, and turn lane and taper lengths were reviewed.

4.10.1 Traffic Operations

Intersection operations were assessed for the Off-site Study Area intersections using the software program Synchro Traffic Signal Coordination Software Version 11, which employs methodology from the Highway Capacity Manual (HCM) (TRB, 2000). The intersection analysis considers three separate measures of performance:

- The capacity of all intersection movements, represented by the volume to capacity (v/c) ratio;
- The level of service (LOS) for all intersection turning movements as well as for the overall intersection. The overall intersection LOS is based on the average control delay per vehicle (weighted) for the various movements through the intersection; and
- The forecasted queue lengths (50th and 95th percentile queue lengths).

LOS is an indicator of how long a vehicle must wait to complete a movement and is represented by a letter between 'A' and 'F', with 'F' being the longest delay. The volume to capacity (v/c) ratio is a measure of the degree of capacity utilized at an intersection. Highway Capacity Manual (TRB, 2000) definitions are summarized in **Table 4-11**.

Table 4-11. Highway Capacity Manual Level of Services Definitions

Level of Service (LOS)	Signalized Control Delay per Vehicle (s)	Unsignalized Control Delay per Vehicle (s)	Description
A	≤ 10	≤ 10	Ideal
B	> 10 and ≤ 20	> 10 and ≤ 15	Acceptable
C	> 20 and ≤ 35	> 15 and ≤ 25	Acceptable
D	> 35 and ≤ 55	> 25 and ≤ 35	Somewhat undesirable
E	> 55 and ≤ 80	> 35 and ≤ 50	Undesirable
F	> 80	> 50	Poor

Existing traffic volumes for study area intersections were captured in November 2022. The November counts are considered to be representative of typical conditions for background traffic[13]. The traffic counts captured the standard peak periods including the weekday AM peak period (7:00am to 9:00am), the weekday midday peak period

[13] As a general observation, cyclist and pedestrian activity is expected to be higher during summer months, while overall traffic volumes can be lower; therefore, analysis of summer conditions is not recommended for traffic analysis purposes.

(11:00am to 2:00pm), and the weekday PM peak period (4:00pm to 6:00pm). Follow-up turning movement counts were collected in May 2025 to validate the November 2022 data.

In addition to the external intersection traffic volumes, weigh scale data was provided for the TCEC including the same day as the traffic counts. The weigh scale information was used to validate the turning movement counts by comparing the inbound and outbound volumes to the weigh scale.

Using weigh scale data, truck traffic volumes were adjusted to reflect a high-volume, high-activity day. Based on this, estimated traffic volumes during peak hours are as follows:

- AM Peak Hour: 47 inbound and 77 outbound trips;
- Midday Peak Hour: 44 inbound and 52 outbound trips; and
- PM Peak Hour: 26 inbound and 30 outbound trips.

These volumes were used to model inbound queue lengths, confirming that on high-activity days, queues may extend back to Nauvoo Road, resulting in subsequent queueing in the northbound right-turn and southbound left-turn lanes. However, under typical conditions (i.e., the majority of the time), when fewer trucks are entering the site, these queues do not extend to Nauvoo Road. To manage peak traffic periods, a second weigh scale queuing lane is available and can be used to help reduce inbound queueing.

A traffic operations analysis of nearby intersections, using 2022 traffic data adjusted for high-activity conditions, found that all intersections are operating within acceptable limits. Volume-to-capacity ratios, delays, and queue lengths are within expected thresholds, with all intersection movements operating at LOS ‘C’ or better. LOS ‘D’ typically warrants monitoring, while ‘E’ and ‘F’ are considered unacceptable. The highest volume-to-capacity ratio observed was 0.28, well below the 0.85 threshold for requiring mitigation. In addition, there were no significant changes in traffic operations when comparing the May 2025 traffic data to that collected in November 2022. No operational concerns were identified.

Pedestrian and cyclist traffic volumes were collected in both 2022 and 2025 at the Off-site Study Area intersections, and are provided in **Table 4-12**. The results show little to no pedestrian and cyclist use of Nauvoo Road north of Confederation Line.

Table 4-12. 2025 vs 2022 Total 7-hour Pedestrian Volumes

Location	2022	2025
Pedestrian Volumes		
Nauvoo Rd at Hwy 402 EB on/off-ramp	0	0
Nauvoo Rd at Hwy 402 WB on/off-ramp	0	0
Nauvoo Rd at Zion Line	0	0

Location	2022	2025
Nauvoo Rd at Primary Facility Access	0	0
Nauvoo Rd at Confederation Line	22	9
Cyclist Volumes		
Nauvoo Rd at Hwy 402 EB on/off-ramp	0	0
Nauvoo Rd at Hwy 402 WB on/off-ramp	0	0
Nauvoo Rd at Zion Line	1	0
Nauvoo Rd at Primary Facility Access	0	0
Nauvoo Rd at Confederation Line	2	0
Nauvoo Rd at Victoria St	0	0
Nauvoo Rd at Simcoe St (south leg)	0	0
Nauvoo Rd at Ontario St (south leg)	0	0

Note. Eastbound (EB) and Westbound (WB).

Additional pedestrian counts were conducted within Watford in May 2025 at three locations on Nauvoo Road: Victoria Street, Simcoe Street, and Ontario Street. Traffic counts were conducted simultaneously. These results are presented in **Table 4-13**.

Table 4-13. Pedestrian Volumes and Traffic Volume

ATR Station and Description	AM Peak Hour	Midday Peak Hour	PM Peak Hour	7-hour
Pedestrian Volumes at Pedestrian Crossovers in Watford				
Nauvoo Road at Victoria Street	3	8	0	11
Nauvoo Road at Simcoe Street	15	9	1	35
Nauvoo Road at Ontario Street	6	16	13	55
Bi-directional Vehicular Volume				
Nauvoo Road at Ontario Street	291	335	391	-

The maximum peak hour pedestrian volume was 16 pedestrians observed at Nauvoo Road and Ontario Road during the midday peak hour. During this peak hour, there was approximately 335 vehicles travelling on Nauvoo Road in both directions. The highest hourly vehicular volume was 391 vehicles during the PM peak hour. During this time, 13 pedestrians crossed Nauvoo Road at Ontario Street.

4.10.2 Road Safety

Safety assessments included evaluations of driveway sightlines, storage and taper lane design, and historical collision data. The entrance to the TCEC from Nauvoo Road was found to have sufficient sightlines, and the existing taper and storage lanes are appropriately designed. No collisions or near-misses were observed during on-site

visits. The RNG Facility entrance was also reviewed and found to have adequate sightlines.

A review of the past five years of collision data revealed no patterns of frequent or repeated collisions, nor any indications of design issues or environmental risks. There was no evidence of an elevated number of truck-related incidents or collisions specifically linked to the TCEC site entrance on Nauvoo Road. The analysis concluded that the area does not experience a high frequency of collisions and raised no significant safety concerns.

Signage recommendations from the 2017 Road Safety Audit included an advance warning sign that the northbound acceleration lane is ending on approach to Zion Line, and “share the road” signage along Nauvoo Road to let drivers know that cyclists may use the roadway. These signs had not been installed as of the February 2023 site visit. Installation remains at the discretion of the County of Lambton. The current Road Safety Assessment did not identify any critical safety concerns related to the recommendations.

4.11 Current and Planned Land Use

The existing conditions are summarized from the Land Use Existing Conditions Report (**Supporting Document 1-13**).

The On-site and Off-site Study Areas for Land Use correspond to those for the Social Environment, shown on **Figure 4-16**. The On-site Study Area corresponds to the general On-site Study Area, while the Off-site Study Area was expanded to encompass the village of Watford.

Land Use considers the planned and existing Built Environment Conditions within the On-Site and Off-Site Study Areas, with a focus on sensitive land uses (as defined by the Provincial Policy Statement (PPS) and the MECP D-1 and D-4 Guidelines). The PPS, issued under the *Planning Act*, provides policy direction on these interests and is implemented at the County and Municipal levels through OPs and Zoning By-laws, and provides the overarching guiding definition of sensitive land use.

While the PPS provides an overarching, broad definition, the D1-3 Guideline provides a more specific sensitive land use definition as it relates to compatibility; the D-4 Guideline provides the most specific sensitive land use definition in the context of sensitive land uses for landfills currently in operation. The definitions of ‘sensitive land use’ from each guidance document are provided in **Table 4-14**. The PPS definition of sensitive land use considers a landfill as a “major facility”.

Table 4-14. Provincial Definitions of 'Sensitive Land Use'

Source	Definition
Provincial Policy Statement (2020)	***Sensitive land uses:*** *means buildings, amenity areas, or outdoor spaces where routine or normal activities occurring at reasonably expected times would experience one or more adverse effects from contaminant discharges generated by a nearby major facility. Sensitive land uses may be a part of the natural or built environment. Examples may include, but are not limited to: residences, day care centres, and educational and health facilities.*
D-1-3 Land Use Compatibility Definitions	***Sensitive Land Use*** *A building, 'amenity area' or outdoor space where routine or normal activities occurring at reasonably expected times would experience 1 or more 'adverse effect(s)' from contaminant discharges generated by a nearby 'facility'. The 'sensitive land use' may be a part of the natural or built environment. Depending upon the particular 'facility' involved, a sensitive land use and associated activities may include one or a combination of:* *i. residences or facilities where people sleep (e.g., single and multi-unit dwellings, nursing homes, hospitals, trailer parks, camping grounds, etc.). These uses are considered to be sensitive 24 hours/day.* *ii. a permanent structure for non-facility-related use, particularly of an institutional nature (e.g., schools, churches, community centres, day care centres).* *iii. certain outdoor recreational uses deemed by a municipality or other level of government to be sensitive (e.g., trailer park, picnic area, etc.).* *iv. certain agricultural operations (e.g., cattle raising, mink farming, cash crops and orchards).* *v. bird/wildlife habitats or sanctuaries*
D-4 Land Use On or Near Landfills and Dumps	***Sensitive land uses for landfills currently in operation*** *Any existing or committed land use which includes:* *a. a permanent structure used in animal husbandry; or* *b. agricultural land used for pasturing livestock; or* *c. a permanent structure where:* *i. a person sleeps, or* *ii. a person is present on a full-time basis; but not including food or motor vehicle service facilities adjacent to a highway, utility operations, scrap yards, heavy industrial uses, gravel pits, quarries, mining or forestry activities; or* *d. cemeteries*

Source: PPS (2020), D-1-3 Land Use Compatibility Definitions, D-4 Land Use On or Near Landfills and Dumps

Existing Land Use conditions were characterized through the collection of background information and review of aerial mapping, and a field visit in March 2023 to confirm and identify existing and sensitive land uses.

4.11.1 Current Land Use

The TCEC is the predominant existing land use within the On-site Study Area, with the licensed landfill site spanning approximately 101.8 ha. The active landfill operations are located within the northern portion of the 301 ha TCEC site, while the southern portion of the site includes a leachate transfer station, LFG management infrastructure, the excess soil stockpile, a poplar plantation for leachate treatment, the RNG Facility, and an agricultural field used for crop cultivation. Several private recreational features managed by WM are also located within on the On-site Study Area, including the Watford Dog Park (at the south end of the site along Confederation Line), Nauvoo Park (a passive recreation park located to the north of the Watford Cemetery on the west side of the site), and the Twin Creeks Nature Trail, a 2.4-km walking path which connects the two parks.

The County of Lambton OP designates the TCEC site as 'Agricultural Area', which prioritizes agricultural activities and limits non-farm development. Recreational or non-agricultural uses would require amendments to the County's OP. According to the Township of Warwick OP, the On-site Study Area lands are largely designated as a 'Landfill Site' within a 'WM Policy Area', with remaining portions designated as 'Agriculture'. Permitted landfill uses include waste disposal, processing, and energy-from-waste activities. Residential uses are prohibited. Notably, the site overlaps a Primary Corridor and contains Significant Woodlands, both of which are recognized natural heritage features requiring protection under provincial and municipal policy.

Zoning for the On-site Study Area is primarily M3-1 (Industrial Waste Disposal) under the Township of Warwick Zoning By-law 121 of 2012. This zoning permits landfill operations, waste processing, composting, recycling, and other ancillary facilities. Specific sub-zones include the southernmost 500 m, which is limited to a poplar forest and leachate treatment. Additional zoning overlays include EP-WD (Natural Heritage – Significant Woodlot), allowing for limited agriculture, conservation, and some residential uses; EP-H (Natural Heritage – Hazard), which permits agriculture and passive recreation; and A2-3 (Agricultural 2-3), which supports crop production and agricultural structures on parcels over four hectares.

The Off-site Study Area includes a mix of agricultural and settlement land uses. The predominant land uses within the north, east, and west portions of the Off-Site Study Area are agricultural in nature, featuring cash crop operations, livestock barns, pastures, and farm-related residences. These uses qualify as sensitive land uses under the PPS and D-1 and D-4 Guidelines. Two cemeteries located immediately west of the On-site Study Area are also considered sensitive under the D-4 Guidelines due to their proximity to the active landfill.

The southwestern portion of the Off-site Study Area includes the Watford Settlement Area, which includes the highest concentration of sensitive land uses in the Study Area, consisting of residential (predominantly single-detached dwellings), recreational resources (parks, community centres, and arenas), and institutional land uses (schools, daycares, and churches).

The majority of the lands within the Off-Site Study Area are predominantly designated as 'Agricultural Area' on Map '1' of the County's OP, with the entire 'Urban Centre' of Watford located within the Off-Site Study Area to the southwest, and a 'Hwy 402 Service Centre' designation located at the northwest corner of the Off-Site Study Area, south of Highway 402 and west of County Road 79.

The lands within the north, east, and west portions of the Off-Site Study Area are predominantly zoned 'Agriculture 1' (A1) on Schedule 'A' of the Township of Warwick Zoning By-law, with scattered 'Natural Heritage – Hazard' (EP-H) and 'Natural Heritage – Significant Woodlot' (EP-WD) zoning associated with streams and woodlands in the area. The Watford Settlement Area includes a wide range of residential (R1, R2, R3, and R5), commercial (C1, C2), institutional (I), Open Space

(OS1, OS2), and industrial (CM, M1) zones. The industrial zones are the only ones that do not permit sensitive land uses.

Residential zones permit single detached and medium-density housing, along with group homes and home occupations. Commercial zones permit a range of uses including retail, medical, daycare, hotels, and motels. Institutional uses can include schools, long-term care facilities, and places of worship, while industrial zoning allows for light and general industrial activities. Open space zones support parks, recreation, and conservation areas.

Watford has a population of 1,563 residents inhabiting approximately 648 residences located within the Watford settlement area and approximately 33 residences located outside of the Watford settlement area. Urban residential dwellings within the Watford Settlement Area are located between 30 m and 1,592 m from the TCEC site boundary, while agricultural residential dwellings within the Off-site Study Area are located between 59 m and 1,801 m from the site. The properties with residential dwellings in the Off-site Study Area are shown on **Figure 4-25**.

Agricultural uses (both cash crops and livestock operations) are the predominant land uses within the Off-Site Study Area (apart from the Watford Settlement Area, as noted above). Most “undeveloped” land within the Off-Site Study Area is used for agricultural cash crop farming, and 13 livestock operations have been identified within the Study Area. There is also one greenhouse operation within the Off-Site Study Area, located directly to the east of the TCEC site. Agricultural land uses within the Off-site Study Area are located between 0 m and 1,665 m from the TCEC site boundary, as shown on **Figure 4-26**.

The definition of “sensitive land use” in the D-1-3 Land Use Compatibility Guidelines includes *“certain outdoor recreational uses deemed by a municipality or other level of government to be sensitive,”* as well as permanent structures such as community centres. There are four public parks and one community centre located within the Off-Site Study Area, located between 282 m and 1,022 m from the TCEC site boundary: Bluebird Parkette; Centennial Park; Sunken Gardens; Watford Memorial Park; and the East Lambton Community Centre.

There are two elementary schools located in Watford: East Lambton Elementary School and St. Peter Canisius Catholic School. The two daycares in Watford are co-located with the elementary schools: the East Lambton Best Start Daycare is located within the East Lambton school building, and the North Lambton Childcare Centre is located within the Catholic school. East Lambton Elementary School is located on the east side of the settlement area, approximately 477 m from the On-Site Study Area and directly south of the East Lambton Community Complex and Centennial Park. St. Peter Canisius Catholic School is located on the west side of the settlement area, a block away from the main commercial corridor along Nauvoo Road.

There are also four places of worship within the Off-Site Study Area, all located within Watford along the Nauvoo Road Commercial Corridor (or a block to the east or west).

Figure 4-25. Properties with Associated Dwellings within the Off-Site Study Area

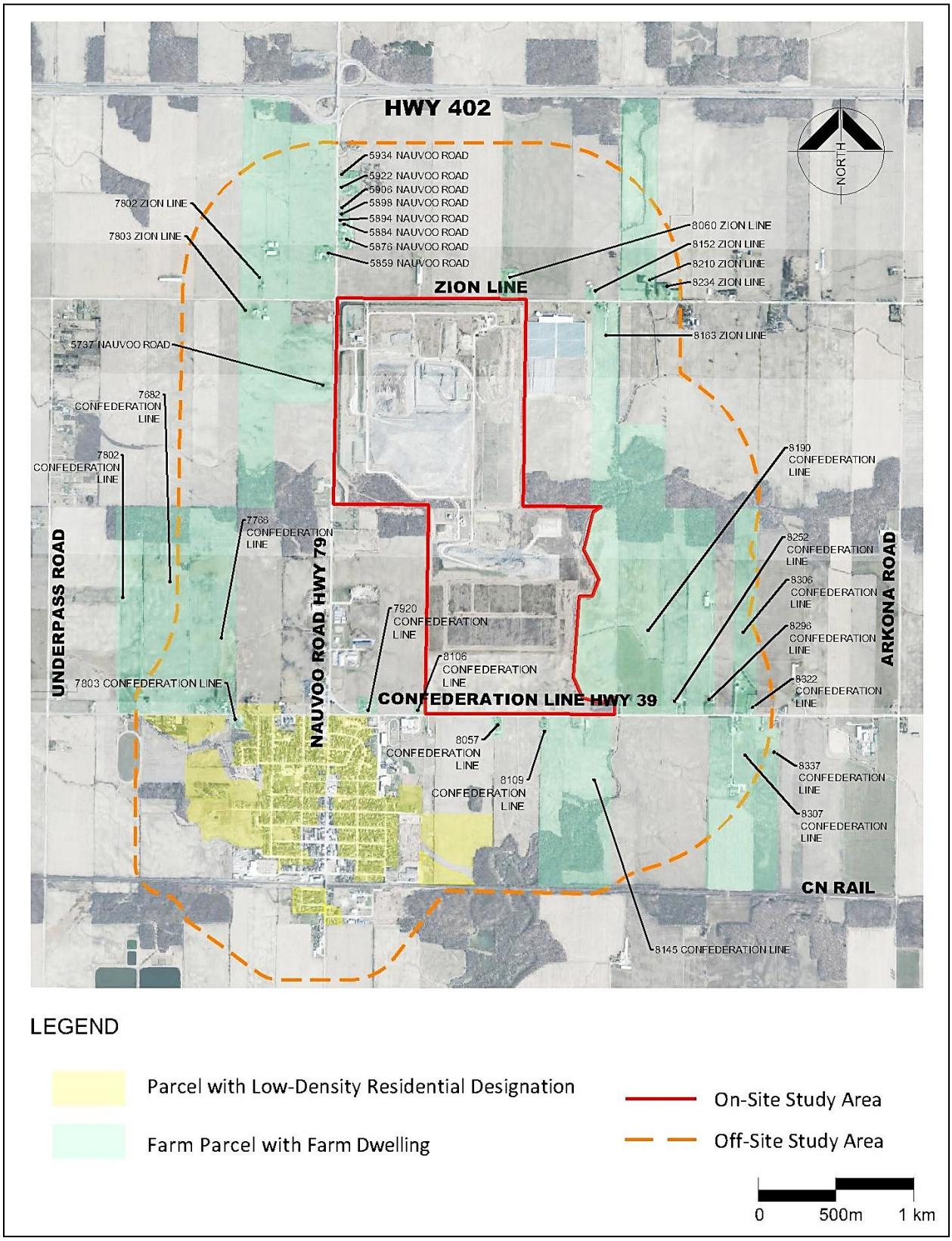
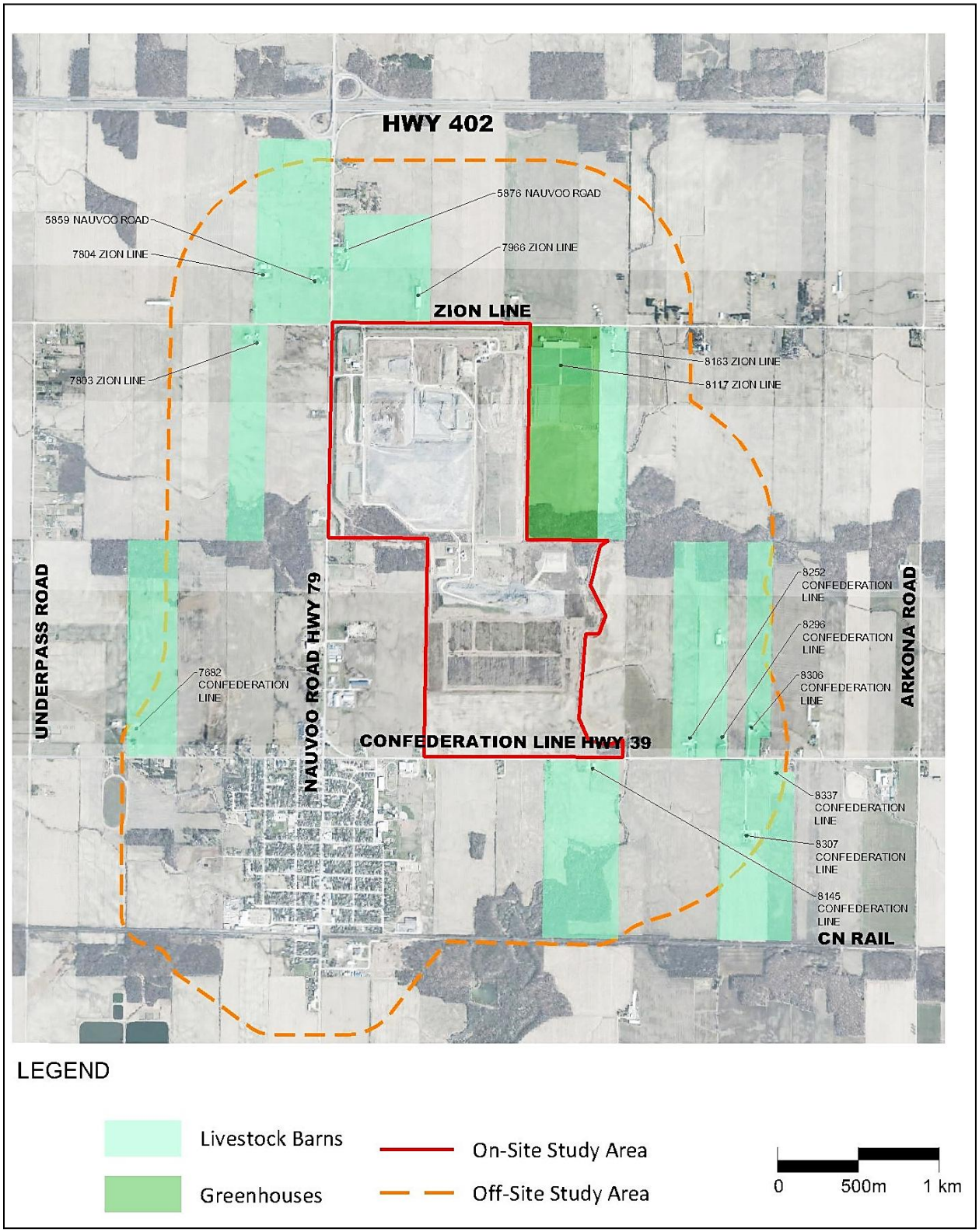


Figure 4-26. Livestock and Greenhouse Agricultural Operations within the Off-Site Study Area



There are two healthcare facilities providing services to the public in the Off-Site Study Area, both located in Watford: the North Lambton Community Health Centre (located approximately 733 m southwest of the On-Site Study Area) and a pharmacy and virtual telemedicine clinic (located approximately 1,050m southwest of the On-Site Study Area). Watford Quality Care is the only long-term care facility located within the Off-Site Study Area. The 62-bed facility is located at the western edge of Watford, approximately 1,009 m to the southwest of the On-Site Study Area.

Cemeteries are also considered *"sensitive land uses for landfills currently in operation"* under the D-4 Guidelines. There are two cemeteries located directly to the west of the On-Site Study Area: Our Lady Help of Christians Roman Catholic Cemetery, located across Nauvoo Road from the TCEC; and Watford Cemetery, directly abutting the site.

4.11.2 Planned Land Use

The Provincial, County, and local planning frameworks guide future growth (including residential, commercial, institutional, and industrial development) toward serviced settlement areas such as Watford. Within Watford, land is designated and zoned to accommodate this growth, with industrial and mixed commercial/industrial uses generally situated along the northern, southern, and western boundaries of the settlement. These areas are strategically separated from sensitive uses located within the settlement core, consistent with planning principles aimed at minimizing land use conflict.

As development continues in accordance with these planning frameworks, the existing and proposed built environment within the Study Areas will see increased land use intensity (particularly in and around Watford). The continued operation and proposed expansion of the TCEC landfill must therefore be evaluated in the context of these planned land use changes, as there is potential for conflict with current and future sensitive receptors. These may include residences, churches, and recreational amenities, all of which may be affected by landfill-related impacts such as noise, odour, or traffic.

The County's OP indicates that any expansion of waste management facilities, including landfills, must occur on appropriately designated lands and is subject to both OP Amendments and provincial approvals. Recreational and non-agricultural developments in the Agricultural Area similarly require policy amendments. The Township's OP continues to support waste management uses on the site but emphasizes that any expansion or new development within or near the landfill must follow proper provincial consultation processes and planning approvals.

The southeastern corner of the on-site study area intersects with a Primary Corridor, which represents an existing connection between natural heritage areas following a watercourse. Local municipalities are responsible for identifying and protecting Primary Corridors in their OPs and zoning by-laws.

Future land use in the Off-site Study Area is shaped by the broader planning policies of the County of Lambton and Township of Warwick. The County OP designates the

majority of the area as ‘Agricultural Area’, prioritizing continued agricultural production and limiting incompatible non-farm development. Recreational and residential uses are generally discouraged unless permitted through amendments. However, certain nodes within the Off-site Area are planned for growth. The Watford Settlement Area in the southwest is designated as an Urban Centre, intended to accommodate residential, commercial, institutional, and industrial development. The Highway 402 Service Centre in the northwest corner of the study area is identified for highway-oriented commercial and industrial uses and is subject to employment land policies, which prohibit new residential development.

Within Watford, the Township’s OP and Zoning By-law allow for a range of planned land uses. Residential areas will continue to support low- to medium-density housing and compatible institutional uses. Commercial zones are expected to grow, supporting mixed-use and service-oriented developments. Industrial and mixed commercial/industrial zones will expand along the periphery of the settlement area, consistent with land use separation policies. Open space and natural heritage areas will be preserved and enhanced, with development discouraged in and around significant woodlots and designated Primary Corridors.

As new development proceeds in and around Watford, the proximity of planned sensitive land uses (such as residential neighbourhoods, schools, places of worship, and parks) to the TCEC landfill must be considered. Under the D-4 Guidelines, “the most significant contaminant discharges and visual problems to be normally within 500 m of the perimeter of a fill area,” although the actual influence areas may vary by individual landfills. Any new development or change of use on or within 500 m of the Landfill Site will be subject to consultation with the Province before a *Planning Act* approval is adopted or granted.

5 Alternative Methods of Carrying Out the Undertaking

'Alternative Methods' of carrying out the undertaking are different ways of implementing the Project. This section of the Draft Environmental Assessment (EA) Study Report presents a screening of horizontal and vertical Alternative Methods that could be implemented to achieve the required additional landfill capacity, and describes the resulting three Alternative Methods of carrying out the undertaking that are carried forward for further assessment in the EA. The screening of Alternative Methods was released for review by Agencies, Indigenous communities, and the public in December 2023, and considers the feedback received as part of that review.

5.1 Overview

The development of approximately 14.3 million cubic metres (m^3) of additional landfill capacity within the 301 ha Twin Creeks Environmental Centre (TCEC) site area can be achieved through a:

- vertical expansion of the currently approved Expansion Landfill footprint;
- horizontal expansion over the closed Old Landfill to the east of the Expansion Landfill; or
- horizontal expansion into other available areas of the TCEC site.

As outlined in the approved Terms of Reference (ToR), based on a qualitative consideration of the potential vertical and horizontal expansion methods available within the site area, in addition to potentially locating waste in close proximity to the Village of Watford, horizontal Alternative Methods would result in significant additional costs and would not optimize the use of the available and constructed infrastructure at the site to the extent possible. Given the financial, technological, and community risks and concerns associated with the horizontal Alternative Methods, WM identified a preference for a vertical Alternative Method.

WM committed to undertaking a screening of vertical and horizontal Alternative Methods as part of the EA to confirm that a vertical Alternative Method would be preferred. As such, this section provides a description of representative vertical and horizontal Alternative Methods that could be constructed at the TCEC, followed by a screening-level assessment of the horizontal and vertical Alternative Methods and identification of a preferred Alternative Method.

The first step in developing Alternative Methods was to determine the available areas of the TCEC site that could provide up to approximately 14.3 million m^3 of landfill capacity. This involved examining the past, existing, and planned land uses within the TCEC site to determine suitable locations for development.

Once suitable locations for development were identified within the TCEC site, representative concepts were developed for vertical and horizontal Alternative Methods within these areas to accommodate the required landfill capacity. The representative concepts were intended to encompass several different landfill configurations that could occur within the defined development areas.

Screening evaluation criteria were developed to allow for a comparison of the identified Alternative Methods based on other landfill and waste facility siting assessments conducted in Canada along with professional judgement, with a focus on aspects where the Alternative Methods were likely to differ. Consideration was given to various cost, constructability, technical, environmental, social, cultural, and land use factors.

A qualitative screening evaluation of the Alternative Methods was conducted based on the identified evaluation criteria. The Alternative Methods were compared against each other for each set of criteria. Colour-coding was used in the comparative evaluation to indicate whether an Alternative Method was better (green), average (yellow), or worse (orange) overall for each criterion. The Alternative Method that resulted in the most ‘better’ (green) coding overall was identified as the preferred Alternative Method to be carried forward for further development.

5.2 Horizontal and Vertical Alternative Methods Identified for Evaluation

Three areas within the TCEC site were identified as potentially available for the development of approximately 14 million m³ of additional landfill capacity:

- the vacant southern portion of the TCEC site south of the soil stockpile (43.2 hectares [ha]);
- part of the Expansion Landfill footprint (excluding the north, west and south side slopes) plus the closed Old Landfill footprint to the east (79.2 ha); and
- the Expansion Landfill footprint (75.4 ha).

Alternative Method concepts were developed within each of these areas, as outlined below.

5.2.1 Horizontal and Vertical Alternative Method Concepts

Two horizontal and one vertical Alternative Methods were developed for the evaluation, corresponding to the three areas identified above. Conceptual details are provided below.

5.2.1.1 Horizontal Alternative Method 1

A large portion of undeveloped land is available within the southern portion of the TCEC site. This area is in close proximity to the Village of Watford and sensitive land uses within the community. Current land uses within this area are the excess soil stockpile, a 28.3 ha area to dispose on-site treated leachate referred to as the Poplar

Plantation, and approximately 36 ha currently used for agriculture and recreation. WM has constructed the renewable gas (RNG) Facility just north of the excess soil stockpile which is serviced by a new on-site road along the western property boundary from Confederation Road.

The representative area for Horizontal Alternative Method 1 is shown on **Figure 5-1**. The additional landfill capacity would be developed within an approximate footprint area of 43.2 ha. To be able to provide approximately 14.3 million m³ of additional landfill capacity, the area will be required to be excavated by about 10 m below ground, and the top final cover elevation will be approximately 40 m above ground. Any existing vegetation or agricultural areas will require removal for the landfill development. The proposed top elevation including the final cover would be consistent with the approved Expansion Landfill peak elevation of approximately 280 metres above sea level (masl).

The area for Horizontal Alternative Method 1 is bound to the south by County Road 39 (Confederation Line), to the east by Brown Creek, to the north by the excess soil stockpile, and to the west by the walking trail and Industrial Park. The landfill footprint area for this Alternative Method provides a buffer of approximately 170 m to County Road 39 and 110 m to Brown Creek.

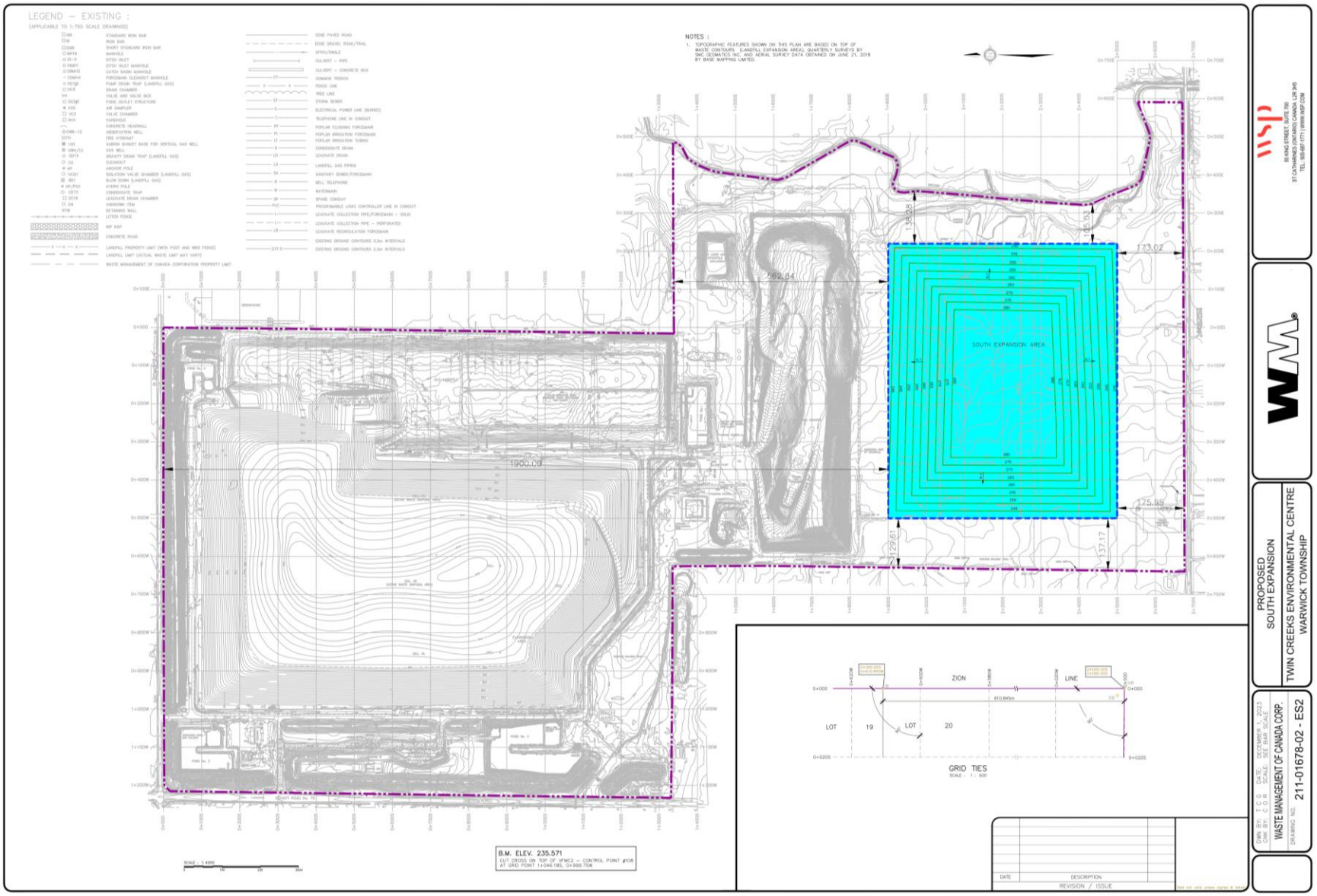
For stormwater management (SWM), the establishment of drainage ditches and the requirement for a stormwater pond(s) within the southern portion of the TCEC site are anticipated. The potential effect on surface water flows discharging to Brown Creek and surrounding lands would need to be considered. Potential effects to groundwater quantity may be associated with a reduction in precipitation infiltration rates. In addition, the majority of this area is within a ‘significant groundwater recharge area’ (SGRA) designated by the St. Clair Region Conservation Authority. Groundwater recharge rates are predicted to be typically greater than for the surrounding areas.

The leachate collection system for Horizontal Alternative Method 1 would require its own separate pump stations and the potential for a new holding tank or a long forcemain to transfer the collected leachate to the leachate storage tanks. This Alternative Method would result in additional leachate volumes being generated due to the increase in overall landfill surface area. An assessment of alternative leachate disposal alternatives would be required considering the increased leachate volumes and the poplar forest irrigation zones would significantly be reduced as part of the development.

To be able to connect the landfill gas (LFG) collection system for Horizontal Alternative Method 1 to the existing LFG infrastructure located north of the excess soil stockpile, longer header pipes will be required which could cause a potential pressure loss. This would require additional infrastructure upgrades.

As part of the site development and to reduce vehicle travel time to access the landfill, consideration of alternative haul routes may be necessary including relocating the site entrance to County Road 39.

Figure 5-1. Horizontal Alternative Method 1



Horizontal Alternative Method 1 would also require the development of perimeter screening berms along County Road 39 and the western and eastern property boundaries.

5.2.1.2 Horizontal Alternative Method 2

A horizontal expansion could also be developed to the east of the Expansion Landfill, integrating the Expansion Landfill with the closed Old Landfill. The closed Old Landfill is situated east of the Expansion Landfill and covers an area of approximately 30.9 ha. A road separates the closed Old Landfill from the 75.4 ha Expansion Landfill. By integrating these two landfill footprints, the total area of Horizontal Alternative Method 2 would be approximately 79.2 ha. The representative area for this Alternative Method is shown on **Figure 5-2**.

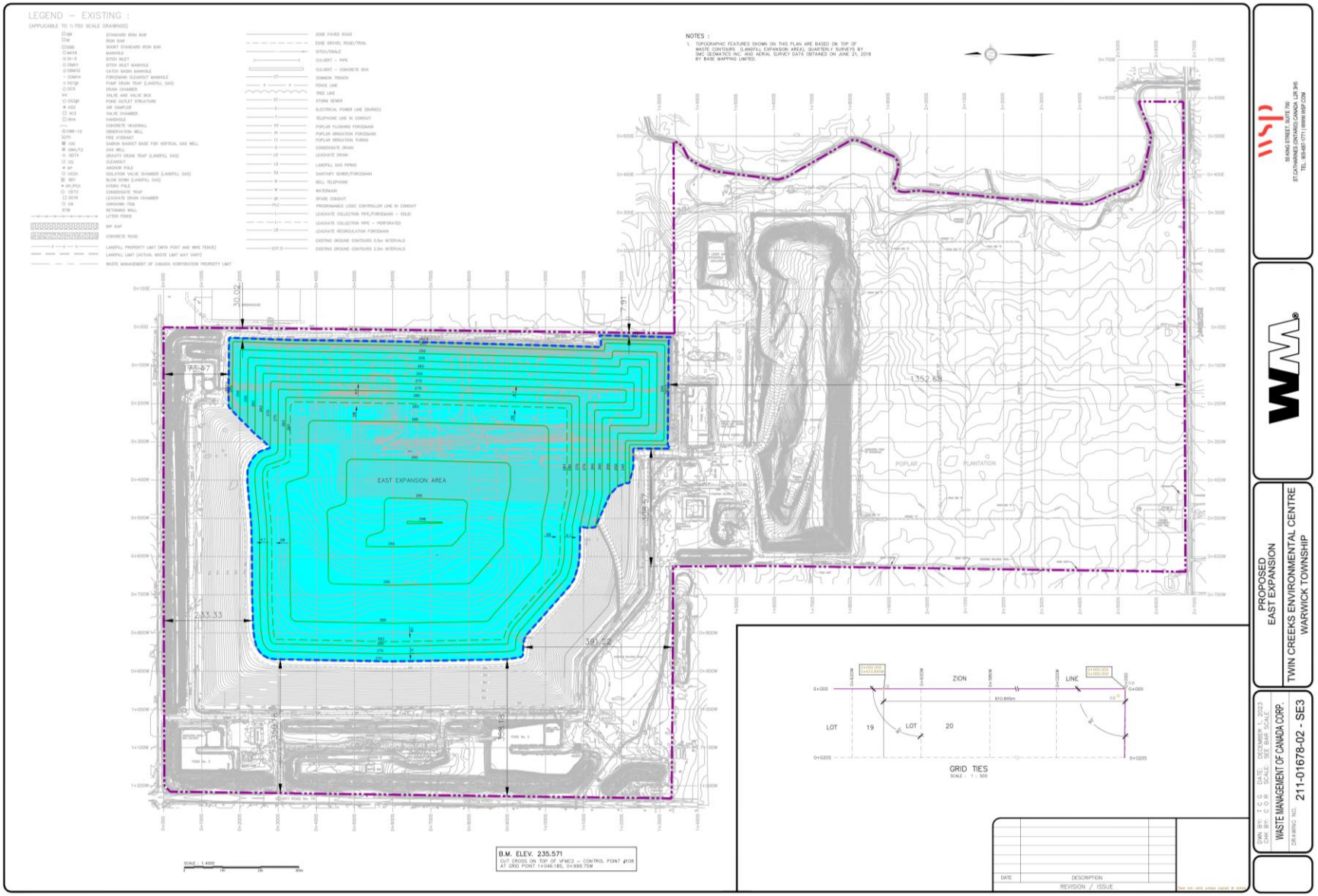
The closed Old Landfill is a partially lined landfill under final cover. Poplar trees planted on 9.3 ha of the final cover, referred to as the Poplar System, are utilized for the on-site management of leachate. Horizontal expansion in this area would require that development occurs over the existing partially-lined landfill area, or require the excavation of landfilled waste to line the landfill area, with a limited buffer from the eastern site boundary and the neighbouring land use (i.e., Twin Creeks Greenhouse). Horizontal Alternative Method 2 would require significant cost associated with remediation and/or engineering of the area in order to comply with applicable landfill design standards.

To be able to provide approximately 14.3 million m³ of landfill capacity, the height of the closed Old Landfill area would increase to a peak elevation of approximately 280 masl, which is an increase in height of about 31 m. The Expansion Landfill peak elevation would need to increase by approximately 18 m, from the current approved height of 280 masl to approximately 298 masl. The north, east, and south side slopes of the closed Old Landfill would be extended at 4H:1V and the connection to the Expansion Landfill would have a finished grade of 5 percent (%) sloping to the east.

The area for Horizontal Alternative Method 2 is bound to the south by the existing poplar forest, to the east by the neighbouring greenhouse, to the north by Sedimentation Pond 4 and Zion Line, and to the west by the active Expansion Landfill. The proposed Horizontal Alternative Method 2 provides a buffer of approximately 180 m to Zion Line and 30 m to the east property line, except for the existing poplar forest area located in the southeast corner which has a setback to the property line of 8 m.

The existing poplar forest located on the south corner of the closed Old Landfill would need to be removed followed by removal of the final cover. The east access road between the Expansion Landfill and the closed Old Landfill would need to be decommissioned and replaced with an access road east of the closed Old Landfill. An engineered base liner would then be constructed after excavation of the old waste or over the closed landfill. Additional investigation of either design approach and approvability would be required.

Figure 5-2. Horizontal Alternative Method 2



SWM infrastructure is in place at the site for both the Expansion Landfill and closed Old Landfill. Some design modifications may be required due to increased surface areas subject to precipitation and run-off.

Depending on the design criteria for the base liner system, the approach to leachate collection and management from the closed Old Landfill area will require upgrades. While the total area of the site subject to precipitation percolating into waste and generating leachate would only be marginally greater than the current situation, it is anticipated that an increased volume of leachate would be collected through the leachate collection system and require management. As noted above, the existing poplar forest which is used for leachate treatment would be removed to accommodate Horizontal Alternative Method 2.

The LFG collection system for the closed Old Landfill would need to be decommissioned. The Expansion Landfill perimeter LFG collection system would then be extended around the perimeter of the closed Old Landfill area. Additional LFG collection piping within the waste footprint area would be installed and connected to the active LFG management infrastructure.

The existing site entrance to the TCEC and on-site road network would continue to be utilized except for Street D.

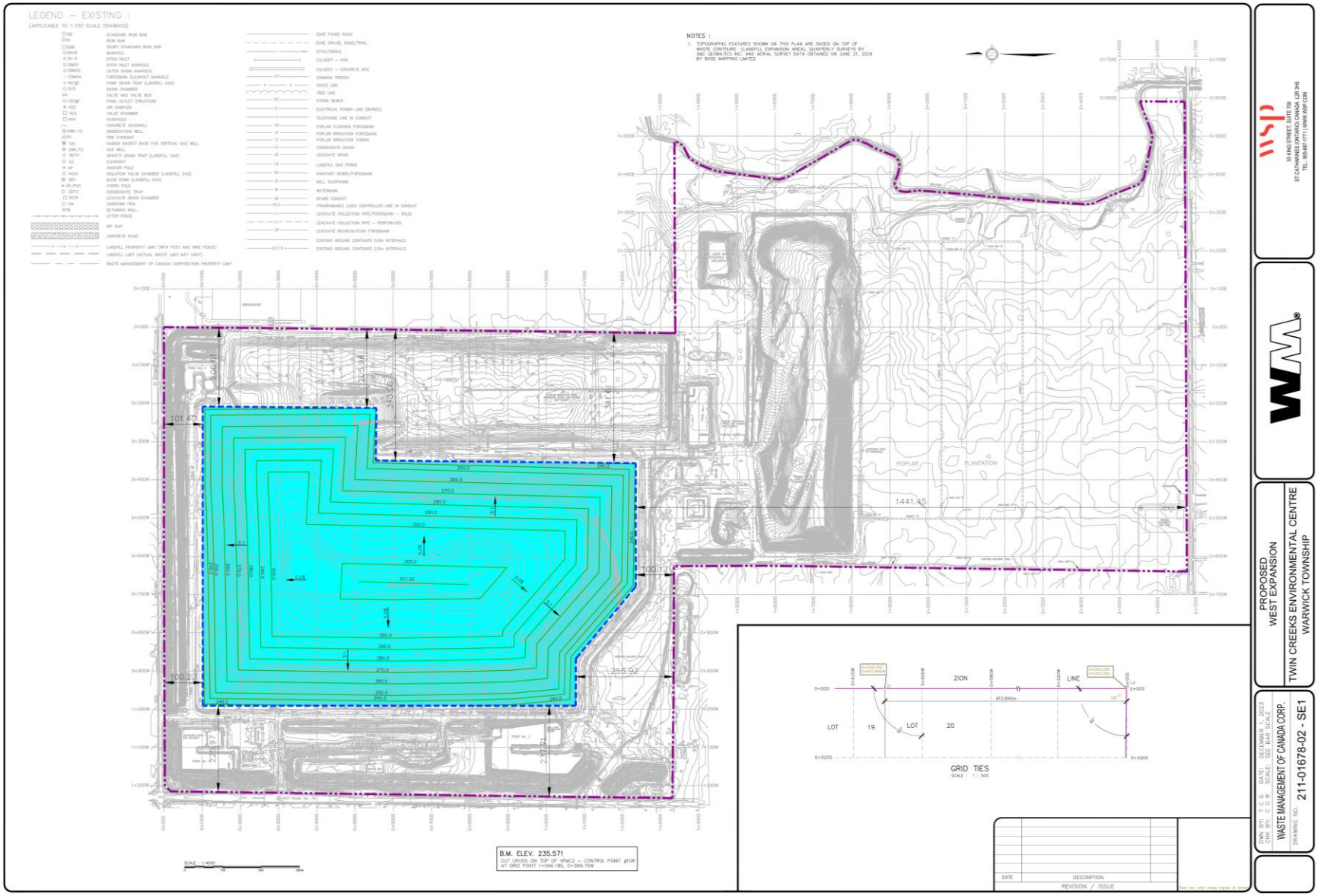
5.2.1.3 Vertical Alternative Method

The potential exists to develop the additional landfill capacity vertically above the existing Expansion Landfill. The representative area for this alternative is shown on **Figure 5-3**. The ground elevation in the area of the TCEC site is approximately 245 masl. The approved Expansion Landfill utilizes 4:1 exterior side slopes to an elevation of 265.7 masl and then transitions to 20:1 side slopes to the landfill peak elevation of 278 masl. A two-metre thick final cover results in a landfill peak at 280 masl.

The Vertical Alternative Method would involve redesigning the originally planned and approved final contours of the 75.4 ha Expansion Landfill including potential changes to the grade of the side slopes and the peak elevation. A range of potential changes to the side slopes and peak elevation (up to approximately 320 masl or 75 m above surrounding ground surface) would be possible. By constructing over the engineered Expansion Landfill footprint, the Vertical Alternative Method would optimize the use of the available and constructed infrastructure at the site to the greatest extent possible, including LFG management, leachate management, and SWM infrastructure.

During consultation and engagement on the development of the approved ToR, WM received comments regarding the feasibility of increasing the height of the Expansion Landfill; specifically, the comments were focused on the strength of the underlying leachate collection system pipes and if they could withstand the weight of the additional landfilled waste. To address these comments, WM completed a

Figure 5-3. Vertical Alternative Method



geotechnical feasibility review of potential Vertical Alternative Methods focused on the following design aspects:

- Settlement/deformation of the landfill base due to the increased weight of waste and cover material;
- Stability of the exterior side slopes if they are increased from 4:1 to 3:1; and
- Effects of the added weight on the leachate drainage systems, specifically drainage pipe deformation/deflection in the primary drainage layer and geonet compression within the secondary drainage layer (SDL).

The feasibility assessment focused on potential Vertical Alternative Methods with a proposed increase in the side slopes (i.e., steeper, at 3:1) and peak elevation (i.e., up to approximately 320 masl or 75 m above surrounding ground surface). The feasibility assessment confirmed that Vertical Alternative Methods within this envelope would be acceptable as follows:

- Post-settlement landfill base grades would meet O.Reg. 232/98 requirements and maintain acceptable leachate collection in the primary leachate drainage layer;
- The combination of 3:1 final side slopes and proposed peak elevation are stable;
- The strength of the primary drainage layer collection pipes is acceptable for the identified Vertical Alternative Methods; and
- The flow capacity of the geonet within the SDL will meet the design requirements for the identified Vertical Alternative Methods.

5.3 Screening and Evaluation of Horizontal and Vertical Alternative Methods

The three Alternative Methods (i.e., Horizontal Alternative Method 1, Horizontal Alternative Method 2, and the Vertical Alternative Method) were evaluated and comparatively screened against each other using criteria consisting of:

- Cost and Constructability considerations;
- Technical considerations;
- Environmental considerations;
- Social and Cultural considerations; and
- Land Use considerations;

The criteria, their indicator and rationale, for each of these considerations are presented in **Table 5-1**.

Table 5-1. Evaluation Criteria, Indicators, and Rationale for Screening of Horizontal and Vertical Alternative Methods

Criteria	Indicator	Rationale
Cost & Constructability Considerations		
Landfill Capacity	Landfill capacity provided by the Alternative Method.	Provided landfill capacity must be sufficient to justify capital cost. Alternative Methods with larger capacities are preferred as they allow for maximum site life extension.
Site Life Extension	Potential site life extension for the landfill based on the estimated landfill capacity.	Provided site life extension must be sufficient to justify capital cost. Alternative Methods with longer site life extensions are preferred.
Required infrastructure	Infrastructure required but not currently available in the proposed landfill area.	New infrastructure increases capital cost. Alternative Methods with comparatively lower requirements for new infrastructure are preferred.
Upgrades to existing infrastructure	Infrastructure present in the landfill area that requires upgrades.	Infrastructure upgrades increase capital cost. Alternative Methods with comparatively lower requirements for infrastructure upgrades are preferred.
Required site development	Site development required to accommodate the Alternative Method.	Additional site development increases capital cost. Alternative Methods with comparatively lower site development requirements are preferred.
Required permits and approvals	Nature and complexity of required permits and approvals.	Increased complexity of permits, approvals, and agreements can increase capital cost and create schedule delays. Alternative Methods with less-complex permitting and approval requirements are preferred.
Technical Considerations		
Excavation requirements	Excavation required to accommodate the Alternative Method.	Excavation requirements add to the technical complexity of the development. Alternative Methods with comparatively lower excavation requirements are preferred.
Soil stockpiling requirements	Soil stockpiling requirements for the Alternative Method.	Soil stockpiling and soil management add to the technical complexity of the development. Alternative Methods with comparatively lower soil stockpiling and soil management requirements are preferred.
Liner requirements	Liner system required for the Alternative Method.	Liner system requirements add to the technical complexity of the development. Alternative Methods with comparatively lower additional liner requirements are preferred.
LFG management	LFG management required for the Alternative Method.	LFG management requirements add to the technical complexity of the development. Alternative Methods with comparatively lower LFG management requirements are preferred.
Leachate management	Leachate management required for the Alternative Method.	Leachate management requirements add to the technical complexity of the development. Alternative Methods with comparatively lower leachate management requirements are preferred.
Stormwater management	SWM required for the Alternative Method.	SWM requirements add to the technical complexity of the development. Alternative Methods with comparatively lower SWM requirements are preferred.
Haul distance on site	Distance from the weigh scale to the Alternative Method along on-site roadways.	Longer on-site haul distances add to the technical complexity of the design. Shorter on-site haul distances are preferred.

Criteria	Indicator	Rationale
Environmental Considerations		
Air Quality, Odour, and Noise	Changes in potential effects on air quality, odour, and noise.	Air, odour, and noise emissions from the landfill can affect local air quality at nearby receptors and cause disturbance through odour and noise. Alternative Methods with minimal changes to air quality, odour, and noise at nearby receptors are preferred.
Surface Water	Changes in potential effects on surface water.	Alternative Methods that avoid changes in potential effects on surface water are preferred.
Groundwater	Changes in potential effects on groundwater.	Alternative Methods that avoid changes in potential effects on groundwater are preferred.
Vegetation Removal	Extent of vegetation removal required for landfill development.	Alternative Methods that avoid vegetation removal are preferred.
Social and Cultural Considerations		
Residential Areas and Sensitive Receptors	Proximity to residential areas and sensitive receptors.	The proximity to residential areas and sensitive receptors could result in potential noise, odour, air quality, and visual impacts.
Cultural Heritage and Archaeological Resources	Proximity to cultural heritage sites, structures, areas of significance, archaeological resources, historic artifacts, or historic sites.	The importance of preserving and protecting cultural heritage sites and archaeological resources.
Agricultural Land	Proximity to agricultural lands.	Potential impact on agricultural land such as crop production.
Land Use Considerations		
Zoning	Compatibility with existing zoning.	Landfill location should be compatible with existing zoning or zoning will need to be amended.
Land Use	Compatibility with current and planned land use.	Landfill locations that are compatible with existing and planned land uses are preferred.

As noted in **Section 5.1**, a qualitative screening evaluation of the horizontal and vertical Alternative Methods was conducted based on these identified evaluation criteria. The horizontal Alternative Methods were compared against each other for each set of criteria. Colour-coding was used in the comparative evaluation to indicate whether an Alternative Method was better (green), average (yellow), or worse (orange) overall for each criterion when compared to the other Alternative Methods. The Alternative Method that resulted in the most 'better' (green) coding overall was identified as the preferred Alternative Method to be carried forward for further development.

The screening of the horizontal and vertical Alternative Methods is presented in **Table 5-2**.

Table 5-2. Screening of Horizontal and Vertical Alternative Methods

Criteria	Indicator	Rationale	Vertical Alternative Method	Horizontal Alternative Method 1	Horizontal Alternative Method 2
Cost & Constructability Considerations					
Landfill Capacity	Landfill capacity provided by the Alternative Method.	Provided landfill capacity must be sufficient to justify capital cost. Alternative Methods with larger capacities are preferred as they allow for maximum site life extension.	Approximately 14 million m^3	Approximately 14 million m^3	Approximately 14 million m^3
Site Life Extension	Potential site life extension for the landfill based on the estimated landfill capacity.	Provided site life extension must be sufficient to justify capital cost. Alternative Methods with longer site life extensions are preferred.	About 12 years	About 12 years	About 12 years
Required infrastructure	Infrastructure required but not currently available in the proposed landfill area.	New infrastructure increases capital cost. Alternative Methods with comparatively lower requirements for new infrastructure are preferred.	None. Infrastructure is in place and upgrades would be required.	As no infrastructure currently exists in the proposed area, required infrastructure includes an LFG collection system, a leachate collection system, and on-site access roads to allow trucks to reach the landfill.	Infrastructure currently exists within the Expansion Landfill footprint and the closed Old Landfill area; however, a new LFG collection system and a new access road east of the closed Old Landfill area would be required.
Upgrades to existing infrastructure	Infrastructure present in the landfill area that requires upgrades.	Infrastructure upgrades increase capital cost. Alternative Methods with comparatively lower requirements for infrastructure upgrades are preferred.	The existing LFG collection system would require expansion as the landfill is constructed.	The leachate collection system would require additional pump stations and potentially a new holding tank and a long forcemain to dispose the collected leachate at the existing storage tank. The LFG collection system may require upgrading due to pressure loss from longer header pipes required to connect the new LFG collection system to the existing LFG infrastructure.	The existing leachate collection system within the closed Old Landfill area may require substantial upgrades to handle additional leachate generation.

Criteria	Indicator	Rationale	Vertical Alternative Method	Horizontal Alternative Method 1	Horizontal Alternative Method 2
Required site development	Site development required to accommodate the Alternative Method.	Additional site development increases capital cost. Alternative Methods with comparatively lower site development requirements are preferred.	Site development that may be required includes the potential addition to existing visual screening berms.	Site development that may be required includes excavation of the landfill area, the establishment of SWM including drainage ditches and potentially a new SWM pond, and the construction of visual screening berms.	Site development that may be required includes the relocation of the existing poplar forest within the closed Old Landfill area, the removal of final cover, potential additional SWM, and potentially the construction of visual screening berms.
Required permits and approvals	Nature and complexity of required permits and approvals.	Increased complexity of permits, approvals, and agreements can increase capital cost and create schedule delays. Alternative Methods with less-complex permitting and approval requirements are preferred.	Key permits and approvals that would be required include an environmental assessment (EA), amendments to environmental compliance approvals (ECAs), and Official Plan (OP) Amendments to the County of Lambton OP and the Township of Warwick OP.	Key permits and approvals that would be required include an environmental assessment (EA), amendments to ECAs, OP Amendments to the County of Lambton OP and the Township of Warwick OP, and an amendment to the Township of Warwick Zoning By-law.	Key permits and approvals that would be required include an environmental assessment (EA), amendments to ECAs, and OP Amendments to the County of Lambton OP and the Township of Warwick OP.
Technical Considerations					
Excavation requirements	Excavation required to accommodate the Alternative Method.	Excavation requirements add to the technical complexity of the development. Alternative Methods with comparatively lower excavation requirements are preferred.	None.	Excavation of 43.2 ha area to 10 m below ground.	Excavation of final cover and partial excavation of waste within the closed Old Landfill area, and excavation of area between the Expansion Landfill footprint and the closed Old Landfill area.
Soil stockpiling requirements	Soil stockpiling requirements for the Alternative Method.	Soil stockpiling and soil management add to the technical complexity of the development. Alternative Methods with comparatively lower soil stockpiling and soil management requirements are preferred.	None.	Substantial stockpiling of excavated soil would be required.	Stockpiling of removed final cover materials and excavation of area between the Expansion Landfill footprint and the closed Old Landfill area.

Criteria	Indicator	Rationale	Vertical Alternative Method	Horizontal Alternative Method 1	Horizontal Alternative Method 2
Liner requirements	Liner system required for the Alternative Method.	Liner system requirements add to the technical complexity of the development. Alternative Methods with comparatively lower additional liner requirements are preferred.	None.	A full engineered base liner would be required.	An engineered base liner would be required between the Expansion Landfill footprint and the closed Old Landfill area. The closed Old Landfill area was constructed without an engineered base liner.
LFG management	LFG management required for the Alternative Method.	LFG management requirements add to the technical complexity of the development. Alternative Methods with comparatively lower LFG management requirements are preferred.	The existing LFG collection system would require expansion as the landfill is constructed.	A new LFG collection system would be required. The existing on-site LFG collection system may require upgrading due to pressure loss from longer header pipes required to connect the new LFG collection system to the existing LFG infrastructure.	A new LFG collection system would be required.
Leachate management	Leachate management required for the Alternative Method.	Leachate management requirements add to the technical complexity of the development. Alternative Methods with comparatively lower leachate management requirements are preferred.	No changes required.	A new leachate collection system would be required. The leachate collection system would require additional pump stations and potentially a new holding tank or a long forcemain to dispose of the collected leachate at the existing storage tank.	The existing leachate collection system within the closed Old Landfill area may require substantial upgrades to handle additional leachate generation.
Stormwater management	SWM required for the Alternative Method.	SWM requirements add to the technical complexity of the development. Alternative Methods with comparatively lower SWM requirements are preferred.	No changes required.	SWM would be required including drainage ditches and potentially a new SWM pond.	Additional SWM may be required.
Haul distance on site	Distance from the weigh scale to the Alternative Method along	Longer on-site haul distances add to the technical complexity of the design. Shorter on-site haul distances are preferred.	No changes required.	Approximately 2 km of additional haul distance.	Approximately 1.6 km of additional haul distance.

Criteria	Indicator	Rationale	Vertical Alternative Method	Horizontal Alternative Method 1	Horizontal Alternative Method 2
	on-site roadways.				
Environmental Considerations					
Air Quality, Odour, and Noise	Changes in potential effects on air quality, odour, and noise.	Air, odour, and noise emissions from the landfill can affect local air quality at nearby receptors and cause disturbance through odour and noise. Alternative Methods with minimal changes to air quality, odour, and noise at nearby receptors are preferred.	There may be changes to potential effects on air quality, odour, and noise due to the change in landfill shape and height; however, they will likely occur within the same general area.	There would be changes to potential effects on air quality, odour, and noise due to the change in location of the landfill. Air quality, odour, and noise effects will occur closer to sensitive receptors in Watford and the south end of the TCEC site.	There would be changes to potential effects on air quality, odour, and noise due to the change in location of the landfill. Air quality, odour, and noise effects will occur closer to neighbouring residences and businesses to the east of the TCEC site.
Surface Water	Changes in potential effects on surface water.	Alternative Methods that avoid changes in potential effects on surface water are preferred.	There may be changes to potential effects of stormwater on-site change in landfill shape and height; however, it is unlikely that surface water off-site would be affected.	There may be changes to stormwater drainage patterns and potential effects on surface water flows to Brown Creek and surrounding lands due to required changes in SWM.	There may be changes to stormwater drainage patterns and potential effects of stormwater on-site due to change in landfill shape and location; however, it is unlikely that surface water off-site would be affected.
Groundwater	Changes in potential effects on groundwater.	Alternative Methods that avoid changes in potential effects on groundwater are preferred.	No changes anticipated.	There may be changes to groundwater quantity from reduced infiltration rates caused by the excavation of 43.2 ha area to 10 m below ground. Situated within a SGRA.	There may be changes to groundwater quality because the closed Old Landfill was constructed without an engineered base liner.
Vegetation Removal	Extent of vegetation removal required for landfill development.	Alternative Methods that avoid vegetation removal are preferred.	None.	Removal of vegetation within the footprint and for access roads.	The existing poplar forest located on the south corner of the closed Old Landfill Area would be required to be compensated. Removal of the final cover would be required.

Criteria	Indicator	Rationale	Vertical Alternative Method	Horizontal Alternative Method 1	Horizontal Alternative Method 2
Social and Cultural Considerations					
Residential Areas and Sensitive Receptors	Proximity to residential areas and sensitive receptors.	The proximity to residential areas and sensitive receptors could result in potential noise, odour, air quality, and visual impacts.	No change to proximity to residential areas and sensitive receptors.	Much closer to Watford, residential receptors to the south of the TCEC site, and nearby recreational facilities such as the Watford Dog Park and East Lambton Community Complex.	Closer to residential receptors to the east of the TCEC site and neighbouring farms and businesses.
Cultural Heritage and Archaeological Resources	Proximity to cultural heritage sites, structures, areas of significance, archaeological resources, historic artifacts, or historic sites.	The importance of preserving and protecting cultural heritage sites and archaeological resources.	No change to proximity to cultural heritage and archaeological resources.	Much closer to archaeological resources located in the southeast corner of the TCEC site (within 250 m).	Slightly closer to archaeological resources located in the southeast corner of the TCEC site.
Agricultural Land	Proximity to agricultural lands.	Potential impact on agricultural land such as crop production.	No change to proximity to agricultural lands.	Located partially within existing agricultural lands at the south end of the TCEC site.	Directly adjacent to neighbouring agricultural lands to the east.
Land Use Considerations					
Zoning	Compatibility with existing zoning.	Landfill location should be compatible with existing zoning or zoning will need to be amended.	Compatible with existing zoning.	Zoning By-law Amendment required for the use of the agricultural area at the south end of the TCEC site.	Compatible with existing zoning.
Land Use	Compatibility with current and planned land use.	Landfill locations that are compatible with existing and planned land uses are preferred.	No changes to land use.	Land at the south end of the site is currently used for agriculture; therefore, this landfill location is partially compatible with existing land use.	Land at the east side of the site is used for a closed landfill and a poplar plantation for leachate management. This landfill location is partially compatible with existing land use.

The screening level comparison shows that the Vertical Alternative Method is preferred over both Horizontal Alternative Methods for all criteria and considerations.

Based on the results of the screening, WM proceeded with the development of specific vertical Alternative Methods within the Expansion Landfill footprint to achieve the required additional landfill capacity. These vertical Alternative Methods, described below, are assessed and comparatively evaluated in the EA in order to identify a Preferred Alternative.

5.4 Overview of the Vertical Alternative Methods for Consideration in the EA

Four (4) preliminary vertical Alternative Methods to provide additional landfill disposal capacity were identified in the ToR and were refined down to three (3) vertical Alternative Methods for the purposes of the EA. Flexibility was included in the ToR to adjust the Alternative Methods to be considered in the EA.

The Alternative Methods are detailed in the Conceptual Design Report (CDR) (**Supporting Document 2**) and are summarized below.

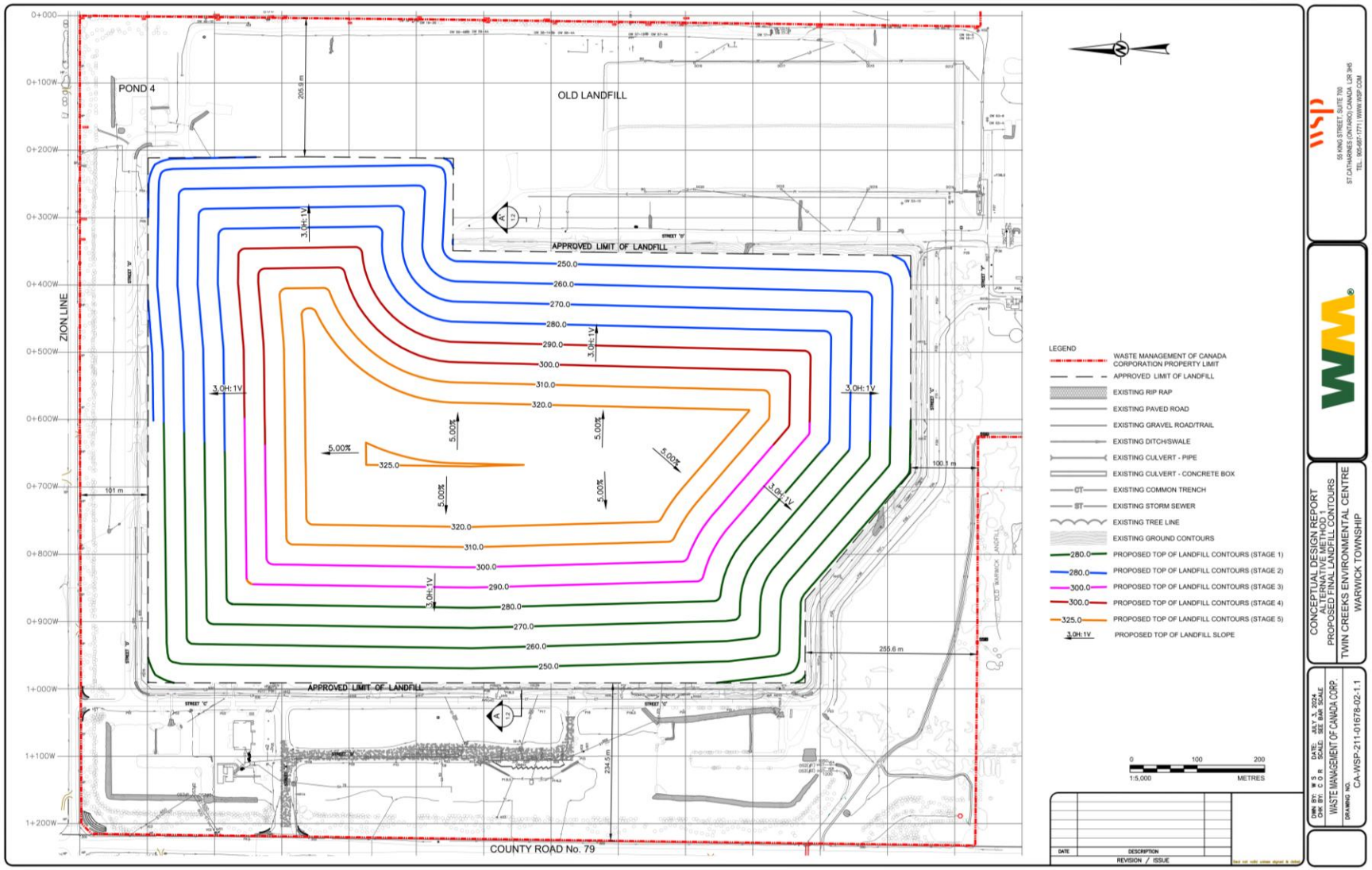
5.4.1 Alternative Method 1

Alternative Method 1 includes the increase of final landfill side slopes from 4H:1V to 3H:1V between the original grade and elevation 320 masl (about 16 m in grade change), transitioning to a 20H:1V upper slope and peaking at elevation 324.5 masl (**Figure 5-4**), over the Expansion Landfill. The proposed landfill expansion consists of five stages, as shown by the different colours from the contour lines as indicated in the legend of **Figure 5-4**.

The Expansion Landfill is fully engineered and has an approved peak elevation of 280 masl. Alternative Method 1 will provide an additional 14.3 million m³ of landfill capacity.

Considering the proposed final side slopes of 3H:1V are steeper than the current 4H:1V, as per O. Reg. 232/98, a geotechnical feasibility review was performed to confirm the slope stability and settlement. The geotechnical assessment showed that this Alternative Method is acceptable with respect to the stability of the final slopes (3H:1V) and proposed peak profile height.

Figure 5-4. Alternative Method 1

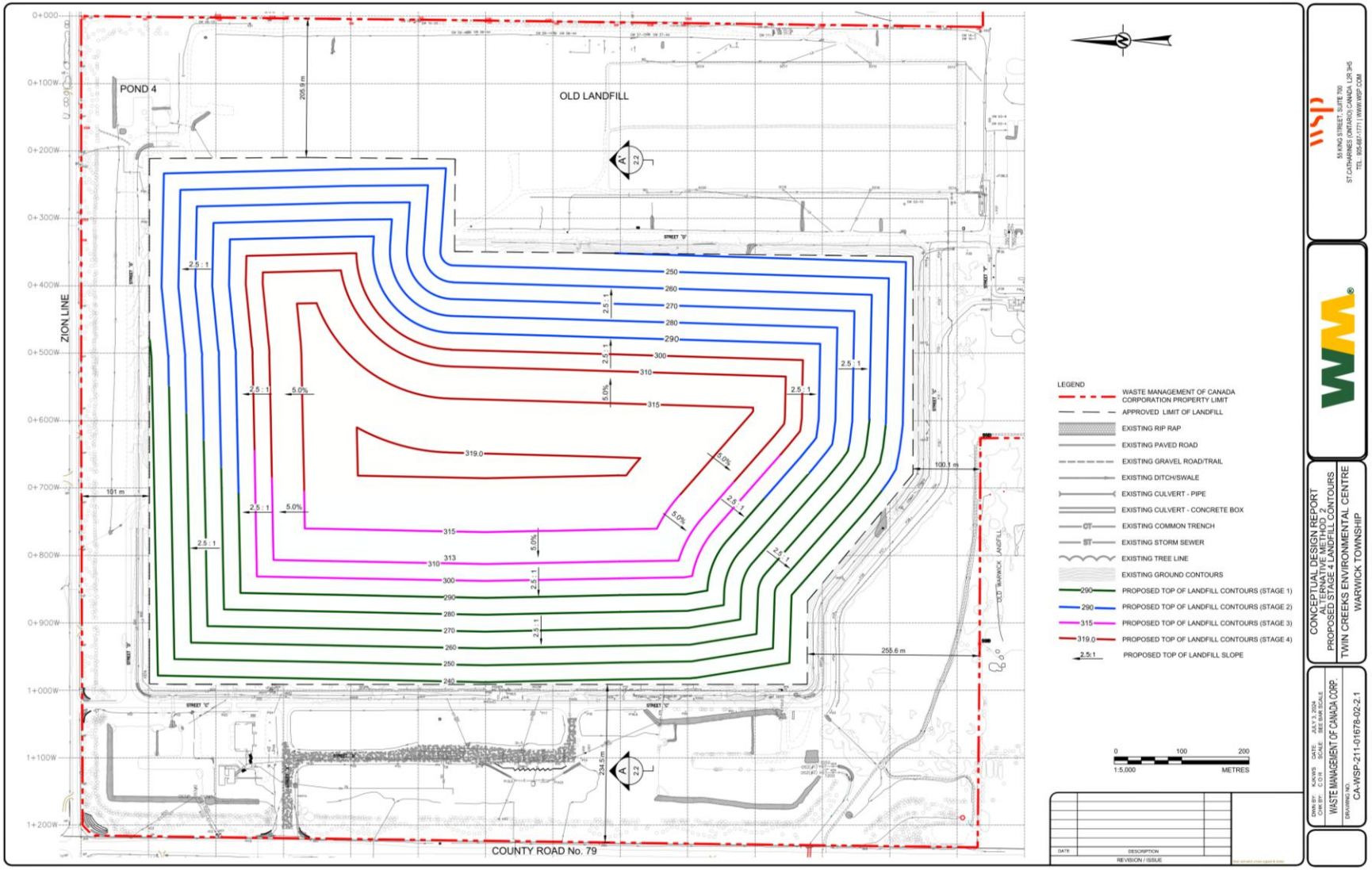


5.4.2 Alternative Method 2

Alternative Method 2 includes the increase of the final landfill side slopes from 4H:1V to 2.5H:1V between elevation 250 masl and elevation 310 masl, about 60 m in grade change, transitioning to a 20H:1V upper slope and peaking at elevation 319 masl (**Figure 5-5**) over the Expansion Landfill. The Expansion Landfill is fully engineered and has an approved peak elevation of 280 masl. Alternative Method 2 will provide an additional 14.3 million m³ of landfill capacity.

Considering the proposed final side slopes of 2.5H:1V are steeper than the current 4H:1V as per O. Reg. 232/98, a geotechnical feasibility review was performed to confirm the slope stability and settlement. The geotechnical assessment showed that this alternative is acceptable with respect to the stability of the final slopes (2.5H:1V) and proposed peak profile height.

Figure 5-5. Alternative Method 2

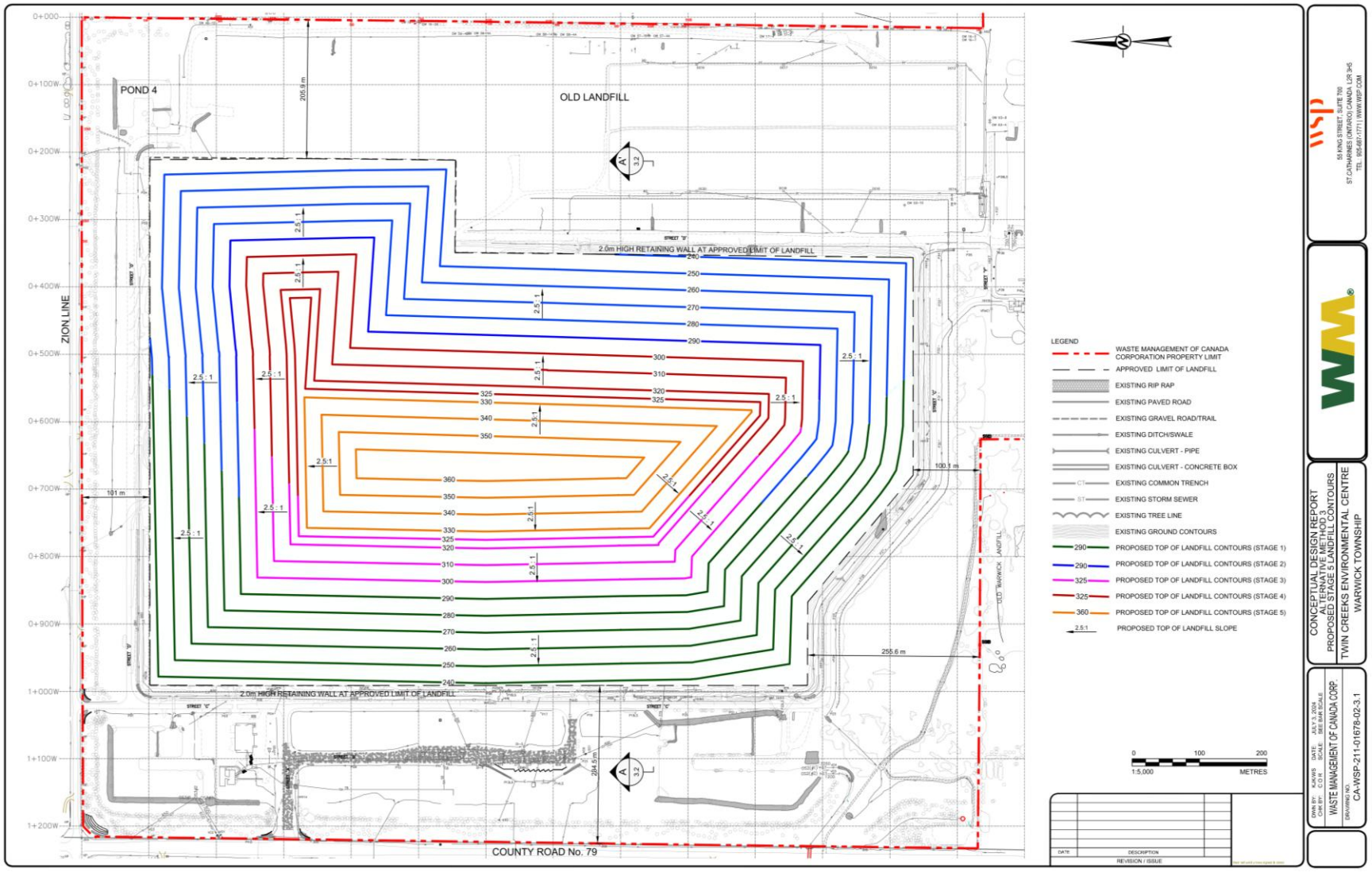


5.4.3 Alternative Method 3

Alternative Method 3 includes the increase of final landfill side slopes from 4H:1V to 2.5H:1V between elevation 260 masl and elevation 360 masl, about 100 m in grade change, peaking at elevation 360 masl (**Figure 5-6**) over the Expansion Landfill. The Expansion Landfill is fully engineered and has an approved peak elevation of 280 masl. Alternative Method 3 will provide an additional 14.3 million m³ of landfill capacity.

Considering the proposed final side slopes of 2.5H:1V are steeper than the current 4H:1V, as per O. Reg. 232/98, a geotechnical feasibility review was performed to confirm the slope stability and settlement. The geotechnical assessment showed that this alternative is acceptable with respect to the stability of the final slopes (2.5H:1V) and proposed peak profile height.

Figure 5-6. Alternative Method 3



5.5 Conceptual Design of the Alternative Methods

This section presents the conceptual design and operations details for the three Alternative Methods within the Expansion Landfill area, which are based on the preliminary Alternative Methods identified in the approved ToR. As previously noted, the ToR identified four (4) preliminary vertical Alternative Methods; however, flexibility was included in the ToR to adjust the Alternative Methods to be considered in the EA.

The conceptual designs of the landfill expansion Alternative Methods were developed in greater detail as part of the EA and presented in the CDR (**Supporting Document 2**). These more detailed conceptual designs were used to support the net effects assessment and comparative evaluation.

The conceptual design for each Alternative Method was prepared with the consideration of the requirements in O.Reg. 232/98 and the associated guidance document "Landfill Standards: A Guideline on the Regulatory and Approval Requirements for New or Expanding Landfilling Sites" (MOE, 2012).

The aspects of the design and operations of the Alternative Methods included in the CDR (**Supporting Document 2**) are as follows:

- Landfill design and geometry (location, orientation, volume, key design features);
- Buffer zones around the waste footprint;
- Site development (phasing and schedule of landfill development and construction activities);
- Leachate generation, management, and treatment;
- LFG generation, management, and treatment;
- Stormwater management;
- Ancillary facilities;
- Traffic management; and
- Landfill operations (operating hours, site equipment, waste placement, daily and intermediate cover, and nuisance controls).

A discussion is also provided on climate change considerations including the effects of climate change on the conceptual design (stormwater, operations, LFG, leachate) and the effects of the conceptual design on climate change (LFG generation and emissions).

Upon selection of a Preferred Alternative for the Project, and completion of the EA, WM will proceed to develop the detailed design for the selected Preferred Alternative. It is understood that the concept presented herein will be refined during detailed design.

5.6 Alternative Method 1

This section describes the landfill design and geometry, buffer zones, site development, leachate generation and management, LFG generation and management, SWM, ancillary facilities, site traffic, and landfill operations for Alternative Method 1.

5.6.1 Landfill Design and Geometry

Alternative Method 1 includes the increase of final landfill side slopes from 4H:1V to 3H:1V between the original grade and elevation 320 masl (about 16 m in grade change), transitioning to a 20H:1V upper slope and peaking at elevation 324.5 masl over the Expansion Landfill. The geometry of Alternative Method 1 is shown in plan view on **Figure 5-4**. Under the proposed vertical expansion, the existing approved waste disposal footprint area of the TCEC would not change, but rather, the maximum permitted height of waste would be increased by 44.5 m, from 280 masl (the current approved elevation for top of waste) to 324.5 masl, which is the maximum elevation of the top of the final cover for Alternative Method 1. The 3H:1V side slopes will start at the existing landfill toe of slope continuing to elevation 320 masl, and then will transition to a finished grade of 5% as shown in the cross-section on **Figure 5-7** and **Figure 5-8**. This will increase the current landfill capacity by approximately 14.3 million m³.

To assess the stability of the final slopes and proposed peak profile height, a preliminary slope stability analysis was performed. For the purposes of numerical modelling, the following assumptions were made:

- Landfill base liners and drainage layers were ignored in the modelling analysis as these materials are thin compared to the overall profile, and their effect on the results are negligible.
- Groundwater levels at the site are close to the original ground surface (approx. 238 masl). Groundwater is captured by the primary drainage layer within the landfill area.
- No internal leachate mound is expected to develop. Leachate is captured and removed by the primary drainage layer.

Based on the results of the model, the factor of safety of the circular failure surface for Alternative Method 1 is 1.76; therefore, Alternative Method 1 meets the recommended minimum factor of safety of 1.3 for the side slopes. The minimum factor of safety of 1.3 is consistent with standard geotechnical practice for static conditions.

The landfill base design is site-specific and comprises a compacted clay liner with two (2) separate leachate drainage layers. Both primary and SDLs (leachate collection systems) have been designed to comply with O. Reg. 232/98. The landfill base was designed with a 0.5% minimum grade toward the leachate collectors, which are

Figure 5-7. Alternative Method 1 Cross-Section (East-West)

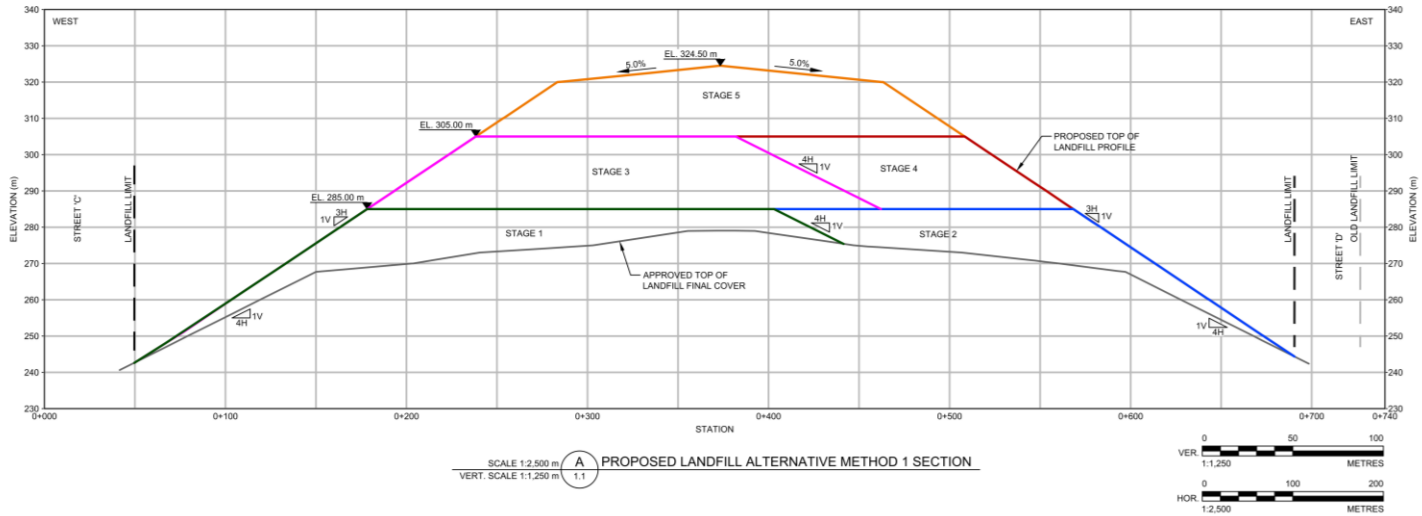
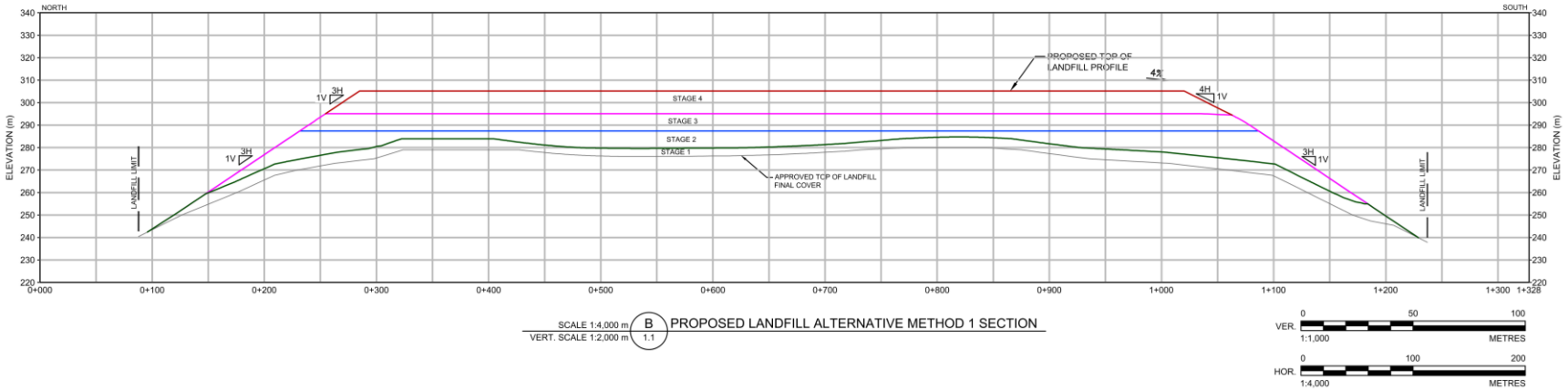


Figure 5-8. Alternative Method 1 Cross-Section (North-South)



Source: CDR (**Supporting Document 2**)

spaced such that the drainage path for leachate is no longer than 50 m for the primary collectors and 100 m for the secondary collectors.

Settlement for Alternative Method 1 was evaluated during the ToR stage. Settlement was calculated at intervals along the base of the landfill for the approved landfill profile and Alternative Method 1 considering a unit weight of waste of 12 kiloNewtons per cubic metre (kN/m³). Based on the results, the overall slope in westerly direction (i.e., toward pumping station) will be maintained despite the slight changes in the approved landfill base grades due to long-term settlement under the heavier inferred waste loading. Additionally, base flattening on the west side will not exceed initial base conditions on the east side, which are considered minimum as defined by O. Reg. 232/98. Therefore, it is concluded that Alternative Method 1 will not have a significant effect on the functionality of the leachate collection system, and leachate will continue to drain toward the designated withdrawal points. The maximum calculated settlement at the landfill centre for Alternative Method 1 is 480 millimetres (mm).

To determine if the existing primary leachate collection piping can withstand the loading associated with Alternative Method 1, the pipe specifications were reviewed and the deflection under the proposed design conditions was calculated. Considering a unit weight of overlying material of 12 kN/m³, the pipe deflection is around 5.75%, which is acceptable relative to the maximum deflection criterion of 7.5%, as per CSA B182.11[14]. In accordance with the Plastic Pipe Institute, a deflection limit of 7.5% provides at least a 3-to-1 safety factor against reverse curvature.

The LFG collection system is constructed using high-density polyethylene (HDPE) consistent with the leachate collection system and is encased in compacted granular material. The LFG collection system is located at higher elevations within the landfill and is subject to less loading as a result. In addition, the granular material minimizes differential settlement and ensures uniform structural support throughout the LFG collection pipeline alignment. An assessment of geonet performance was undertaken, which concluded that geonet secondary drainage capacity performance will meet the design requirements for Alternative Method 1. Details are provided in **Supporting Document 2**.

In summary, it is concluded that Alternative Method 1 is acceptable with respect to:

- Post-settlement landfill base grades meeting O. Reg. 232/98 requirements and maintaining acceptable leachate collection in the primary drainage layer;
- Stability of the final slope (3H:1V maximum) and proposed peak profile height;
- Available collector pipe strength within the primary drainage layer; and

Flow capacity of geonet within the secondary layer.

[14] The lower-bound unit weight was used to conservatively estimate maximum deflections, not minimum settlement, confirming structural performance under worst-case conditions.

5.6.2 Buffer Zones

The TCEC is bounded to the north by Zion Line, to the east by the Twin Creeks Greenhouse and agricultural lands, to the south by lands owned by WM used for agricultural production and by Confederation Line, and to the west by Nauvoo Road (**Figure 5-4**). The setbacks from the Expansion Landfill footprint to the property boundaries are 101 m to the north, approximately 206 m to the east, 100 m to 256 m to the south, and 235 m to the west.

Since Alternative Method 1 would not change the existing approved landfill limit of waste, the existing property boundaries and buffer width will remain the same after the vertical expansion. Therefore, the buffer area for Alternative Method 1 will meet the requirements of Section 7 of O. Reg. 232/98.

5.6.3 Site Development

5.6.3.1 Phasing and Schedule of Site Development

The proposed landfill expansion consists of five (5) stages as shown in **Table 5-3**, **Figure 5-7**, and **Figure 5-8**. The areas and volumes of the stages shown in **Table 5-3** are approximate and will be confirmed through detailed design; however, the total landfill volume of Alternative Method 1 will remain at approximately 14.3 million m³.

Table 5-3. Alternative Method 1 Stage Areas and Volumes

Stage	Peak Elevation (masl)	Volume (M m³)
Stage 1	287.4	3.5
Stage 2	287.4	3.5
Stage 3	305.2	2.6
Stage 4	305.2	2.1
Stage 5	324.5	2.6
TOTAL	-	**14.3**

Note. Million cubic metres (M m³)

The site development phases have taken into consideration to have adequate space to allow disposal and operational vehicles to operate in the same area. The phases are proposed to be developed from west to east, considering the removal of final/interim cover along the side slopes prior to waste placement (as explained in **Section 5.6.3.2**, below). The LFG collection system will be progressively expanded as waste is placed and cells reach final grades. Temporary separation berms between lateral phases will be implemented for surface water control and will be removed as the next phase becomes operational.

Considering the approved landfilling rate is 1.4 million tonnes per year, the additional airspace could extend the site life by approximately 12 years.

Based on the estimated volumes provided for each phase in **Table 5-3**, Stage 1 and Stage 2 can provide a site life of about 3 years each while the site life of the other stages will range between 1.5 to 2.5 years.

5.6.3.2 Construction Activities

The Expansion Landfill area has been already prepared for landfilling and currently is active. Some areas have interim/final cover that will require the removal of soil cover prior to waste placement. This operation procedure will take place as the staging progresses. The current fill rate of 1.4 million tonnes per year will apply to the proposed expansion.

Transfer trailers with walking floors will discharge their contents at the rear of the truck. Piston-driven pusher types will push out their loads. Similarly, packer trucks will be discharged by the ram push. Roll-off trucks will raise the hydraulic hoist to discharge the load. There may even be a few smaller trucks that will be unloaded manually, although most vehicles are anticipated to have hydraulic cylinders to lift and unload the truck box.

The waste, once tipped from the trucks, will be pushed over the active cell in a uniform layer by the compactors. Waste placement will continue to be in daily lifts of 2.5 to 3 m thickness. The compactors will compact the waste by making three to four passes on each loose lift.

Waste haul vehicles (packer trucks, roll-off trucks, trailers, etc.) will travel to the working face via access roads. These access roads will be constructed prior to the active cells becoming operational.

In addition to waste placement, the LFG collection system expansion will be constructed as part of the landfill development sequence.

Daily/interim cover will continue to be placed as part of the landfill operations as per current landfill operations. The final cover will be placed on the side slopes of the phases that are no longer operational as an erosion control measure and to minimize the potential for leachate seeps.

Considering the factor of safety encountered for the slope stability assessment for each Alternative Method was above 1.3, the constructability of the final cover will be done in phases. Considering the landfill is being filled in stages, soil cover will be placed along the side slopes as final waste grades are achieved. The area will be topsoiled and seeded to minimize erosion. As part of the ongoing landfill operations, areas under final cover that are encountered to have been affected by failed vegetation growth, washouts, or settlement will be repaired. The repairs can involve applying additional topsoil and seed, to implementing rip-rap channels for SWM.

5.6.4 Leachate Generation and Management

5.6.4.1 Leachate Generation

Alternative Method 1 will not change the current expected infiltration rate, instead, it will increase the rate of run-off due to higher side slopes. Consequently, the leachate collection system will not require changes as a result of Alternative Method 1. Details of the leachate generation assessment are provided below.

Leachate generation for the different landfill expansion Alternative Methods was estimated using the HELP model. The maximum leachate elevation above the primary drainage layer averages less than 1 mm. As per Condition 7.18 of ECA A032203, the maximum leachate head of 300 mm on the landfill liner is not exceeded except after significant precipitation events.

For the proposed landfill optimization, the HELP model from the 2008 assessment[15] was used as a basis with some modifications. For calculating leachate generation, infiltration rates of 450 millimetres per year (mm/year), 150 mm/year, and 100 mm/year were adopted for active areas, areas of interim cover, and areas of final cap, respectively. These are the same infiltration rates that were considered in the previous studies.

The existing design profile is currently split with 67% on top of the mound and 33% sideslopes, while Alternative Method 1 inverts these proportions. Higher slope grades generally result in increased runoff and lower infiltration; as such, Alternative Method 1 could conceptually be expected to generate less leachate than the existing design.

Two HELP models were created to assess infiltration for Alternative Method 1: one to simulate infiltration at the top of the waste mound and another to simulate infiltration on the sideslopes. The predicted infiltration in both cases is around 96 mm/year. An average annual infiltration rate of about 96 mm/year is also predicted for both the top of the waste mound and sideslopes for the existing design. Thus, the results suggest that leachate generation at the Expansion Landfill is insensitive to either the slope of the final cap or the total waste thickness. This means that Alternative Method 1 will not change the expected infiltration rate used in the predicted leachate generation rates for the Expansion Landfill outlined in the 2008 D&O Report.

The maximum leachate generation for Alternative Method 1 is predicted to peak at 120,500 m^3 per year (330 m^3 per day) in Year 3 after completion of Stage 1 (approximately 2036). Leachate generation will then decrease to approximately 106,700 m^3 per year (292 m^3 per day) following placement of the final cover in Year 12 (estimated to be in 2045). An additional 25,550 m^3 of leachate annually (70 m^3 per day) is estimated to be generated from the closed Old Landfill.

[15] A leachate generation assessment was previously completed by Henderson Paddon & Associates Limited in 2008 for the Expansion Landfill, as summarized in the 2008 Design and Operations (D&O) Report.

Based on the above, maximum leachate generation is estimated at 400 m³ per day (330 m³ + 70 m³) from both Alternative Method 1 (including the Expansion Landfill) and the closed Old Landfill, which is expected to occur in Year 3 (approximately 2036).

WM developed a leachate management framework and supporting documents in 2017 which identified that the HELP model produced overly conservative estimates of leachate generation at TCEC. In addition, since the Expansion Landfill footprint began operating in late 2009, WM has implemented a range of design and operational practices to minimize leachate generation. The March 2023 Leachate Management Plan (LMP) reported that the volume of leachate extracted from the Expansion Landfill remained consistent for the past four years, at approximately 41,000 to 44,000 m³ per year. Based on the annual leachate extraction volumes to the end of 2022, it is evident that the leachate generation estimates from the HELP model are overestimated. In addition, WM plans to continue to reduce the volume of leachate stored within the closed Old Landfill over several years. Initially, WM is targeting a reduction of 5,000 m³ per year in the total volume stored.

Leachate generation volumes increased in 2023 to approximately 70,400 m³. This is approximately 60% of the predicted peak generation of 120,500 m³/year for Alternative Method 1. The Expansion Landfill continued to develop including construction of a new stage increasing the amount of open area and reopening previously covered areas for filling, resulting in increased leachate generation. The annual leachate volume is anticipated to continue to fluctuate as landfilling areas are opened and closed each year.

Based on the above, future generation of leachate should be anticipated to be at annual volumes between the HELP predictions and current levels.

Leachate seeps during the active landfill will be managed as part of the landfill operations. The slopes will be capped and seeded as part of the landfill closure, and leachate seeps, if they occur, will be repaired as part of the post-closure maintenance.

5.6.4.2 Leachate Management

The current approach to managing leachate generated at the TCEC includes phytoremediation of a portion of the leachate volume generated through irrigation of the on-site Poplar System. The Poplar System is anticipated to manage approximately 44,000 m³ of leachate per year. The balance of the leachate generated is removed from the site and sent to an off-site wastewater treatment plant for disposal.

The automated leachate pumping stations allow the leachate to be pumped to the equalization tank (capacity of 2,300 m³) or to the Poplar System irrigation tanks. The irrigation liquid is applied to the Poplar System from May to mid-October and the remaining leachate is hauled for off-site treatment and disposal. The Poplar System refers to the poplar trees planted on the final cover of the closed Old Landfill. A new equalization tank with the same capacity as the existing tank will be implemented by 2025. This additional storage capacity will provide contingency and capacity for RNG condensate.

The 2005 EA for the Expansion Landfill identified the preferred alternative for leachate treatment as full on-site treatment with no liquid effluent discharge to surface water. Subsequently, a leachate treatment facility was designed and permitted with a rated capacity to treat 146,000 m³/year (400 m³/day).

When considering the leachate generation estimates being identified through the HELP model compared to actual leachate generation observed at the Expansion Landfill, the leachate treatment facility design is significantly oversized and, as a result, would not operate as intended. The leachate treatment facility has not yet been constructed and would require redesign and permitting prior to construction.

The proposed approach for leachate management and disposal for Alternative Method 1 is consistent with the current approach and includes a combination of the following:

- Phytoremediation of a portion of the leachate volume generated through irrigation of the on-site poplar system (up to approximately 44,000 m³/year).
- Trucking of leachate to an off-site wastewater treatment plant (up to 8 trucks per day).
- Modification of the rated capacity required for the leachate treatment facility to reflect actual leachate generation being observed, updating of the rated capacity, and design and construct the leachate treatment facility prior to landfill closure.

5.6.5 Landfill Gas Management

5.6.5.1 Landfill Gas Generation

LFG is produced as a by-product of the biological decomposition of organic matter within the waste and typically increasing throughout the operational period of the landfill development and peaking upon site closure.

The LFG production rate slowly declines over the years after a landfill is closed, until the waste has finished decomposing. Many factors affect LFG generation rates including, but not limited to, the waste moisture content, water movement (infiltration), temperature, pH, waste composition, waste age, and nutrient availability.

The generated LFG production was estimated by using the USEPA LANDGEM model, which is a recognized method by the Ontario Ministry of Environment, Conservation and Parks (MECP). For the closed Old Landfill and Expansion Landfill with Alternative Method 1 (**Table 5-4**), it is estimated that the landfill will produce a peak amount of LFG of approximately 20,203 m³/hr in 2043, of which 18,169 m³/hr are estimated to be collected (**Figure 5-9**). Collection efficiency for the closed Old Landfill is assumed to be 67% as this gives the best fit with real operational data. For the Expansion Landfill and Alternative Methods, the collection efficiency of 75% is assumed for areas with waste and LFG collection systems in place but without final cover. The collection efficiency is increased to 90% for areas with a final cover and an LFG collection system.

Guidance provided by the US EPA "Available and Emerging Technologies for Reducing Greenhouse Gas Emissions from Municipal Solid Waste Landfills", dated June 2011 suggests that 75% collection efficiency can be expected from intermediate cover areas.

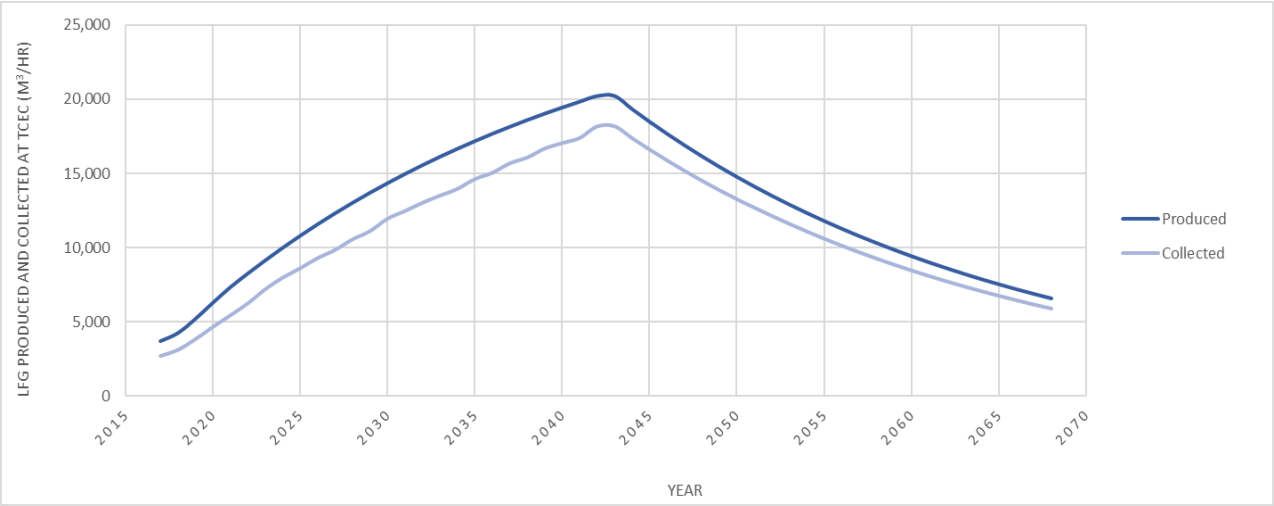
The increase in collection efficiency for the Expansion Landfill under final cover to 90% is reflective of the enhanced final cap that will be installed including 2 m of cover (1.85 m clay and 0.15 m topsoil) with active LFG collection. This aligns with the above noted guidance provided by the US EPA as well as the Canada Gazette, Part I, Volume 158, Number 26: Regulations Respecting the Reduction in the Release of Methane (Waste Sector)", dated June 29, 2024.

Table 5-4. LFG Produced and Collected Rates Alternative Method 1, 2 and 3

Year	LFG Produced at Closed Old Landfill (m^3/hr)	LFG Produced at Expanding Landfill (m^3/hr)	Total LFG Produced at TCEC with Vertical Expansion (m^3/hr)	Total LFG Collected at TCEC with Vertical Expansion (m^3/hr)
2017	585	2,757	3,680	2,716
2018	559	3,259	4,224	3,126
2019	534	4,122	5,180	3,844
2020	510	5,105	6,271	4,665
2021	487	6,044	7,315	5,450
2022	465	6,882	8,244	6,252
2023	444	7,682	9,133	7,205
2024	424	8,447	9,982	7,988
2025	405	9,179	10,793	8,621
2026	387	9,878	11,569	9,302
2027	370	10,547	12,311	9,850
2028	353	11,186	13,020	10,564
2029	337	11,797	13,699	11,119
2030	322	12,381	14,347	11,951
2031	308	12,939	14,967	12,472
2032	294	13,473	15,559	13,027
2033	281	13,984	16,125	13,505
2034	268	14,472	16,667	13,962
2035	256	14,938	17,185	14,618
2036	245	15,384	17,679	15,043
2037	234	15,810	18,153	15,680
2038	223	16,218	18,605	16,074
2039	213	16,607	19,037	16,675
2040	204	16,980	19,451	17,040
2041	195	17,336	19,846	17,389

Year	LFG Produced at Closed Old Landfill (m^3/hr)	LFG Produced at Expanding Landfill (m^3/hr)	Total LFG Produced at TCEC with Vertical Expansion (m^3/hr)	Total LFG Collected at TCEC with Vertical Expansion (m^3/hr)
2042	186	17,676	20,224	18,161
2043	178	17,690	20,231	18,169
2044	170	16,911	19,341	17,370
2045	162	16,167	18,489	16,605
2046	155	15,456	17,676	15,874
2047	148	14,776	16,898	15,176
2048	141	14,125	16,154	14,508
2049	135	13,504	15,443	13,870
2050	129	12,910	14,764	13,259
2051	123	12,342	14,114	12,697
2052	118	11,799	13,493	12,138
2053	112	11,279	12,899	11,604
2054	107	10,783	12,331	11,093
2055	103	10,309	11,789	10,605
2056	98	9,855	11,270	10,138
2057	94	9,421	10,774	9,692
2058	89	9,007	10,300	9,265
2059	85	8,610	9,846	8,858
2060	82	8,232	9,413	8,468
2061	78	7,869	8,999	8,095
2062	74	7,523	8,603	7,739
2063	71	7,192	8,224	7,398
2064	68	6,876	7,862	7,073
2065	65	6,573	7,516	6,762
2066	62	6,284	7,185	6,464
2067	59	6,007	6,869	6,180

Figure 5-9. LFG Produced and Collected Curves for Alternative Method 1, 2 and 3



5.6.5.2 Landfill Gas Collection and Treatment

LFG is currently collected from the closed Old Landfill and the Expansion Landfill. The LFG collection system includes conventional vertical wells within the closed Old Landfill footprint and mostly Early Vertical Gas System (EVGS) wells within the Expansion Landfill. The Expansion Landfill also draws gas from the Primary Leachate Collection System (PLCS). All wells are connected to a network of laterals and sub-headers directing flow to the LFG Facility through a 900 mm diameter header pipe, which is sufficient to handle the generated LFG after vertical expansion. LFG is discharged to the on-site blower building and to fully enclosed flares.

The EVGS wells are extended upward as landfill operations progress and cells are filled. The LFG collection system is extended sequentially following horizontal and vertical growth of the Expansion Landfill. At approximately 15-metre intervals, additional gas subheaders and laterals are installed within the landfill. Condensate drains by gravity into several drain traps equipped with compressed air powered pumps which transfer liquid by forcemain for disposal into the PLCS. Vertical wells are extended as the waste placement progresses to minimize odours and reduce the amount of LFG escaping.

The expanded LFG collection system will be similar to the existing design and will comprise vertical wells, LFG subheaders, and LFG laterals that are connected to the main 900 mm header pipe located along the perimeter of the landfill.

The LFG collection system has a collection efficiency of approximately 75% for areas without final cover based on operational data and can be increased to 90% for areas with final clay cover. It is anticipated that this level of collection efficiency will continue to be achieved for Alternative Method 1. At peak LFG generation, approximately 18,169 m³/hour (**Table 5-4**) of LFG will be collected and require treatment.

The landfill has four approved LFG flares. Flares 1 to 4 provide a combined capacity of approximately 25,847 m³/hr. The new RNG Facility, which has been constructed at

the TCEC, has the capacity to process up to 13,592 m³/hr of LFG on a dry basis and transforms it into RNG, reducing greenhouse gas (GHG) emissions over the operating life of the site and during post-closure years. Additionally, Flares 5 and 6 as part of the RNG Facility will provide a capacity of 10,188 m³/hr.

In total, the TCEC has an approved combined treatment/flare operational capacity of 49,627 m³/hr (considering the four flares, the RNG Facility capacity and two flares), which provides an excess capacity of approximately 63% more than the estimated peak volume of LFG being generated at the site.

5.6.6 Stormwater Management

5.6.6.1 Existing System

Stormwater is currently managed on site through swales and detention ponds. Swales direct runoff to the ponds and outlets, providing infiltration along the way. Four SWM ponds that are situated at the corners of the Expansion Landfill footprint collect runoff from the surface of the landfill and release flows through culvert outlets. In this manner, they maintain peak site runoff at pre-development levels. There are ten stormwater outlets from the site, labelled A-J, four of which receive water from the detention ponds. **Figure 5-10** shows the layout of the existing SWM system, including the locations of the ponds, swales, and outlets. Details on these aspects of the SWM system are available in **Supporting Document 1-5** (Surface Water Quantity Existing Conditions Report).

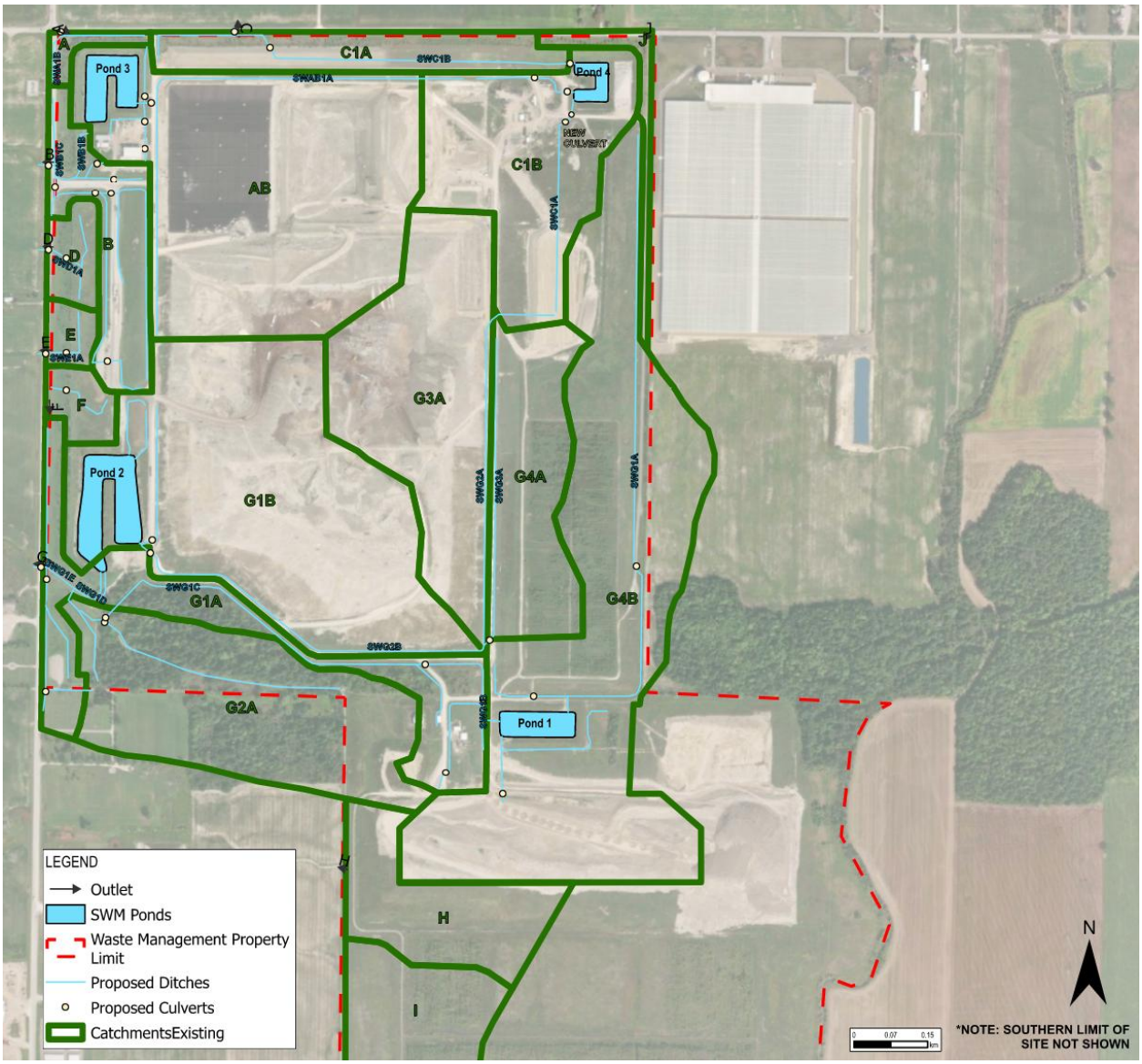
An analysis of the existing SWM system found that, so long as regular maintenance removes excess sediment buildup, there is sufficient capacity in the four detention ponds to hold a 4-hour 1:100-year storm (**Supporting Document 1-5**). This was verified by modeling the SWM ponds within a hydrological software (Visual OTTHYMO Model Version 6.2).

Furthermore, the 3-hour Chicago storm was also run, however the 4-hour storm results were found to be more conservative (i.e., higher peak flows and higher storage volumes). The results from both the 100-year 3-hour Chicago storm and the 100-year 4-hour Chicago storm are provided in **Supporting Document 2**.

Additionally, water quality treatment for runoff from the site will also be provided by the SWM ponds with a 75% TSS removal rate. Further, a 4-hour, 25-mm storm event was modelled within Visual OTTHYMO to confirm that the ponds have the capacity to store/treat the runoff volume generated from the landfill site.

Swales are designed for a 25-year return period; the swales were also found to have sufficient capacity under existing conditions.

Figure 5-10. Existing Stormwater Management



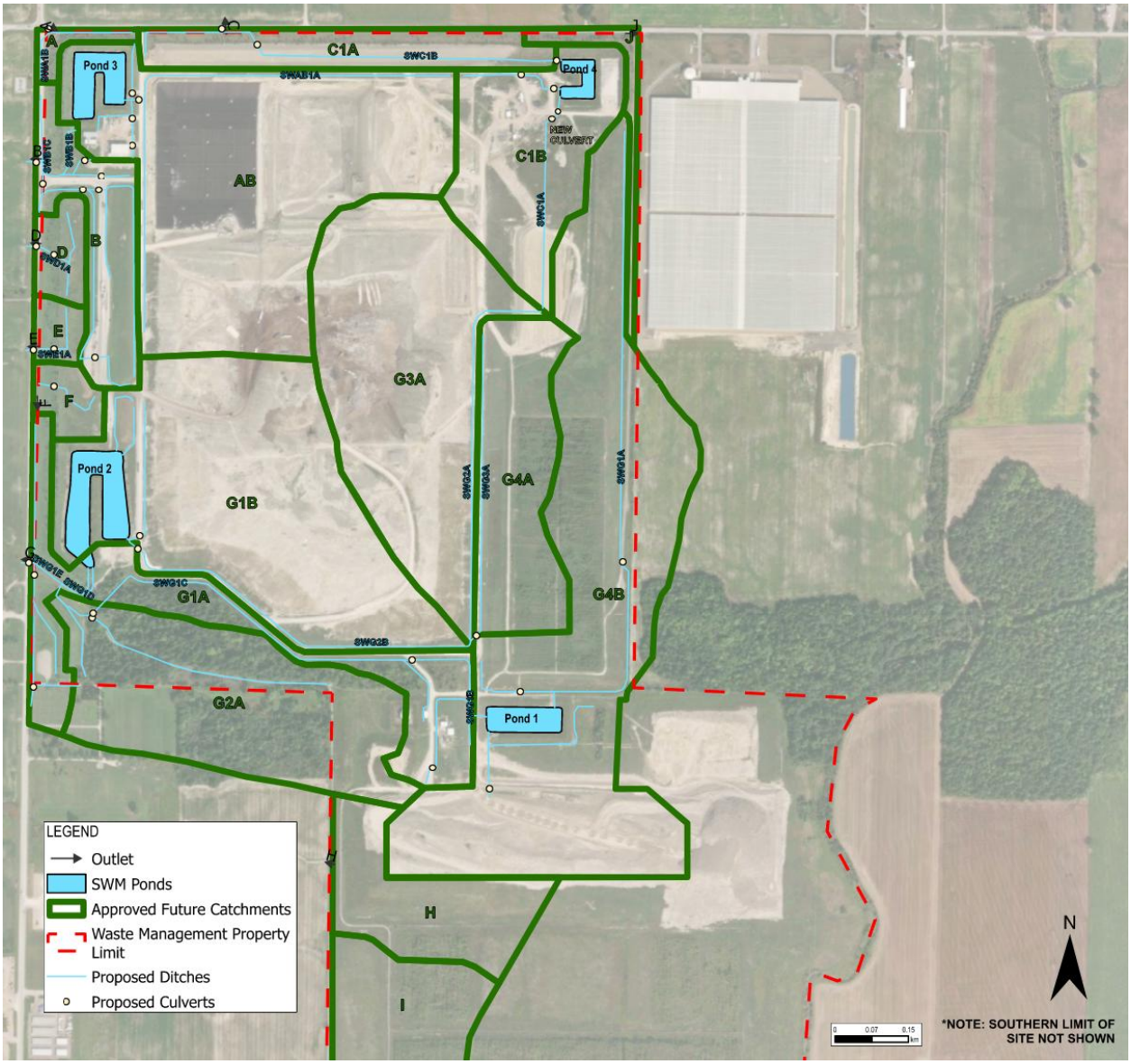
5.6.6.2 Future Baseline Scenario

Should the Project not proceed, the development of the approved Expansion Landfill will continue until it has reached its full horizontal footprint and currently approved height of 280 masl. This will alter the outlets' catchment areas, land cover, and time of concentration, as well as the path of the swales in the northeast corner. This scenario is considered the Future Baseline and was modelled as part of the assessment of the proposed landfill expansion as detailed below.

The full buildout of the Expansion Landfill in the northeast corner will move the bordering swales to the east as shown in **Figure 5-11**.

The swale leading to Pond 4 will be slightly shorter (now 0.4 km in length), while the swale heading south towards Pond 2 will be longer (1.6 km total). A new culvert will be required under the servicing road. These new and realigned components of the stormwater system will be finalized during detailed design and as such were sized appropriately for the 25-year return period storm for Alternative Method 1 in **Section 5.6.6.3**, below.

Figure 5-11. Approved Stormwater Management



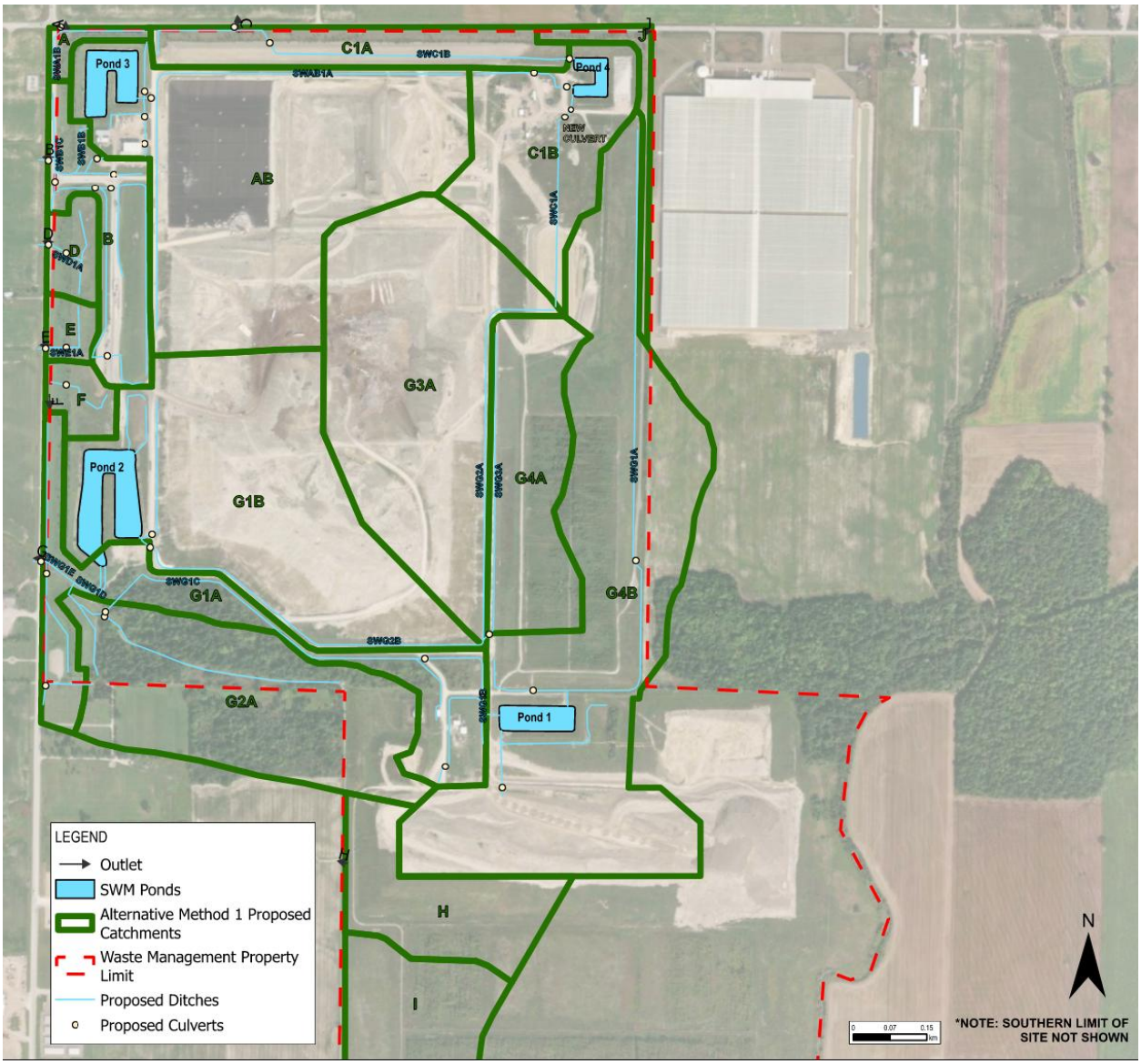
5.6.6.3 Alternative Method 1

Alternative Method 1 will impact the SWM system in two ways:

1. Altering catchment areas within the landfill site; and
2. Decreasing time of concentration.

It is noteworthy that the landfill optimization will not change total runoff volume from the landfill site; however, the timing of peak flows and the redistribution of catchment areas is expected to increase or decrease some of the peak flows leaving through the outlets as shown in **Table 5-5**. For this reason, all catchments experiencing one or both of these above-noted changes under Alternative Method 1 were modelled under Existing Conditions, and Future Baseline, and Alternative Method 1 Scenarios to both compare changes to stormwater runoff and assess any capacity issues with the detention ponds and swales. This excluded Catchments D, E, F, H, I, and J, as they will not be physically altered in any way from their existing characteristics. The results of this analysis are presented in **Table 5-5** and **Table 5-6**. Full results showing all return period storms are available in **Supporting Document 2**. The redistributed catchment areas for Alternative Method 1 are shown in **Figure 5-12**.

Figure 5-12. Stormwater Management for Alternative Method 1



The geometries of the realigned swales (SWC1A and SWG2A) and new culvert have been designed to blend with the grades of the existing surface and to mirror the cross-section and profile of the existing swales. Their required dimensions under Alternative Method 1 + Climate Change conditions are presented in **Table 5-5** (see **Supporting Document 2** for a discussion of the climate change modelling procedure).

Table 5-5. Changes to Site Outlet Peak Flows during 100-year Event for Alternative Method 1

Outlet	Peak Runoff (cms / % increase from Existing Conditions)				
	Existing Conditions	Future Baseline		Alternative Method 1	
A	0.261	0.275	5%	0.276	6%
B	1.006	0.97	-4%	0.97	-4%
C	0.643	0.518	-19%	0.52	-19%
G	1.627	1.825	12%	1.81	11%

Note: Cubic metres per second (cms).

Table 5-6. SWM Pond Function during 100-year Event for Alternative Method 1

Pond	Capacity (ha·m)	Peak Storage Used (ha·m)		
		Existing Conditions	Future Baseline	Alternative Method 1
1	2.773	0.943	0.943	0.943
2	5.271	1.625	1.838	1.824
3	2.857	0.732	0.75	0.75
4	1.099	0.347	0.285	0.282

Note: Hectare-metre (ha·m).

The data presented in **Table 5-5** shows peak outflows from different outlets leaving the landfill site. The results for the Alternative Method 1 scenario closely mirror those of the Future Baseline scenario; in both, Outlets A and G experience an increase in peak flow compared to existing levels, while Outlets B and C demonstrate a decrease. It is noteworthy that SWM Pond 3 discharges flows to Outlets A and B and as seen from **Table 5-5**, Outlet A shows an increase in flows of approximately 6% and conversely Outlet B shows a decrease in flows of approximately 4% when compared to existing conditions. Outlet C shows a decrease in flows of approximately 19% when compared to existing conditions. Outlet G shows an approximate increase of 11% in flows when compared to existing conditions. However, it should be noted that the swales conveying the flows to Outlet G have sufficient capacity and are able to convey the flows downstream safely.

Further, the data presented in **Table 5-6** indicates that all four SWM ponds on the landfill site have enough capacity to store the 100-year flows across the Future Baseline and Alternative Method 1 scenarios, and therefore do not require alteration or enlargement.

The existing swales around the landfill site currently are also able to safely convey the 25-year design storm (**Table 5-7**) without overtopping. Hence, a modification to the existing cross-section geometries of the swales is not warranted. The relocated swales (SWC1A) and SWG2A) and new culvert will also be able to convey these flows appropriately when constructed to the design requirements listed in **Table 5-8**.

Table 5-7. Swale Function during 25-year Event for Alternative Method 1

Swale	Flow Capacity (L/s)	Peak Flow (L/s)	
		Future Baseline	Alternative Method 1
SWAB1A	9,384	1,539	1,594
SWA1B	6,256	193	193
SWB1B	23,461	216	215
SWB1C	120,733	773	773
SWC1A	3,699	577	570
SWC1B	191,849	483	484
SWD1A	28,626	233	233
SWE1A	100,850	213	213
SWG1A	3,981	1,103	1,103
SWG1B	17,669	463	463
SWG1C	11,847	813	813
SWG1D	6,229	409	400
SWG1E	10,909	1,216	1211
Stream	18,095	1,216	1,211
SWG2A	1,592	668	691
SWG2B	12,631	2,813	2,723
SWG3A	1,246	297	297

Table 5-8. Design Geometry of Modified Swales and New Culvert

Name	Bottom Width / Diameter (m)	Depth (m)	Side Slope (x:1)	Slope
SWC1A	3	0.90	3:1	0.09%
SWG2A	1	0.54	3:1	0.64%
New Culvert (HDPE – 1 pipe)	1.2			0.44%

5.6.7 Ancillary Facilities

No additional ancillary facilities, beyond those already existing on the site, will be required for Alternative Method 1.

5.6.8 Site Traffic

There are no operational changes anticipated for the landfill optimization and the landfill will operate consistent with current conditions with the same annual tonnage limit. There is no proposed change to the effective catchment area for the TCEC, the origin-destination patterns of vehicles travelling to or from the TCEC, or the maximum daily trips generated. Accordingly, there should be little to no impact to the surrounding road network or along the haul routes within the greater context.

The Project is not expected to increase its average daily tonnage received. Therefore, traffic conditions are expected to remain the same as they are today. A traffic analysis was prepared that reflected a peak operating day for the TCEC (the highest vehicular activity) (HDR, 2025).

Weigh scale and turning movement count data was used to project traffic volumes for the TCEC under the following assumptions:

- Employee traffic volumes remain unchanged.
- The origins/destinations of site traffic do not change.
- Haul routes do not change.
- The hourly, daily, and seasonal patterns remain stable.
- The breakdown of vehicle types and average vehicle loads remain stable.

Turning movement counts (TMCs) were collected in November 2022 and validated with landfill weigh scale data. Site traffic was adjusted using the weigh scale information to adjust the site traffic so that it was representative of a peak day. There are typically 47 inbound and 77 outbound trips during the weekday AM peak hour, 44 inbound and 52 outbound trips during the midday peak hour, and 26 inbound trips and 30 outbound trips during the weekday p.m. peak hour.

No off-site road network improvements are required to accommodate the extension of the landfill's operating life to approximately 2043.

Traffic related to landfill construction is not anticipated (e.g., landfill cell preparation in advance of waste placement) as the landfill liner will be fully constructed prior to vertical expansion of the landfill. Current construction traffic and any materials used for landfill cover are captured in the weigh scale data provided for the traffic impact analysis and is therefore included in the projected vehicle trips.

5.6.9 Landfill Operations

5.6.9.1 Operating Hours

Waste is currently received at the site from 7:00 a.m. to 7:00 p.m. Monday to Saturday, excluding statutory holidays. On-site equipment used for daily operations can operate from 6:00 a.m. to 8:00 p.m. Monday to Saturday. No changes to the landfill operating hours are anticipated as a result of the Project.

5.6.9.2 Site Equipment

The list of normal site equipment will remain unchanged as a result of the Project and will consist of the following:

- Working Face:
  - 2 CAT 836 Compactors
  - 2 CAT D8R Dozers
  - 1 CAT D6R Dozer
  - 2 Tippers
- Daily Cover and Capping:
  - 2 – Articulated CAT D400 Trucks
  - 1 – Excavator CAT 330L
- Road Maintenance
  - 1 – CAT 140H Grader
- Other Equipment:
  - 1 - Tracked Loader
  - 1 - Portable Air Compressor
  - 1 - Portable Pressure Washer
  - 1 - Utility Tractor with sweeper attachment, rear mounted scraper blade and bush hog-type mower
  - 1 - Portable Electric Generator and Lighting Plant;
  - 1 - Roll-off Truck, complete with roll-off bins
  - 1 - Pelican Road Sweepers with Water Flush System
  - 1 - Portable 100-mm Diesel Water Pump
  - 1 - 3/4 tonne 4 x 4 Pickup Truck, complete with hydraulic-operated
  - snow plough and diesel fuel tank and pump
  - 1 - Cat 950F Rubber-Tired Loader
  - Other auxiliary equipment, such as pickup trucks, maintenance equipment, steam jennies, welders, small tools, portable diesel generator for variable use and portable construction pumps, and power road sweeper attachment for farm tractor.
  - 1 - Portable Wood Crusher / Screener - periodic only
  - 1 - Wood tub Grinder, 1 - Chipper - periodic only

5.6.9.3 Waste Placement

There are no operational changes anticipated to result from the Project and it will operate consistent with current conditions with the same 1.4 million tonnes annual capacity. Landfilling of waste will continue to occur in phases. Contaminated soil is anticipated to be disposed of in the active portions of the Expansion Landfill.

Contaminated soil used for daily cover is only used where precipitation runoff would not be directed to a surface water drainage course (i.e., an inside sideslope).

The working face will be approximately 1,500 square metres (m²), according to current site operations. This is a reasonable area for dozers to push the waste, to spread and level the waste from the tip face, and for the compactors to operate. An active face this wide could accommodate two (2) tippers, six (6) transfer trailers and four (4) packers unloading simultaneously. This width should be adequate for peak hour traffic during average day capacities. If additional capacity were required for peak days, the width or length of the working face would be adjusted accordingly.

5.6.9.4 Daily and Intermediate Cover

At the end of each working day, at least 75% of the working face will be covered with 0.15 m of soil cover or an approved alternative cover material.

Areas remaining inactive for six months or longer should be provided with 0.30 m intermediate cover of soil or an approved alternative cover material.

Cover materials that may be used as an alternative to soil include contaminated soil, automobile shredder residue (ASR), wood chips, or tarps.

5.6.9.5 Nuisance Controls

WM employs a variety of proactive measures to minimize nuisance effects related to odour, litter, dust, noise, and birds on the surrounding environment. These established measures, detailed below, are expected to continue at the TCEC until landfill closure.

Odour

Odour has been managed at the site in accordance with the Odour Best Management Plan (BMP). This plan will be applicable for any of the Alternative Methods.

Walkabout surveys are scheduled for completion in the spring and the early fall to identify unexplained odour events. The results of these walkabout surveys, the times they were completed, and any remedial actions will each be noted in the site odour log. Routine visual inspections of the landfill cap integrity will also occur on a monthly basis to identify possible problem areas. In addition, during the survey of site and during regular inspection periods, detectable odours from the site will be noted and recorded. At a minimum, the odour information will include a description of the odour, time of day (to correspond with wind conditions) and if possible, an indication of the main sources contributing to the odour.

The odour control measures relate largely to on-going monitoring and maintenance that has been identified in the Best Management Plan. However, there are a number of specific details including:

- Progressively expand and activate the LFG collection and flaring system (two installed and two flares proposed) to minimize the amount of odourous LFG that escapes through the mound. The systems should be constructed in a manner to ensure that a minimum of 70% collection efficiency is achieved on a regular basis.
- Regular repairs to the covered landfill areas (existing and future landfill areas) based on identifying any fissures, cracks or erosion of the soil cover that would allow for unmitigated LFG to escape directly to the atmosphere. These areas will be identified in the “walkabout” survey as described above. The areas requiring repair should be covered with clay, compacted, and then covered with topsoil.
- Routinely monitor the size of the active working face of the landfill. The size of the working face will be minimized, accounting for traffic at the working face.
- Regular inspection and monitoring of temperature and moisture of the compost windrows. If waste from the diversion area becomes unacceptable for composting or overly odourous, the material should be removed from this area and landfilled.
- Cap completed cells as quickly as possible with final cover to minimize odourous emissions.

Litter

Litter is retrieved from the external access roads, on site, adjacent properties, and on more remote properties, if required. WM personnel (waste hauler drivers) are instructed to stop and retrieve any litter observed along the access route. On-site litter is controlled by the use of good operating practices such as prompt compaction of loose waste at the active face, daily cover application, interim cover (300 mm) of areas sitting dormant, final capping and vegetation of completed portions of the landfill, gull control, landfilling at a lower elevation during high wind events, high litter barrier fence on the downgradient side of high winds, moveable litter barriers near the active face that can be moved to the downwind side of the compaction and landfilling operation, prompt retrieval of blown litter both off and on site, and tree plantings on property lines to catch any loose litter before it reaches neighbouring properties.

A series of portable litter barriers will be used to shield the downwind side of the active face from escaping litter. These barriers will be skid-mounted and can be towed into place. Labourers will be engaged to pick litter regularly, both on and off WM property.

Dust

The TCEC has created a Best Management Practices Plan (BMPP) for dust that is implemented at the site and will be in effect under Alternative Method 1. All TCEC employees are trained in the contents of the BMPP. The combined efforts of the mitigation measures and implementation of the Dust BMPP will limit the number of

total suspended particulate (TSP) exceedances during the periods of heavy construction and beyond.

Currently, particulate emission mitigation measures are in place at the TCEC and consist of watering on-site roadways and construction sites as well as a number of other practices as outlined in the Dust BMPP. The practices will not occur if precipitation events cause these activities to become redundant or if the ground is sufficiently wet from previous precipitation events.

As part of the dust control strategy, the shift supervisor will be responsible to see that a record of roadway sweeping and watering is maintained. The control measure will be initiated whenever a visible plume behind vehicles is longer than ¼ the length of the vehicle. These logs will be kept on-site for a period of not less than two (2) years and will be made available for inspection.

Noise

All landfill perimeter berms, road berms, and fills have been constructed to provide visual barriers, noise barriers, and dust barriers along the landfill and TCEC perimeter. The operational berms have significantly reduced noise from the operational face. Additionally, in accordance with the 2005 Noise Impact Assessment, the operation of the dozer(s) for applying daily cover in the evening or removing it in the morning outside of daytime hours has been restricted (see **Section 5.6.9.1** Operating Hours).

The TCEC's obligations with respect to noise reporting are described in ECA A032203. Monitoring of the facility noise levels are completed quarterly at four (4) monitoring sites around the perimeter of the TCEC. All measurements are conducted in compliance with requirements outlined in Ministry Publication NPC-103 – Procedures (MOE, 1978).

Birds

The following acoustic devices have been used to scare away gulls:

- Whistling and/or Pyrotechnic Pistol Cartridges;
- Shots fired from a starter pistol or other type of gun;
- Propane canons ("bird bangers"); and
- Electronic distress calls.

The above devices produce impulsive noise which is less than the MECP Landfill sound level limit of 70 dBAI, for all receptors, regardless of the position of firing within the TCEC.

In addition to using acoustic devices, trained birds of prey such as falcons, hawks, eagles or owls have been used at the TCEC for bird control. The bird of prey is flown at intervals throughout the day, serving as a natural deterrent for seagull control.

5.7 Alternative Method 2

This section describes the landfill design and geometry, buffer zones, site development, leachate generation and management, LFG generation and management, SWM, ancillary facilities, site traffic, and landfill operations for Alternative Method 2.

5.7.1 Landfill Design and Geometry

Alternative Method 2 includes the increase of final landfill side slopes from 4H:1V to 2.5H:1V between elevation 250 masl and elevation 310 masl (about 60 m in grade change), transitioning to a 20H:1V upper slope and peaking at elevation 319 masl over the Expansion Landfill. The geometry of Alternative Method 2 is shown in plan view in **Figure 5-5**. Under the proposed vertical expansion, the existing approved waste disposal footprint area of the TCEC would not change, but rather, the maximum permitted height of waste would be increased by 39 metres (m), from 280 masl (the current approved elevation for top of waste) to 319 masl, which is the maximum elevation of the top of the final cover for Alternative Method 2. The 2.5H:1V side slopes will start at elevation 250 masl and continue to elevation 313 masl, and then transition to a grade of 5% and peak at elevation 319 masl as shown in the cross-section on **Figure 5-13** and **Figure 5-14**. This will increase the current landfill capacity by approximately 14.3 million m³.

To assess the stability of the final slopes and proposed peak profile height, a preliminary slope stability analysis was performed. Based on the results of the model, the factor of safety of the circular failure surface for Alternative Method 2 is 1.50. Therefore, Alternative Method 2 meets the recommended minimum factor of safety of 1.3 for slopes.

Settlement for Alternative Method 2 was calculated at intervals along the base of the landfill for the approved landfill profile and Alternative Method 2 considering a unit weight of waste of 12 kN/m³. Based on the results of the model, the overall slope in westerly direction (i.e., toward pumping station) will be maintained despite the slight changes in the approved landfill base grades due to long-term settlement under the heavier inferred waste loading. Additionally, base flattening on the west side will not exceed initial base conditions on the east side, which are considered minimum as defined by O. Reg. 232/98. Therefore, it is concluded that Alternative Method 2 will not have a significant effect on the functionality of the leachate collection system, and leachate will continue to drain toward the designated withdrawal points. The maximum calculated settlement at the landfill centre for Alternative Method 2 is 590 mm.

For the details of the leachate collection piping, please refer to **Section 5.6.1**. Considering a unit weight of overlying material of 12 kN/m³, the pipe deflection under the loading associated with the Alternative Method 2 is around 6.8%, which is lower than the deflection limit of 7.5%, as described in **Section 5.6.1**.

Figure 5-13. Alternative Method 2 Cross-Section (East-West)

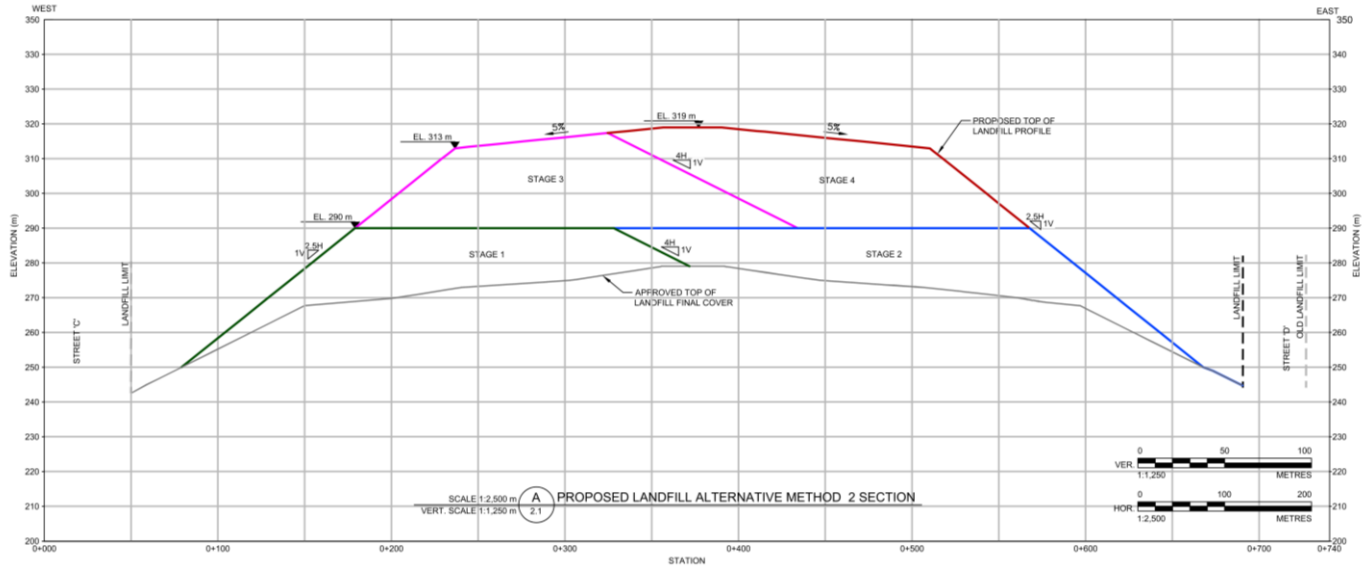
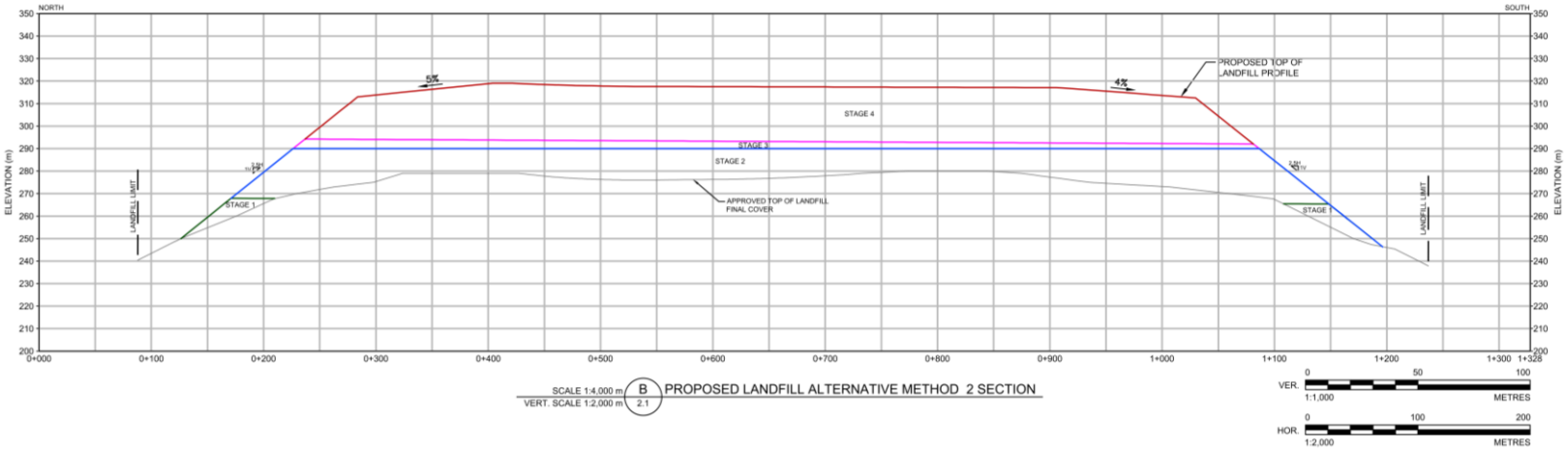


Figure 5-14. Alternative Method 2 Cross-Section (North-South)



Source: CDR (**Supporting Document 2**)

For the geonet, based on what is mentioned in **Section 5.6.1**, it is concluded that geonet secondary drainage capacity performance will meet the design requirements for Alternative Method 2.

In summary, it is concluded that Alternative Method 2 is acceptable with respect to:

- Post-settlement Landfill base grades meeting O. Reg. 232/98 requirements and maintaining acceptable leachate collection in the primary drainage layer;
- Stability of the final slope (4H:1V maximum) and proposed peak profile height;
- Available collector pipe strength within the primary drainage layer; and
- Flow capacity of geonet within the secondary layer.

5.7.2 Buffer Zones

Since Alternative Method 2 would not change the existing approved landfill limit of waste, the existing property boundaries and buffer width, as mentioned in **Section 5.6.2**, will remain the same after the vertical expansion as indicated in **Figure 5-5**. Therefore, the buffer area for Alternative Method 2 will meet the requirements of Section 7 of O. Reg. 232/98.

5.7.3 Site Development

5.7.3.1 Phasing and Schedule of Site Development

The proposed landfill expansion consists of four (4) stages as shown in **Table 5-9**, **Figure 5-13**, and **Figure 5-14**. The areas and volumes of the stages shown in **Table 5-9** are approximate and will be confirmed through detailed design; however, the total landfill volume of Alternative Method 2 will remain at approximately 14.3 million m³.

Table 5-9. Alternative Method 2 Stage Areas and Volumes

Stage	Peak Elevation (masl)	Volume (M m³)
Stage 1	313	3.2
Stage 2	313	4.3
Stage 3	319	3.0
Stage 4	319	3.8
TOTAL	-	**14.3**

The site development phases have taken into consideration to have adequate space to allow disposal and operational vehicles to operate in the same area. The phases will be developed from west to east, considering the removal of final/interim cover along the side slopes prior to waste placement (as explained in **Section 5.6.3.2**).

Considering the approved landfilling rate is 1.4 million tonnes per year, the additional airspace could extend the site life by approximately 12 years.

Based on the estimated volumes provided for each phase in **Table 5-9**, Stage 2 can provide a site life of about 3.0 years while the other phases site life will range between 2.1 to 2.7 years.

5.7.3.2 Construction Activities

Please refer to **Section 5.6.3.2**.

5.7.4 Leachate Generation and Management

Similar to Alternative Method 1, Alternative Method 2 will not change the current expected infiltration rate, instead, it increases the rate of run-off due to the higher side slopes compared to the existing condition. Therefore, the leachate collection system will remain the same after vertical expansion. For more details, please refer to **Section 5.6.4**.

5.7.4.1 Leachate Generation

The maximum leachate generation for Alternative Method 2 is predicted to peak at 119,000 m³ per year (326 m³ per day) in Year 3 after completion of Stage 1 (approximately 2036). Leachate generation will then decrease to approximately 107,000 m³ per year (293 m³ per day) following placement of the final cover in Year 12 (estimated to be in 2045). **Supporting Document 2** provides the modelling results. An additional 25,550 m³ of leachate annually (70 m³ per day) is estimated to be generated from the closed Old Landfill.

Based on the above, maximum leachate generation is estimated at 396 m³ per day (326 m³ + 70 m³) from both Alternative Method 2 (including the Expansion Landfill) and the closed Old Landfill, which is expected to occur in Year 3 (approximately 2036).

Details regarding the HELP modelling are provided in **Section 5.6.4.1**. Based on the information presented, future generation of leachate should be anticipated to be at annual volumes between the HELP predictions and current levels.

5.7.4.2 Leachate Management

Please refer to **Section 5.6.4.2**.

5.7.5 Landfill Gas Management

5.7.5.1 Landfill Gas Generation

Please refer to **Section 5.6.5.1**.

5.7.5.2 LFG Collection and Treatment

Please refer to **Section 5.6.5.2**.

5.7.6 Stormwater Management

5.7.6.1 Existing System

Please refer to **Section 5.6.6.1** for a discussion of the analysis of the existing system.

5.7.6.2 Future Baseline Scenario

Should the landfill optimization not proceed, the landfill development will continue until it has reached its full horizontal footprint and currently approved height of 280 masl. This will alter the outlets' catchment areas, land cover, and time of concentration, as well as the path of the swales in the northeast corner. This scenario is considered the Future Baseline and was modelled as part of the assessment of the proposed expansion as detailed below. Please refer to **Section 5.6.6.2** for a discussion on the analysis of the Future Baseline scenario.

5.7.6.3 Alternative Method 2

The impacts of Alternative Method 2 would be similar to that of Alternative Method 1 in several ways. The factors altering the magnitude and timing of the peak flows (although not the total runoff volume) are the same. The same scenarios were modelled: Existing; Future Baseline; and Alternative Method 2. **Table 5-10** to **Table 5-12** highlight the differences in 100-year peak flows at the site outlets, SWM pond function under a 100-year design storm, and swale function under a 25-year design storm between the different scenarios. **Table 5-8** presents the geometric requirements of realigned swales SWC1A and SWG2A and the new culvert leading to Pond 4. **Section 5.6.6.3** presents a detailed description of the methodology used and **Supporting Document 2** provides the full results for storms of 2-year to 100-year return periods. The redistributed catchment areas for Alternative Method 2 are shown on **Figure 5-15**.

Table 5-10. Changes to Site Outlet Peak Flows during 100-year Event for Alternative Method 2

Outlet	Peak Runoff (cms / % increase from Existing Conditions)				
	Existing Conditions	Future Baseline		Alternative Method 2	
A	0.261	0.275	5%	0.279	7%
B	1.006	0.97	-4%	0.97	-4%
C	0.643	0.518	-19%	0.522	-19%
G	1.627	1.825	12%	1.794	10%

Note. Centimetre per second (cms)

Table 5-11. SWM Pond Function during 100-year Event for Alternative Method 2

Pond	Capacity (ha·m)	Peak Storage Used (ha·m)		
		Existing Conditions	Future Baseline	Alternative Method 2
1	2.773	0.943	0.943	0.943

Pond	Capacity (ha·m)	Peak Storage Used (ha·m)		
		Existing Conditions	Future Baseline	Alternative Method 2
2	5.271	1.625	1.838	1.808
3	2.857	0.732	0.75	0.757
4	1.099	0.347	0.285	0.284

Note. hectares per metre (ha·m)

Figure 5-15. Stormwater Management for Alternative Method 2

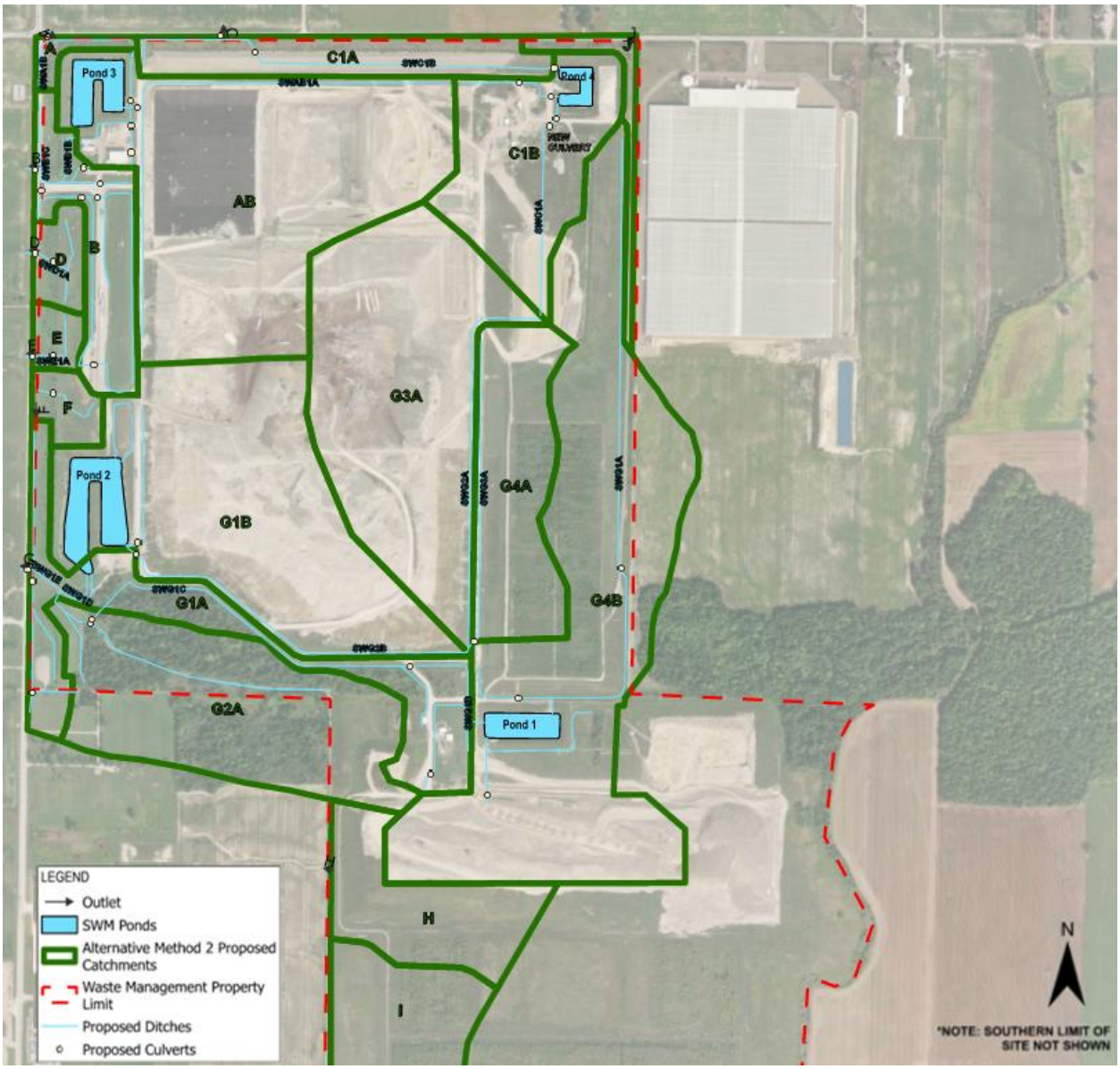


Table 5-12. Swale Function during 25-year Event for Alternative Method 2

Swale	Flow Capacity (L/s)	Peak Flow (L/s)	
		Future Baseline	Alternative Method 2
SWAB1A	9,384	1,539	1,560
SWA1B	6,256	193	196
SWB1B	23,461	216	218
SWB1C	120,733	773	773
SWC1A	3,699	577	581
SWC1B	191,849	483	485
SWD1A	28,626	233	233
SWE1A	100,850	213	213
SWG1A	3,981	1,103	1,103
SWG1B	17,669	463	463
SWG1C	11,847	813	813
SWG1D	6,229	409	391
SWG1E	10,909	1,216	1,209
Stream	18,095	1,216	1,209
SWG2A	1,592	668	661
SWG2B	12,631	2,813	2,696
SWG3A	1,246	297	297

Like Alternative Method 1, peak outflows from different outlets leaving the site under the Alternative Method 2 scenario are comparable to the Future Baseline scenario. It is noteworthy that SWM Pond 3 discharges flows to Outlets A and B and as seen from **Table 5-10**, Outlet A shows an increase in flows of approximately 7% and conversely Outlet B shows a decrease in flows of approximately 4% when compared to existing conditions. Outlet C shows a decrease in flows of approximately 19% when compared to existing conditions. Outlet G shows an approximate increase of 10% in flows when compared to existing conditions. However, it should be noted that the swales conveying the flows to Outlet G have sufficient capacity and are able to convey the flows downstream safely. **Table 5-11** and **Table 5-12** demonstrate that the existing SWM ponds and swales will have enough capacity to process their respective design storms under Alternative Method 2. The relocated swales (SWC1A and SWG2A) and new culvert will also be able to convey these flows appropriately as long as they meet the design requirements listed in **Table 5-8**.

5.7.7 Ancillary Facilities

Please refer to **Section 5.6.7**.

5.7.8 Site Traffic

Please refer to **Section 5.6.8**.

5.7.9 Landfill Operations

Please refer to **Section 5.6.9**.

5.8 Alternative Method 3

This section describes the landfill design and geometry, buffer zones, site development, leachate generation and management, LFG generation and management, SWM, ancillary facilities, site traffic, and landfill operations for Alternative Method 3.

5.8.1 Landfill Design and Geometry

Alternative Method 3 includes the increase of final landfill side slopes from 4H:1V to 2.5H:1V between elevation 260 masl and elevation 360 masl (about 100 m in grade change), peaking at elevation 360 masl over the Expansion Landfill. The geometry of Alternative Method 3 is shown in plan view on **Figure 5-6**. Under the proposed vertical expansion, the existing approved waste disposal footprint area of the TCEC would not change, but rather, the maximum permitted height of waste would be increased by 80 m, from 280 masl (the current approved elevation for top of waste) to 360 masl, which is the maximum elevation of the top of the final cover for Alternative Method 3. The 2.5H:1V side slopes will start at the existing landfill toe of slope (about 21 m in grade change) continuing to elevation 360 masl, and then peaking at elevation 360 masl as shown in the cross-section on **Figure 5-16** and **Figure 5-17**. This will increase the current landfill capacity by approximately 14.3 million m³.

To assess the stability of the final slopes and proposed peak profile height, a preliminary slope stability analysis was performed. Based on the results of the model, the factor of safety of the circular failure surface for Alternative Method 3 is 1.47. Therefore, Alternative Method 3 meets the recommended minimum factor of safety of 1.3 for slopes.

Settlement was calculated at intervals along the base of the landfill for the approved landfill profile and Alternative Method 3 considering a unit weight of waste of 12 kN/m³. Based on the results of the model, the overall slope in westerly direction (i.e., toward pumping station) will be maintained, despite the slight changes in the approved landfill base grades due to long-term settlement under the heavier inferred waste loading. Additionally, base flattening on the west side will not exceed initial base conditions on the east side which are considered minimum as defined by O. Reg. 232/98. Therefore, it is concluded that Alternative Method 3 will not have a significant effect on the functionality of the leachate collection system and leachate will continue to drain toward the designated withdrawal points. The maximum calculated settlement at the landfill centre for Alternative Method 3 is 545 mm.

Figure 5-16. Alternative Method 3 Cross-Section (East-West)

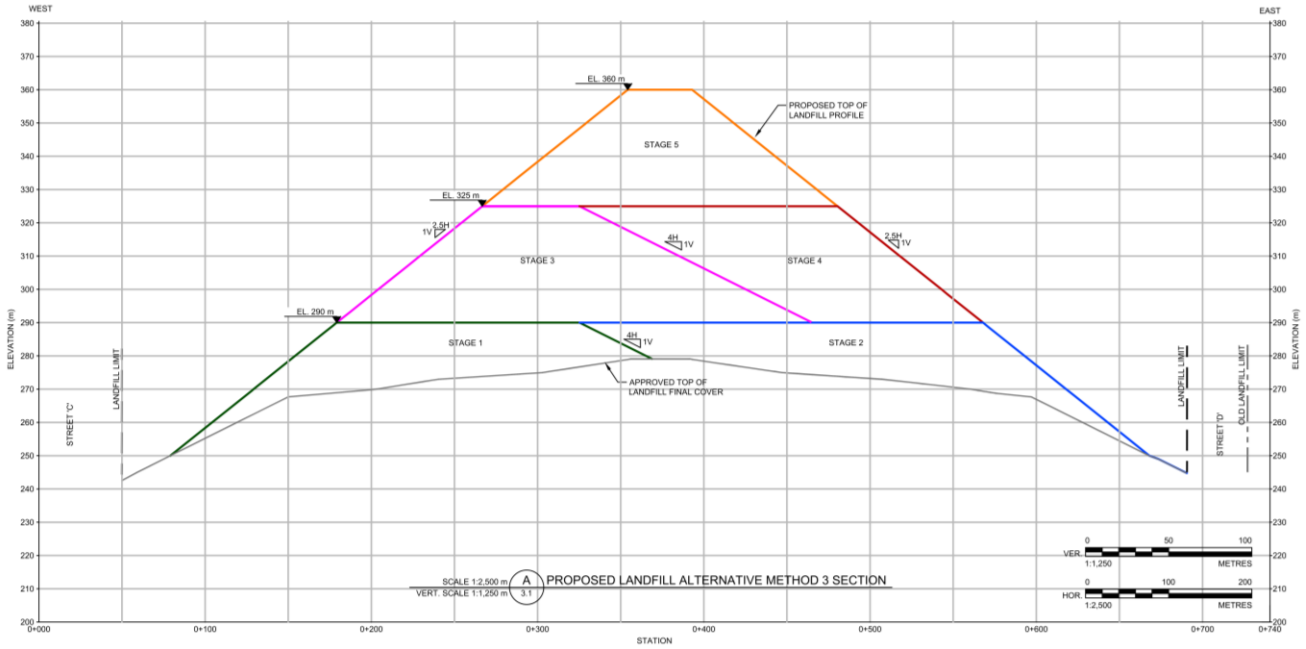
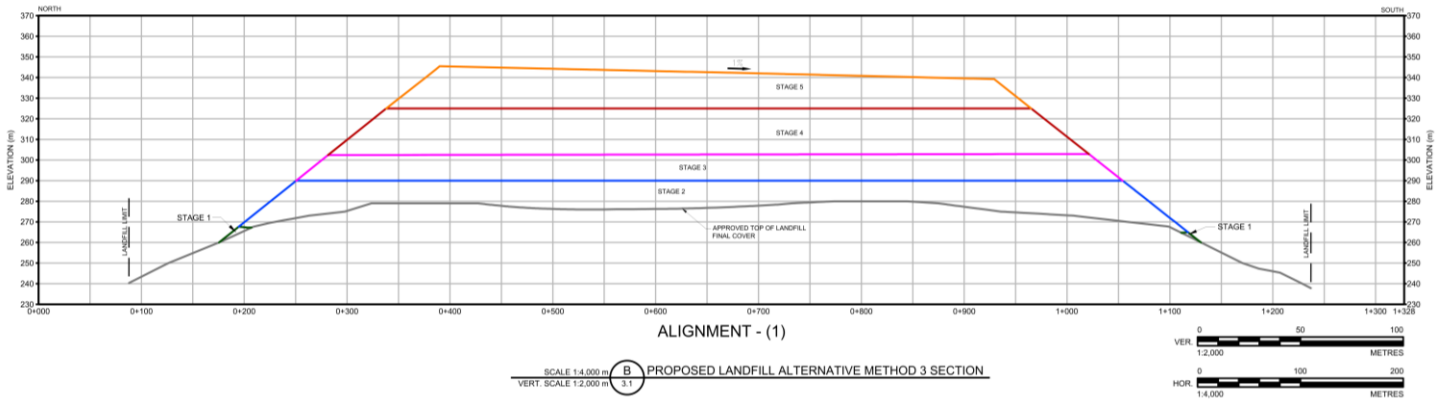


Figure 5-17. Alternative Method 3 Cross-Section (North-South)



Source: CDR (**Supporting Document 2**)

For the details of the leachate collection piping, please refer to **Section 5.6.1**. Considering a unit weight of overlying material of 12 kN/m³, the pipe deflection under the loading associated with the Alternative Method 3 is around 7.9%, which is slightly higher than the deflection limit of 7.5%, as described in **Section 5.6.1**. Therefore, Alternative Method 3 provides lower than 3 to 1 safety factor against reverse curvature and might require a reinforcement of the leachate collection system (i.e., building a perimeter leachate collection system).

For the geonet, based on what is mentioned in **Section 5.6.1**, it is concluded that geonet secondary drainage capacity performance will meet the design requirements for Alternative Method 3.

In summary, it is concluded that Alternative Method 3 is acceptable with respect to:

- Post-settlement Landfill base grades meeting O. Reg. 232/98 requirements and maintaining acceptable leachate collection in the primary drainage layer;
- Stability of the final slope (2.5H:1V maximum) and proposed peak profile height;
- Flow capacity of geonet within the secondary layer.
- Collector pipe strength within the primary drainage layer may require reinforcement.

5.8.2 Buffer Zones

Since Alternative Method 3 would not change the existing approved landfill limit of waste, the existing property boundaries and buffer width, as mentioned in **Section 5.6.2**, will remain the same after the vertical expansion, as indicated in **Figure 5-6**. Therefore, the buffer area for Alternative Method 3 will meet the requirements of Section 7 of O. Reg. 232/98.

5.8.3 Site Development

5.8.3.1 Phasing and Schedule of Site Development

The proposed landfill expansion consists of five (5) stages as shown in **Table 5-13**, **Figure 5-16**, and **Figure 5-17**. The areas and volumes of the stages shown in are approximate and will be confirmed through detailed design; however, the total landfill volume of Alternative Method 3 will remain at approximately 14.3 million m³.

Table 5-13. Alternative Method 3 Stage Areas and Volumes

Stage	Peak Elevation (masl)	Volume (M m³)
Stage 1	290	3.2
Stage 2	290	3.8
Stage 3	325	2.7
Stage 4	325	2.3
Stage 5	360	2.3
TOTAL	-	**14.3**

The site development phases have taken into consideration to have adequate space to allow disposal and operational vehicles to operate in the same area. The phases will be developed from west to east, considering the removal of final/interim cover along the side slopes prior to waste placement (as explained in **Section 5.6.3**).

Considering the approved landfilling rate is 1.4 million tonnes per year, the additional airspace could extend the site life by approximately 12 years. Based on the estimated volumes provided for each phase in **Table 5-13**, Stage 2 can provide a site life of about 2.7 years while the other phases site life will range between 1.6 to 2.3 years.

5.8.3.2 Construction Activities

Please refer to **Section 5.6.3.2**.

5.8.4 Leachate Generation and Management

Similar to Alternative Method 1, Alternative Method 3 will not change the current expected infiltration rate, instead, it increases the rate of run-off due to the higher side slopes compared to the existing condition. Therefore, the leachate collection system will remain the same after vertical expansion. For more details, please refer to **Section 5.6.4**.

5.8.4.1 Leachate Generation

The maximum leachate generation for Alternative Method 3 is predicted to peak at 118,500 m³ per year (325 m³ per day) in Year 3 after completion of Stage 1 (approximately 2036). Leachate generation will then decrease to approximately 101,700 m³ per year (279 m³ per day) following placement of the final cover in Year 12 (estimated to be in 2045). **Supporting Document 2** provides the modelling results. An additional 25,550 m³ of leachate annually (70 m³ per day) is estimated to be generated from the closed Old Landfill.

Based on the above, maximum leachate generation is estimated at 395 m³ per day (325 m³ + 70 m³) from both Alternative Method 3 (including the Expansion Landfill) and the closed Old Landfill, which is expected to occur in Year 3 (approximately 2036).

Details regarding the HELP modelling are provided in **Section 5.6.4.1**. Based on the information presented, future generation of leachate should be anticipated to be at annual volumes between the HELP predictions and current levels.

5.8.4.2 Leachate Management

Please refer to **Section 5.6.4.2**.

5.8.5 Landfill Gas Management

5.8.5.1 Landfill Gas Generation

Please refer to **Section 5.6.5.1**.

5.8.6 Landfill Gas Collection and Treatment

Please refer to **Section 5.6.5.2**.

5.8.7 Stormwater Management

5.8.7.1 Existing System

Please refer to **Section 5.6.6.1** for a discussion on the analysis of the existing system

5.8.7.2 Future Baseline Scenario

Should the landfill expansion optimization not proceed, the landfill development will continue until it has reached footprint will reach its full horizontal footprint and currently approved height of 280 masl. This will alter the outlets' catchment areas, land cover, and times of concentration, as well as the path of the swales in the northeast corner. This scenario is considered the Future Baseline and was modelled as part of the assessment of the proposed expansion as detailed below.

Please refer to **Section 5.6.6.2** for a discussion of the analysis of the baseline future scenario.

5.8.7.3 Alternative Method 3

The impacts of Alternative Method 3 would be similar to that of Alternative Methods 1 and 2 in several ways. The factors altering the magnitude and timing of the peak flows (although not, again, the total runoff volume) are the consistent. The same scenarios were modelled: Existing; Future Baseline; and Alternative Method 3. **Table 5-14 to Table 5-16** highlight the differences in 100-year peak flows at the landfill outlets, SWM pond function under a 100-year design storm, and swale function under a 25-year design storm between the different scenarios. **Table 5-8** presents the geometric requirements of realigned swales SWC1A and SWG2A and the new culvert leading to Pond 4. Please refer to **Section 5.6.6.3** for a more detailed description of the methodology used and **Supporting Document 2** for the full results for storms of 2-

year to 100-year return periods. The redistributed catchment areas for Alternative Method 3 are shown in **Figure 5-18**.

Table 5-14. Changes to Site Outlet Peak Flows during 100-year Event for Alternative Method 3

Catchment	Peak Runoff (cms / % increase from Existing Conditions)				
	Existing Conditions	Future Baseline		Alternative Method 3	
A	0.261	0.275	5%	0.273	5%
B	1.006	0.97	-4%	0.97	-4%
C	0.643	0.518	-19%	0.52	-19%
G	1.627	1.825	12%	1.806	11%

Note. Centimetre per second (cms)

Table 5-15. SWM Pond Function during 100-year Event for Alternative Method 3

Pond	Capacity (ha·m)	Peak Storage Used (ha·m)		
		Existing Conditions	Future Baseline	Alternative Method 3
1	2.773	0.943	0.943	0.943
2	5.271	1.625	1.838	1.823
3	2.857	0.732	0.75	0.746
4	1.099	0.347	0.285	0.281

Note. hectares per metre (ha·m)

Figure 5-18. Stormwater Management for Alternative Method 3

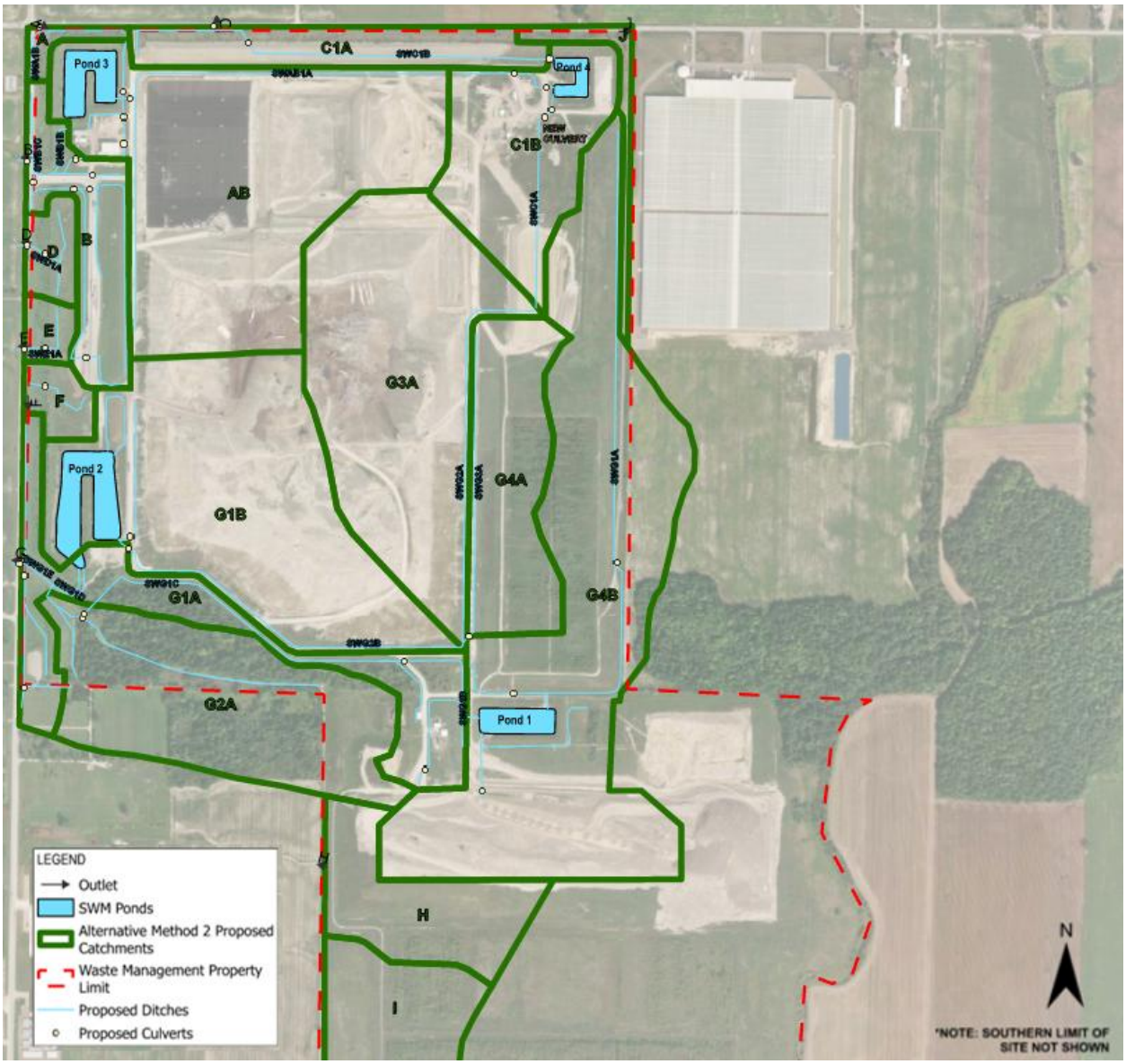


Table 5-16. Swale Function during 25-year Event for Alternative Method 3

Swale	Flow Capacity (L/s)	Peak Flow (L/s)	
		Future Baseline	Alternative Method 3
SWAB1A	9,384	1539	1526
SWA1B	6,256	193	191
SWB1B	23,461	216	214
SWB1C	120,733	773	773
SWC1A	3,699	577	565
SWC1B	191,849	483	483
SWD1A	28,626	233	233

Swale	Flow Capacity (L/s)	Peak Flow (L/s)	
		Future Baseline	Alternative Method 3
SWE1A	100,850	213	213
SWG1A	3,981	1103	1103
SWG1B	17,669	463	463
SWG1C	11,847	813	813
SWG1D	6,229	409	400
SWG1E	10,909	1216	1211
Stream	18,095	1216	1211
SWG2A	1,592	668	658
SWG2B	12,631	2813	2753
SWG3A	1,246	297	297

Table 5-17. Design Geometry of Modified Swales and New Culvert

Name	Bottom Width / Diameter (m)	Depth (m)	Side Slope (x:1)	Slope
SWC1A	3	0.90	3:1	0.09%
SWG2A	1	0.54	3:1	0.64%
New Culvert (HDPE – 1 pipe)	1.2			0.44%

The data presented in the tables above mirror those of **Section 5.6.6.3**. Like Alternative Methods 1 and 2, peak outflows from different outlets leaving the site under the Alternative Method 3 scenario are comparable to the Future Baseline scenario. It is noteworthy that SWM Pond 3 discharges flows to Outlets A and B and as seen from **Table 5-14**, Outlet A shows an increase in flows of approximately 5% and conversely Outlet B shows a decrease in flows of approximately 4% when compared to existing conditions. Outlet C shows a decrease in flows of approximately 19% when compared to existing conditions. Outlet G shows an approximate increase of 11% in flows when compared to existing conditions. However, it should be noted that the swales conveying the flows to Outlet G have sufficient capacity and are able to convey the flows downstream safely. These results are presented in greater detail in **Supporting Document 2**.

Table 5-15 and **Table 5-16** demonstrate that the existing SWM ponds and swales will have enough capacity to process their respective design storms under Alternative Method 3. The relocated swales (SWC1A and SWG2A) and new culvert will also be able to convey these flows appropriately as long as they meet the design requirements listed in **Table 5-17**.

5.8.8 Ancillary Facilities

Please refer to **Section 5.6.7**.

5.8.9 Site Traffic

Please refer to **Section 5.6.8**.

5.8.10 Landfill Operations

Please refer to **Section 5.6.9**.

5.9 Climate Change Considerations

The document entitled "Considering Climate Change in the Environmental Assessment Process" (MECP, 2017a) was used as a guide for incorporating measures in the landfill expansion design that reduce both its impact on climate change (i.e., climate change mitigation) and the impact of climate change on the landfill (i.e., climate change adaptation). These measures are described in the following sections.

5.9.1 Effects of Climate Change on Landfill Design and Operations

Climate change has resulted in extreme weather events including increasingly severe rainfall and wind events, temperature extremes, and reduced snow cover. The potential impacts of these events are expected to influence mainly the design of the SWM system as well as routine site operations. These events are not expected to have a significant influence on the design of the LFG or leachate management systems, although they may influence the rate of generation of leachate and LFG.

5.9.1.1 Stormwater Management Design

Extreme weather events caused by climate change are relevant to the design of SWM systems in the diversion/control of runoff, as well as erosion and sedimentation control. Climate change will impact the SWM system by increasing the intensity and frequency of storms, which will cause larger peak flows, sometimes by a significant amount. It is for this reason that the future conditions were modelled for the currently approved landfill buildout and the three Alternative Methods using current and future climate change intensity-duration-frequency (IDF) curves. These curves were taken from the Sarnia weather station as reported/predicted by Environment and Climate Change Canada. The 2071-2100 SSP2-4.5 (moderate emissions scenario) was used, representing a 27-29% in peak intensity. The analysis demonstrated that despite the increase in peak flows climate change will cause, the existing ponds and swales have sufficient capacity to manage the runoff under the design storms.

5.9.1.2 Landfill Operations

Extreme rainfall and wind events can influence landfill operations although these influences can be mitigated by adapting operating practices. The landfill operations will adapt to climate change by implementing by considering:

- Installing higher or longer litter control fences designed to handle stronger winds.

- Maintaining the on-site perimeter ditches and culverts clear of sediment to promote positive drainage during high intensity precipitation events.
- During extreme heat and cold weather, staff working outdoors will be required to follow WM health and safety operational procedures. On-site vehicles and heavy equipment will be maintained to provide climate-controlled conditions for the operational staff.

5.9.1.3 LFG Management System Design

The rate of generation of methane (e.g., Methane Generation Rate, k) is highly dependent upon the moisture in the waste mass, and the overall methane generation capacity (e.g., Methane Generation Capacity, Lo) depends on the type and composition of waste in the landfill. Extreme weather events caused by climate change may influence the amount of moisture within the waste and therefore the rate at which methane is generated. If climate change results in a lowering of moisture content, the generation rate will be reduced; conversely if the moisture content increases the generation rate will be increased.

The proposed landfill design includes a low permeability soil final cover that will be constructed progressively as the site is developed, and as the final covered area increases, the effect of variations in rain events on moisture content of the waste will be diminished. WM will monitor the LFG generation rate throughout the life of the site and will ensure that adequate gas management capability (e.g., RNG Facility and LFG flaring) is maintained.

The gas treatment/flare system has sufficient operational capacity to manage up to 24,824 m^3/hr, which is greater than the estimated LFG generation rate of 18,169 m^3/hour (**Table 5-4**), without considering the additional Flares 5 and 6 which will operate in the event the RNG Facility is not operational.

5.9.1.4 Leachate Collection System Design

Extreme weather events resulting from climate change are not expected to have a significant long-term effect on precipitation infiltration and generation of leachate considering the site will be progressively capped with a low permeability final cover. Additional infiltration will increase the leachate generation rate within the active cells (without soil cover), but the effect will be reduced by moisture initially going into storage in the waste mass, as well as the progressive closure of the site. The current leachate collection system is capable of managing the additional leachate generation rates.

5.9.2 Effect of the Landfill on Climate Change

The greatest potential influence of the landfill on climate change relates to the generation and emission of LFG, which is comprised primarily of methane and carbon dioxide, both of which are GHGs. This effect is anticipated to be minimal given the following aspects of the landfill design:

- The landfill optimization will incorporate an active LFG collection system with an estimated efficiency of 90% in areas under final cover, limiting LFG emissions to the atmosphere.
- Collected LFG will be processed and converted to RNG or combusted by on-site flares.
- Progressive placement of interim and final cover will reduce LFG emissions.

6 Net Effects of the Alternative Methods

The potential effects of the Alternative Methods were assessed in accordance with the requirements of the approved Terms of Reference (ToR) (**Appendix A**) and the *Ontario Environmental Assessment Act* (*OEAA*). This section of the Environmental Assessment (EA) Study Report provides a summary of the net effects assessments of the Alternative Methods. The detailed net effects assessments for the environmental components are provided in **Supporting Document 3 – Effects Assessment Reports**.

6.1 Assessment Methods

The environmental effects of each Alternative Method were assessed using the evaluation criteria, indicators, rationale, and data sources included in the approved ToR and in **Section 6.1.1**, below, with consideration of the existing conditions provided in **Section 4** and **Supporting Document 1 – Existing Conditions Reports**.

The effects assessment was carried out as follows:

- the potential environmental effects for each Alternative Method were predicted, mitigation measures and monitoring programs were identified where appropriate, and the resulting net environmental effects were determined, taking into account the identified mitigation measures (**Section 6.2**);
- a comparative evaluation of the net environmental effects of each Alternative Method was conducted to identify a Preferred Alternative (**Section 7**); and
- an assessment of the effects of the Preferred Alternative was conducted, including the identification of mitigation measures and monitoring programs (**Section 8**).

The potential environmental effects of each Alternative Method were identified based on the design presented in **Supporting Document 2 – Conceptual Design Report** (CDR) and the currently-approved maximum waste receipt volume of 1.4 million tonnes per year. Key design considerations and assumptions for the effects assessment relevant to each environmental component were documented, including mitigation measures that were incorporated into the design identified in **Supporting Document 2**. Additional mitigation measures beyond those included in **Supporting Document 2** were identified when required to mitigate the potential environmental effects of the Alternative Methods.

6.1.1 Evaluation Criteria, Indicators, and Data Sources

The evaluation criteria, rationale, indicators, and data sources used for the net effects assessment are provided in **Table 4-1**. The evaluation criteria are organized by the aspects of the environment and environmental components provided in **Section 4**, **Table 4-1**.

A summary of the relationships between the evaluation criteria and environmental components for the effects assessment is shown on **Figure 6-1**.

Figure 6-1. Relationship Between Evaluation Criteria and Environmental Components

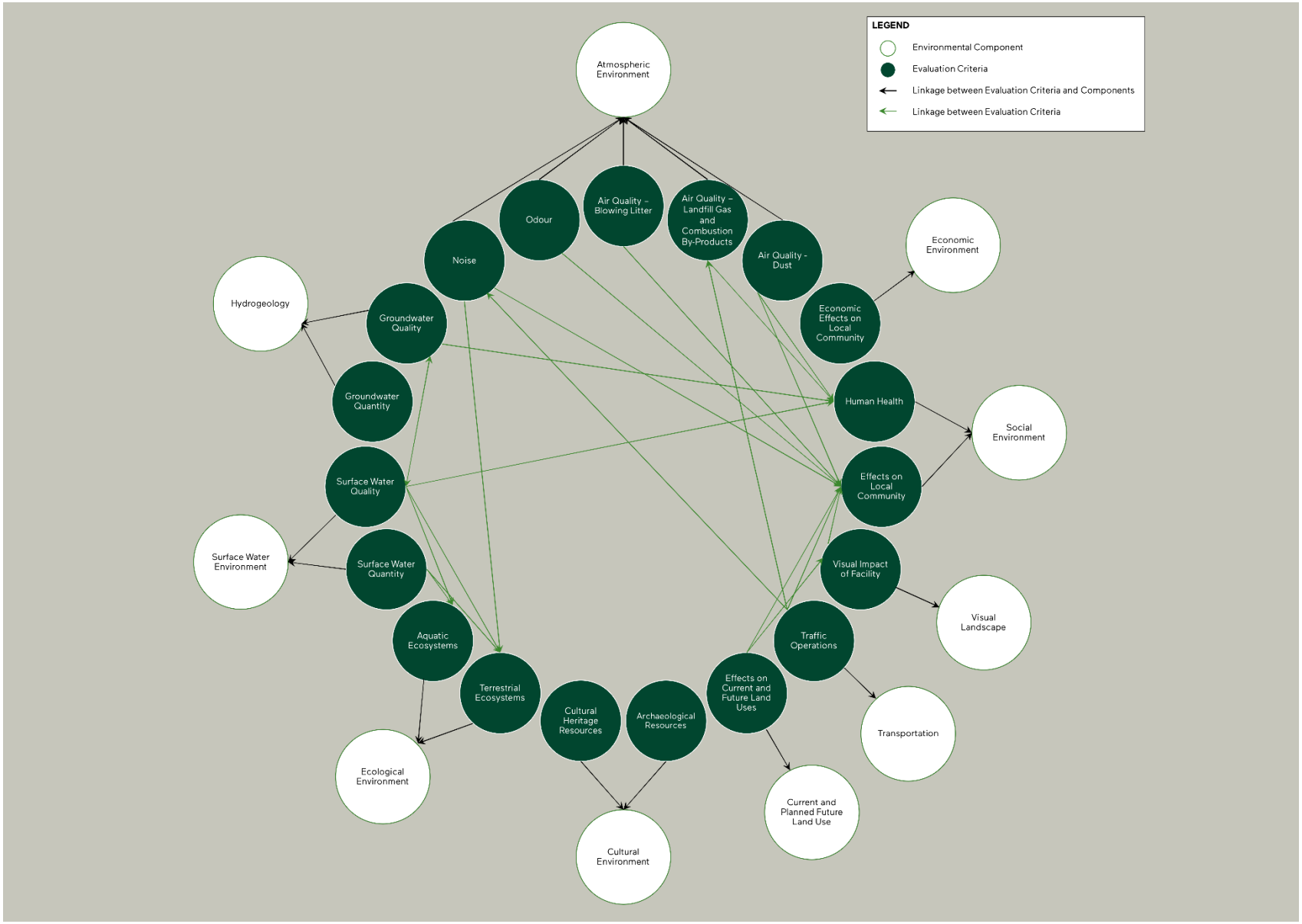


Table 6-1. Evaluation Criteria, Indicators, and Data Sources

Evaluation Criteria	Rationale	Indicators	Data Sources	Effects Assessment Report
Natural Environment				
Atmospheric Environment				
Air Quality – Dust	Construction and operation activities at a waste disposal site can lead to increased levels of particulates (dust) in the air.	• Off-site point of impingement (POI) air concentrations of particulate matter (PM) compounds at identified receptors in the immediate vicinity of the site, and community. • Frequency of any exceedance of applicable standards, limits, or guidelines at identified receptors. • Number of off-site identified receptors potentially affected (e.g., residential properties, public facilities, businesses/farms, institutions). • Both operational and construction activities occurring in each of the future operational stages of the landfill considered in the assessment will be independently identified, described, and assessed.	• Ontario Ministry of Environment, Conservation, and Parks (MECP) -provided meteorological data • Applicable MECP guidelines, technical standards and accepted models • Aerial photographic mapping and field reconnaissance • Previously completed reports for the Twin Creeks Environmental Centre (TCEC) facility, including the 2016 Environmental Screening report, the 2005 EA, various Environmental Compliance Approval (ECA) / Emission Summary and Dispersion Modelling (ESDM) reports, ambient monitoring reports, etc. • Off-site receptors identified in coordination with other disciplines • Available background ambient air data • Site specific ambient particulate monitoring data • Proposed facility characteristics • Landfill design and operation data • Published terrain data • Published air emission factors and predictive models • Published particle size fractionation data • Traffic data • Applicable air quality standards, guidelines, and criteria from the MECP and the Canadian Council of Ministers of the Environment (CCME)	**Supporting Document 3-1 - Air Quality Effects Assessment Report**
Air Quality – Landfill Gas and	Waste disposal site and associated operations can	• Off-site POI air concentrations of indicator compounds at identified receptors in the immediate vicinity	• MECP-provided meteorological data • Applicable MECP guidelines, technical standards and accepted models	

Table 6-1. Evaluation Criteria, Indicators, and Data Sources

Evaluation Criteria	Rationale	Indicators	Data Sources	Effects Assessment Report
Combustion By-Products	emit gaseous contaminants that can degrade air quality.	of the site, and community (within 5 km). • Frequency of any exceedance of applicable standards, limits, or guidelines at identified receptors. • Number of off-site receptors potentially affected (e.g., residential properties, public facilities, businesses/farms, institutions).	• Aerial photographic mapping and field reconnaissance • Previously completed reports for the TCEC facility, including the 2016 Environmental Screening report, the 2005 EA, various ECA/ESDM reports, ambient monitoring reports, etc. • Off-site receptors identified in coordination with other disciplines • Available background ambient air data • Site specific ambient monitoring data • Proposed facility characteristics • Landfill design and operation data • Published terrain data • Published air emission factors and predictive models • Established gas characteristics from the existing operation • Applicable air quality standards, guidelines, and criteria from the MECP and the CCME	
Air Quality – Blowing Litter	Waste disposal site and associated operations can release litter, which may be blown to the surrounding areas.	• Extent of zones potentially impacted by blowing litter. • Number of off-site receptors potentially affected (e.g., residential properties, public facilities, businesses/farms odour sensitive area(s), institutions).	• On-site meteorological data • MECP-provided meteorological data • MECP inspection records, WM inspection records, and complaint history • Published literature related to the factors affecting the generation and mitigation of blowing litter • Landfill design and operation data	
Odour	Waste disposal site and associated operations can emit contaminants that generate odorous emissions.	• Off-site odour concentrations (odour units) at identified odour sensitive receptors in the immediate vicinity of the site. • Frequency of any odour levels above defined odour benchmarks. • Number of off-site receptors potentially affected (e.g., residential properties, public	• MECP-provided meteorological data • Applicable MECP guidelines, technical standards, and accepted models • Aerial photographic mapping and field reconnaissance • Previously completed reports for the TCEC facility, including the 2016 Environmental Screening report, the 2005 EA, various	**Supporting Document 3-1 - Air Quality Effects Assessment Report**

Table 6-1. Evaluation Criteria, Indicators, and Data Sources

Evaluation Criteria	Rationale	Indicators	Data Sources	Effects Assessment Report
		facilities, businesses/farms odour sensitive area(s), institutions).	ECA/ESDM reports, ambient monitoring reports, etc. • Off-site odour-sensitive receptors defined as per the MECP Odour Technical Bulletin, identified in coordination with other disciplines • Proposed facility characteristics • Landfill design and operation data • Published terrain data • Published air emission factors • Emission measurements from comparable landfills and/or on-site sampling • Applicable air quality standards, guidelines, and criteria from the MECP and the CCME	
Noise	Activities related to construction/ rehabilitation, operation of the landfill and ancillary sources, and the off-site haul route can result in an increase in off-site noise levels.	• Predicted site-related noise levels (measured in dBA or dBAI) • Change in sound levels (dB)	• Annual on-site noise monitoring data • Off-site noise monitoring • Manufacturer noise specifications • Noise measurement of on-site sources • Applicable MECP guidelines, technical standards, and models • Aerial mapping and field reconnaissance to confirm off-site receptors • Topographic and land-use mapping • Land use zoning plans • Proposed facility characteristics • Landfill design and operations data • Traffic counting, characterization, and modelling studies	**Supporting Document 3-2 – Noise Effects Assessment Report**
Hydrogeology				
Groundwater Quality	Contaminants associated with waste disposal at the TCEC have the potential to enter the groundwater and impact on-site	• Predicted effects on Groundwater Quality on-site from increased waste quantities disposed within the Expansion Landfill • Predicted Contaminating Lifespan (CLS)	• Applicable regulatory documentation (e.g., Amended TCEC ECAs, MECP guidelines, technical standards, etc.) • 2007 Landfill EMP (Jagger Hims Limited, 2007) (2007 EMP), and as amended per MECP approval • Historical Hydrogeological studies	**Supporting Document 3-3 – Hydrogeology Effects Assessment Report**

Table 6-1. Evaluation Criteria, Indicators, and Data Sources

Evaluation Criteria	Rationale	Indicators	Data Sources	Effects Assessment Report
	groundwater. Acceptable Groundwater Quality, which is 80% of the Guideline B-7 criteria for the Primary Leachate Indicator List (PLIL) parameters, must be shown at the TCEC boundaries.		• Liquid level monitoring data for on-site groundwater monitoring wells and leachate monitoring stations • Groundwater Quality monitoring data at on-site monitoring wells as outlined in the 2007 EMP • Quarterly and Annual TCEC compliance monitoring reports • Leachate generation and management assessments, as outlined in the Leachate Management Plan (LMP) • Proposed facility characteristics • Water well survey within the Off-site Study Area	
Groundwater Quantity	The Landfill Optimization has the potential to affect the established hydraulic trap design for the Expansion Landfill and understood groundwater flow patterns on-site and off-site.	• Predicted effects of Landfill Optimization on Groundwater flow and Quantity both on-site and off-site.	• Applicable regulatory documentation (e.g., Amended TCEC ECAs, MECP guidelines, technical standards, etc.) • Liquid level monitoring data for on-site groundwater monitoring wells and leachate monitoring stations • Historical Hydrogeological studies • Water well records to be reviewed to understand the effect on Groundwater Quantity on-site and off-site as result of off-site water well use in the area • Quarterly and Annual TCEC compliance monitoring reports • Water taking tracking from the Secondary Drainage Layer (SDL) • Proposed facility characteristics • Water well survey within the Off-site Study Area	
Surface Water Environment				
Surface Water Quality	The Landfill Optimization has the potential to	• Predicted effects on Surface Water Quality on-site prior to off-site discharge.	• Applicable regulatory documentation (e.g., Amended TCEC ECAs, MECP guidelines, technical standards, etc.)	**Supporting Document 3-4 – Surface Water Quality Effects Assessment Report**

Table 6-1. Evaluation Criteria, Indicators, and Data Sources

Evaluation Criteria	Rationale	Indicators	Data Sources	Effects Assessment Report
	affect Surface Water Quality through either possible increased erosion of the landfill clayey soil cap or leachate seepage through the landfill cap or track-out of automobile shredder residue (ASR) wastes off-site.	• Erosional effects on TSS and heavy metal concentrations in surface water; and • Leachate seep impacts to Surface Water Quality • Predicted effects from polycyclic aromatic hydrocarbons (PAHs), in ASR, on Surface Water Quality within the roadside ditch of the northbound lane of Nauvoo Road from the TCEC to Hwy 402 in the Off-Site Study Area.	• Landfill Environmental Monitoring Plan (Jagger Hims Limited, 2007) (2007 EMP), and as amended per MECP approval • Surface Water Quality monitoring data at each on-site background, internal, and discharge (compliance) monitoring stations • Provincial Water Quality Monitoring Network (WQMN) • Topographic maps and aerial photos • On-site stormwater management (SWM) system design for the TCEC • Quarterly and Annual TCEC compliance monitoring reports • Leachate generation and management assessments, as outlined in the LMP, (HDR, March 2023) • Proposed facility characteristics • Testing for potential PAH impacts from ASR track-out within the surface water of the roadside ditch along the northbound lane of Nauvoo Road in the Off-Site Study Area	
Surface Water Quantity	Construction of physical works may disrupt natural surface drainage patterns and may alter runoff and peak flows. The presence of the expanded landfill may also affect base flow to surface water.	• Change in runoff volumes and peak flows resulting from steeper and longer side slopes. • Changes to drainage areas on-site and off-site. • Predicted occurrence and degree of off-site effects to surface water flows.	• On-site SWM system design for expanded landfill • Landfill design and operations data • Hydrologic modelling • Annual monitoring reports • Published flow information and hydrology design standards from MECP, MNR, Environment Canada and St. Clair Region Conservation Authority (SCRCA) • Site reconnaissance • Topographic surveys • Air photos • Drainage maps	**Supporting Document 3-5 – Surface Water Quantity Effects Assessment Report**

Table 6-1. Evaluation Criteria, Indicators, and Data Sources

Evaluation Criteria	Rationale	Indicators	Data Sources	Effects Assessment Report
			• Watershed mapping areas including municipal water supply sources within the off-site study area from SCRCA • Typical stream channel geometry within the off-site study area, to the extent accessible • Water well survey within the off-site study area • PTTW records • Liaison with MECP, SCRCA, downstream riparian landowners along Gilliland-Geerts Drain between Nauvoo Road and Underpass Road, Township of Warwick	
Ecological Environment				
Terrestrial Ecosystems	Continued or expanded operation of the waste disposal facility may disturb the functioning of natural terrestrial habitats, including rare, threatened, or endangered species.	• Predicted effects on vegetation communities and species including rare, threatened, or endangered species • Predicted effects on wildlife and wildlife habitat including rare, threatened, or endangered species	• Vegetation and wildlife data, including SAR data from previous studies • Terrestrial field studies • Aerial imagery • Local and Indigenous sources of information on the ecological functions of features within the On-site and Off-site Study Areas • Natural Heritage Reference Manual for Natural Heritage Policies of the Provincial Policy Statement (PPS) (MNR, 2010) • Significant Wildlife Habitat Technical Guide (MNR, 2000) • Significant Wildlife Habitat (Schedule Criteria for Ecoregion 7E (MNRF, 2015a) • Ministry of the Environment, Conservation and Parks (MECP) background data • Ministry of Natural Resources (MNR) background data • St Clair Region Conservation Authority (SCRCA) background data • Natural Heritage Information Centre background data • Ontario Breeding Bird Atlas	**Supporting Document 3-6 – Ecological Environment Effects Assessment Report**

Table 6-1. Evaluation Criteria, Indicators, and Data Sources

Evaluation Criteria	Rationale	Indicators	Data Sources	Effects Assessment Report
			• Ontario Butterfly Atlas • Ontario Reptile and Amphibian Atlas • Ontario Odonata Atlas • Ontario Mammal Atlas • eBird • iNaturalist • Proposed facility characteristics • Landfill design and operations data • Annual monitoring report data • Results of other discipline assessments • Survey protocol for Ontario's Species at Risk Snakes (MNRF, 2016b) • Survey Protocol for Blanding's Turtle in Ontario (MNRF, 2015b) • Blanding's Turtle Nest and Nesting Survey Guidelines (MNRF, 2016a) • Ontario Wetland Evaluation System: Southern Manual (MNRF, 2022)	
Aquatic Ecosystems	Continued or expanded operation of the waste disposal facility may disturb the functioning of direct aquatic habitat features and species, including rare, threatened, or endangered species.	• Predicted effects on aquatic habitat, including fish habitat • Predicted effects on aquatic biota including rare, threatened, or endangered species	• Fish and fish habitat survey data from previous studies • Aquatic field studies • Local and Indigenous sources of information on the ecological functions of features within the On-site and Off-site Study Areas • MNR review letters of previous existing conditions reports • MNR aquatic resource data • Fisheries and Oceans Canada (DFO) Aquatic Species at Risk mapping • Annual monitoring report data • Proposed facility characteristics • Landfill design and operations data • Annual monitoring report data • Results of other discipline assessments • Observations obtained as part of interviews with riparian landowners	**Supporting Document 3-6 – Ecological Environment Effects Assessment Report**

Table 6-1. Evaluation Criteria, Indicators, and Data Sources

Evaluation Criteria	Rationale	Indicators	Data Sources	Effects Assessment Report
Socio-Economic Environment				
Social Environment				
Human Health	Construction and operation activities at a waste disposal site can lead to increased levels of particulates (dust) and related metals in the air.	• Predicted acute and chronic health-based concentration ratios (CR) arising from air concentrations of particulate matter (dust) and related metals at identified sensitive receptor locations within the Study Area. • Frequency of any exceedance of applicable standards, limits, or guidelines at identified receptors.	• Data used in the previous 2005 risk assessment • Available background ambient air data • Ground-level air concentrations modelled by Air Quality team for proposed Preferred Alternative and associated frequency data • Results from Existing Conditions Reports for Air Quality, Surface Water Quality and Hydrogeology • Off-site receptors identified in coordination with other disciplines • Published health-based regulatory benchmarks or toxicity reference values (TRVs) for each contaminant of concern (e.g., WHO, 2021; MECP, 2022; HC, 2021) • WM Annual Monitoring Reports for the TCEC	**Supporting Document 3-7 – Human Health Effects Assessment Report**
	Waste disposal site and associated operations can emit gaseous contaminants that can degrade air quality.	• Predicted acute and chronic health-based CR arising from air concentrations of gaseous contaminants at identified sensitive receptor locations within the Study Area. • Frequency of any exceedance of applicable standards, limits, or guidelines at identified receptors.		
Effects on Local Community	Waste disposal facilities can potentially affect local residents and businesses in the vicinity of the site.	• Number of residents and residences (e.g., receptors) • Number and type of local businesses • Nuisance effects (litter, dust, noise, odour, traffic, visual) • Predicted changes to use and enjoyment of property • Level of satisfaction with living/working in the community • Confidence in TCEC operations	• Mapping and field reconnaissance • Census information and municipal data for Village of Watford and Township of Warwick • Number and nature of nuisance complaints received related to the TCEC (e.g., odour, litter, noise, dust, traffic, visual) • Community survey(s) • Proposed facility characteristics • Results of other discipline assessments	**Supporting Document 3-8 – Socio-Economic Environment Effects Assessment Report**

Table 6-1. Evaluation Criteria, Indicators, and Data Sources

Evaluation Criteria	Rationale	Indicators	Data Sources	Effects Assessment Report
Economic Environment				
Economic Effects on Local Community	The continued operation of the landfill could have economic effects on and/or provide economic benefits to the local community.	• Employment at site (number, type, and duration) • Contributions to the host community • Opportunities for the provision and procurement of products and/or services	• Census and municipal data for Village of Watford and Township of Warwick • Municipal tax information / sources of municipal revenues • WM data on host community fee contributions • WM site employment data • WM data on types and values of goods and services procured • WM data on types and values of goods and services provided • Proposed facility characteristics • Results of other discipline assessments	**Supporting Document 3-8 – Socio-Economic Environment Effects Assessment Report**
Visual Landscape				
Visual Impact of Facility	The contours of the waste disposal facility may affect the visual appeal of the landscape.	• Predicted changes in perceptions of landscape and views.	• Site grading plans • Aerial mapping and field reconnaissance • Proposed facility characteristics • Existing Landfill design and operations data • Regional topographic mapping • Results of other discipline assessments	**Supporting Document 3-9 – Visual Landscape Effects Assessment Report**
Cultural Environment				
Cultural Environment				
Cultural Heritage Resources	Activities related to construction and operation of the landfill may result in direct or indirect effects on identified built heritage resources (BHRs) and cultural heritage	• Proximity of known or potential cultural heritage resources to the landfill (known/potential BHRs and CHLs will be assessed for potential direct or indirect effects). • Direct impacts may include: the destruction of any, or part of any, significant heritage attributes or features; and alteration that is not	• Published data sources • Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes (MCM, 2016) • Ontario Heritage Tool Kit (MCM, 2006) • Commemorative statements • Proposed facility characteristics • Landfill design and operations data • Viewshed analysis	**Supporting Document 3-10 – Cultural Heritage Resources Effects Assessment Report**

Table 6-1. Evaluation Criteria, Indicators, and Data Sources

Evaluation Criteria	Rationale	Indicators	Data Sources	Effects Assessment Report
	landscapes (CHLs).	sympathetic, or is incompatible, with the historic fabric and appearance. • Indirect impacts may include: shadows created that alter the appearance of a heritage attribute or change the viability of a natural feature or plantings, such as a garden; and isolation of a heritage attribute from its surrounding environment, context or a significant relationship; direct or indirect obstruction of significant views or vistas within, from, or of built and natural features; a change in land use such as rezoning a battlefield from open space to residential use, allowing new development or site alteration to fill in the formerly open spaces; and land disturbances such as a change in grade that alters soils, and drainage patterns that adversely affect an archaeological resource.	• Previous EA reports • Municipal Heritage Inventories and Staff Reports • Provincial and Federal Heritage Registers and Inventories • Township of Warwick, MCM, Ontario Heritage Trust, and Walpole Island First Nation (WIFN) consultation • Field survey results • Historical mapping, historical topographical maps and aerial photographs	
Archaeological Resources	Archaeological resources are non-renewable cultural resources that can be destroyed by the construction and operation of a waste disposal facility. Activities related to construction and	• Archaeological resources and areas of archaeological potential on-site and predicted impacts on them • Cemetery property within approximately 10 metres of the proposed impacts	• Published data sources • Standards and Guidelines for Consultant Archaeologists • Ontario Archaeological Sites Database • Ontario Ministry of Citizenship and Multiculturalism (MCM) register of archaeological reports • Existing Stage 1, 2, 3 Archaeological Assessments for the landfill site • Stage 1 property inspection results • Bereavement Authority of Ontario (BAO) Cemetery records, plans and plot maps	**Supporting Document 3-11 – Archaeological Resources Effects Assessment Report**

Table 6-1. Evaluation Criteria, Indicators, and Data Sources

Evaluation Criteria	Rationale	Indicators	Data Sources	Effects Assessment Report
	operation of the landfill may cause negative effects on archaeological sites or areas with archaeological potential.		• Historical mapping, topographical maps and aerial photographs and imagery • Proposed facility characteristics • Landfill design and operations data	
Built Environment				
Transportation				

Traffic Operations	Truck traffic associated with continued operations of the landfill may adversely affect residents, businesses, institutions and movement of farm vehicles in the site vicinity.	• Change in peak hour and daily truck traffic volume and Average Annual Daily Traffic (AADT) along the Off-site Study Area road segments
		• Intersection performance – capacity, delay, queues (based on HCM 2000 and generated by Synchro Traffic Signal Coordination Software Version 11) – for the Off-site Study Area intersections
		• Road safety
		• Collisions per million vehicles at all Off-site Study Area intersections (severity, involving pedestrians, cyclists, autos, trucks, school buses, and agricultural vehicles)
		• Collisions per million vehicle-km along all Off-site Study Area road segments (severity, involving pedestrians, cyclists, autos, trucks, school buses, and agricultural vehicles)
		• Collisions by environmental conditions for segments and intersections
			• Turning Movement Counts
			• Traffic Model
			• Road Safety Assessment
			  • Collision History
			  • Aerials
			  • Land Survey
			  • Stopping and Turning Sight Distance Review
			• Field inventory/investigation: Clear Zone, Conflicts, Visual Obstructions, Signage, Pavement Condition, Linework Condition
				Supporting Document 3-12 – Transportation Effects Assessment Report

Table 6-1. Evaluation Criteria, Indicators, and Data Sources

Evaluation Criteria	Rationale	Indicators	Data Sources	Effects Assessment Report
		• Sight distance at the primary site entrance		
Current and Planned Future Land Use				
Effects on Current and Future Land Uses	The continued operation of the landfill may not be fully compatible with certain current and/or planned future land uses in the Off-site Study Area. Waste disposal facilities can potentially have a negative impact on sensitive land uses, in the vicinity of the site.	• Current land use • Planned land use • Type(s) and proximity of off-site recreational resources within 1 km of a landfill footprint potentially affected • Type(s) and proximity of off-site sensitive land uses as defined by the Provincial Policy Statement (now Provincial Planning Statement) and the MECP D-1 Guidelines (e.g., dwellings, churches, parks) within 1 km of a landfill footprint potentially affected • Type(s) and proximity of agricultural land use/operations (e.g., organic, cash crop, livestock)	• *Planning Act* • Provincial Policy Statement (now Provincial Planning Statement) • All applicable Provincial D-series guidelines, including guidelines D-1, D-1-1, D-1-2 and D-1-3 (Land Use and Compatibility), as well as D-4, D-4-1, D4-2, and D-4-2 (Land Use On or Near Landfills and Dumps) • Lambton County Official Plan (OP) • Township of Warwick OP • Township of Warwick Zoning By-Law 121 of 2012 • Aerial photographic mapping, utilizing the following sources: Lambton County GIS, SCRCA, OMAFRA Agricultural Information Atlas, Google Maps, and Bing Maps • Canadian Lands Inventory mapping • Field reconnaissance • Published data on public recreational facilities/activities • Proposed facility characteristics • Landfill design and operations data • Results of other discipline assessments for this EA, where applicable	**Supporting Document 3-13 – Land Use Effects Assessment Report**

6.1.2 Key Design Considerations and Assumptions

The net effects assessment for each environmental component incorporated key design considerations and assumptions. These considerations and assumptions are outlined in **Section 6.2**.

6.2 Net Effects Assessment

The results of the net effects assessment of the Alternative Methods are described in the sections below, organized by environmental component. The detailed net effects assessments for the environmental components are provided in the corresponding Effects Assessment Reports (**Supporting Document 3**) identified in **Table 4-1**.

6.2.1 Atmospheric Environment

The Atmospheric Environment considers Air Quality (dust, landfill gas [LFG] and combustion by-products, and blowing litter), Odour, and Noise.

6.2.1.1 Air Quality - Dust

The Air Quality – Dust net effects assessment incorporates information from the Air Quality Existing Conditions Report (**Supporting Document 1-1**) and details of the Project design provided in the CDR (**Supporting Document 2**) in order to assess the net environmental effects of the three Alternative Methods. The detailed net effects assessment is provided in the Air Quality Effects Assessment Report (**Supporting Document 3-1**).

To identify the potential effects of the Project on Air Quality – Dust, the conceptual design of each Alternative Method for the landfill optimization was examined to determine if it will have an effect on Air Quality – Dust through changes in:

- Off-site POI air concentrations of PM (dust) compounds at identified receptors in the immediate vicinity of the site, and community;
- Frequency of any exceedances of applicable standards, limits, or guidelines at identified receptors; and
- Number of off-site identified receptors potentially affected.

The key indicator contaminants for Air Quality – Dust are: Total Suspended Particulate (TSP); PM less than 10 µm in diameter (PM_{10}); and PM less than 2.5 µm in diameter ($PM_{2.5}$).

Key indicator contaminants were compared against criteria from O.Reg. 419/05 and/or Ambient Air Quality Criteria (AAQC) where available. In the absence of any MECP criteria, contaminants were compared to Canadian Ambient Air Quality Standards (CAAQS) (MECP, 2009). $PM_{2.5}$ does not have criteria under O.Reg.419/05 or AAQC, so the CAAQS were used for comparison. CAAQS represent regional ambient air quality objectives and are not suitable for comparison for the purpose of facility level compliance. This criterion is only included to provide context for predicted

concentrations of $PM_{2.5}$. A summary of the contaminants for Air Quality – Dust and their applicable criteria are provided in **Table 6-2**.

Table 6-2. Air Quality – Dust Assessment Criteria for Key Indicator Contaminants

Contaminant	Averaging Period	Air Quality Criteria (µg/m³)	Source
Total Suspended Particulate (TSP)	24-hour	120	AAQC & O.Reg. 419/05
	Annual	60	AAQC
PM less than 10 µm in diameter (PM_{10})	24-Hour	50	AAQC
PM less than 2.5 µm in diameter ($PM_{2.5}$)	24-Hour	27[1]	AAQC/CAAQS
	Annual	8.8[2]	CAAQS

Notes:

[1] The 24-hour $PM_{2.5}$ CAAQS criteria is based on the 3-year average of the annual 98th percentile of the daily 24-hour average concentration.

[2] The annual $PM_{2.5}$ CAAQS criteria is based on the 3-year average of the annual average of the daily 24-hour average concentration.

For the Air Quality effects assessment, the general Off-site Study Area was modified to include the area approximately 5 km from the TCEC (**Section 4**, **Figure 4-2**) based on the MECP modelling guidelines for air quality. A total of 25 discrete receptors were identified consisting of 24 residential receptors and the cemetery located at 5606 Nauvoo Rd. These discrete receptors are closest to the landfill area in each compass direction and are expected to provide the worst-case estimate for predicted contaminant concentrations in all directions from the landfill. The changes in predicted contaminant concentrations at each receptor are important indicators for assessment of effects. The receptor locations are shown in **Figure 4-3** (**Section 4**) in relation to the general study areas defined for the EA. Receptors denoted by “R” represent residential receptors and the cemetery is represented by “STR” (Short Term Receptor).

In addition to discrete receptors, a multi-tier receptor grid extending 5 km from the landfill was used in accordance with MECP Guideline A11: “Air Dispersion Modelling Guideline for Ontario” (February 2017) to determine model-predicted ground level concentrations required for developing isopleths for each key indicator contaminant.

Sources of dust from landfill operations considered in the effects assessment are:

- On-site vehicle traffic (on both paved and unpaved roads);
- Idling vehicles;
- Wind erosion of exposed areas;
- Material handling, including waste, soils and daily cover material;
- Bulldozing;
- Combustion sources;

- LFG flares;
- Renewable natural gas (RNG) Facility flares and thermal oxidizers; and
- Emergency generators.

The phasing and schedule of site development determines the location of access roads, construction activities, and landfilling activities. Construction activities include material handling that can generate fugitive dust, such as removal of soil cover prior to waste placement, placement and compaction of waste at the working face, and placement of daily, interim, or final cover. These operations will move around the landfill site over the life of the landfill, and as a result the effects assessment considers three future operational scenarios, which are described within the sections below.

Operating hours define the time of day during which on-site activities may contribute to fugitive dust emissions. While the ECA allows for waste acceptance from 7 a.m. to 7 p.m., Monday to Saturday, and site preparation and closing activities between 6 a.m. to 8 p.m., Monday to Saturday, it is recognized that wind erosion may also generate dust outside of these hours. The effects assessment assumes the arrival of waste delivery vehicles and the operation of on-site equipment during these times.

It was assumed that the maximum annual waste filling rate will remain the same, and therefore site traffic will remain unchanged, so traffic volumes remain consistent with current operations, although the distance travelled will vary depending on on-site access routes. Similarly, it is assumed that site equipment will remain unchanged, so non-road vehicle activity and locations are expected to remain consistent.

Background concentrations, which can represent a significant percentage of the cumulative concentration for some contaminants, were assumed to remain unchanged over the lifespan of the landfill. Similarly, meteorological conditions, including wind speeds and temperatures, which form the basis for dispersion modelling, were assumed to remain unchanged over the lifespan of the landfill. It is noted that localized increases in wind speeds may occur due to the higher waste elevations at the site.

A Dust Best Management Practices Plan (BMPP) is in place at the TCEC, which was designed to minimize dust emissions from landfill operations. The BMPP outlines details on standard operating procedures, mitigation measures, and training to control key operations typically associated with dust emissions. A copy of the Dust BMPP is provided in the Air Quality Effects Assessment Report (**Supporting Document 3-1**). Key control measures outlined in the Dust BMPP include:

- Watering of frequently disturbed or erodible surfaces;
- Watering of roadway surfaces;
- Sweeping of roadways;
- Posting and enforcing paved and unpaved road speed limits;
- Inspection and maintenance of internal and external roadways;
- Development and use of inclement weather areas;

- Ambient monitoring of TSP; and
- Training of relevant staff.

Future Baseline Conditions

Characterization of the Future Baseline Conditions assumed that all currently approved landfill activities were in operation, including the RNG Facility and the leachate treatment facility. Future Baseline Conditions consider landfill operations in the year 2031. The working face and the extension of the southern access haul route were placed towards the northeast corner of the approved footprint of the Expansion Landfill as an approximation of where activity could occur toward the end of landfill Phases 8 and 9.

The modelling results, frequency analysis, and concentration isopleths are provided in the Air Quality Effects Assessment Report (**Supporting Document 3-1**).

Off-Site POI Air Concentrations

Overall, under Future Baseline Conditions, concentrations were predicted to be below their respective criteria for annual TSP, annual $PM_{2.5}$, and 24-hour $PM_{2.5}$ at all discrete receptor locations. Concentrations of 24-hour TSP and 24-hour PM_{10} were predicted to exceed their respective criteria as summarized below.

Frequency of Exceedance of Applicable Criteria

Concentrations of 24-hour TSP were predicted to exceed the applicable criteria of 120 microgram per cubic metre (µg/m³) at receptors R2 through R7 and R9 under Future Baseline Conditions, with the maximum frequency of exceedance being 1.6%, or approximately 6 days per year at R4. The maximum predicted concentration at a sensitive receptor location with background considered was 266 µg/m³.

Concentrations of 24-hour PM_{10} were predicted to exceed applicable criteria of 50 µg/m³ at receptors R2, R3, R4, R7, and R9 under Future Baseline Conditions, with the maximum frequency of exceedance being 0.9%, or approximately 3 days per year at R4. The maximum predicted concentration at a sensitive receptor location with background considered was 99 µg/m³.

Number of Receptors Affected

Under Future Baseline Conditions, a total of seven (7) sensitive receptors were predicted to be affected by the exceedances of 24-hour TSP, while five (5) sensitive receptors were predicted to be affected by the exceedances of 24-hour PM_{10}.

Alternative Methods

The net effects assessment for Air Quality – Dust under all three Alternative Methods is presented in **Table 6-3**.

Since operations will move around the landfill site over the life of the Alternative Methods, the effects assessment considered three future operational stages for each Alternative Method as follows:

- Alternative Method 1:
  - Scenario 1: End of Stage 1, with the working face and extension of the southern access haul route in the northwest corner of the existing landfill footprint;
  - Scenario 2: End of Stage 2, with the working face and extension of the southern access haul route in the northeast corner of the existing landfill footprint; and
  - Scenario 3: End of Stage 5, with the working face and extension of the southern access haul route toward the northeast corner but not as close to the extent of the existing landfill footprint.
- Alternative Method 2:
  - Scenario 1: End of Stage 1, with the working face and extension of the southern access haul route in the northwest corner of the existing landfill footprint;
  - Scenario 2: End of Stage 2, with the working face and extension of the southern access haul route in the northeast corner of the existing landfill footprint; and
  - Scenario 3: End of Stage 4, with the working face and extension of the southern access haul route toward the northeast corner but not as close to the extent of the existing landfill footprint.
- Alternative Method 3:
  - Scenario 1: End of Stage 1, with the working face and extension of the southern access haul route in the northwest corner of the existing landfill footprint.
  - Scenario 2: End of Stage 2, with the working face and extension of the southern access haul route in the northeast corner of the existing landfill footprint.
  - Scenario 3: End of Stage 5, with the working face and extension of the southern access haul route toward the northeast corner but not as close to the extent of the existing landfill footprint.

Modelled operations of LFG flares, boilers, and generators are not expected to change under any of the Alternative Methods, with this equipment assumed to be operating at capacity, and PM emissions associated with combustion sources are expected to remain consistent with Future Baseline Conditions.

Off-Site POI Air Concentrations

Changing the location of the working face and the access haul route for each of the above scenarios is expected to change the predicted concentrations at receptors. In general, when the working face is located near the northeastern or northwestern border of the landfill footprint, there will be an increase in predicted off-site concentrations for receptors to the west and northwest and, to a lesser extent, the northeast. Increased predicted off-site concentrations will be driven by this change in

proximity to receptors; therefore, fugitive and tailpipe emissions associated with haul route traffic, handling emissions associated with daily cover activities, and wind erosion of exposed material at the working face and cap construction are expected to change under each of the Alternative Methods.

Overall, each of the Alternative Methods has the potential to increase off-site concentrations compared to Future Baseline Conditions at discrete receptors to the west and northwest and, to a lesser extent, the northeast as these receptors are brought into closer proximity to the working face and supporting infrastructure during the lifespan of the landfill.

Modelling results are provided for the Preferred Alternative in **Section 8**.

Frequency of Exceedance of Applicable Criteria

As noted above, the Alternative Methods have the potential to increase predicted concentrations of dust at discrete receptors at some points during site operations; therefore, it is expected that the frequency of exceedance at discrete receptors may increase compared to Future Baseline Conditions.

Number of Receptors Affected

As noted above, the Alternative Methods have the potential to increase predicted concentrations of dust at discrete receptors; therefore, it is expected that the number of affected discrete receptors may increase compared to Future Baseline Conditions.

In an effort to reduce the predicted concentrations at discrete receptors, two additional mitigation measures were developed in addition to the implementation of the existing Dust BMPP:

- Replace the existing unpaved south access ramp of the landfill area with a hard surface equivalent to a paved road; and
- Implementation of enhanced watering practices to achieve 95% control along paved haul routes.

In order to achieve 95% control on paved surfaces, one or a combination of the two following control systems will be adopted into the existing Dust BMPP as detailed in **Supporting Document 3-1**:

1. continuous watering of paved road surfaces; and/or
2. an enhanced water truck protocol.

Table 6-3. Air Quality – Dust Net Effects Assessment – Alternative Methods 1, 2, and 3

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Air Quality – Dust	Off-site POI air concentrations of particulate matter (dust) compounds at identified receptors in the immediate vicinity of the site, and community.	• Phasing and schedule of site development determines location of access roads, construction activities, and landfilling activities. • Construction activities include material handling that can generate fugitive dust. • Operating hours define the time of day during which fugitive dust may occur. • Site traffic unchanged, so traffic volumes remain consistent although the distance travelled will vary depending on access routes. • Site equipment unchanged, so nonroad vehicle activity and locations expected to remain consistent. • Compost diversion area and associated material handling activities are considered as permitted in the current ECA. • Background concentrations which can represent a significant percentage of the cumulative concentration for some contaminants are assumed to remain unchanged over the lifespan of the proposed landfill expansion. • Meteorological conditions, including wind speeds and temperatures, which form the basis for dispersion modelling are assumed to remain unchanged over the lifespan of the proposed landfill expansion.	• Predicted concentrations of dust contaminants may exceed criteria at discrete receptor locations	• Replace the existing unpaved south access ramp of the landfill area with a hard surface equivalent to a paved road. • Implementation of enhanced watering practices to achieve 95% control along paved haul routes.	• None. With the application of mitigation strategies, predicted concentrations at discrete receptors are expected to decrease to levels similar to Future Baseline Conditions.
	Frequency of any exceedance of applicable standards, limits, or guidelines at identified receptors.		• Frequency of predicted exceedances at discrete receptors may increase.		• None. With the application of mitigation strategies, the frequencies of predicted exceedance at discrete receptors are expected to decrease to levels similar to Future Baseline Conditions.
	Number of off-site identified receptors potentially affected (e.g., residential properties, public facilities, businesses/farms, institutions).		• The number of discrete receptors with predicted concentrations exceeding criteria may increase.		• None. With the application of mitigation strategies, the number of off-site receptors potentially affected are expected to decrease to quantities similar to Future Baseline Conditions.

6.2.1.2 Air Quality – Landfill Gas and Combustion By-Products

The Air Quality – Landfill Gas and Combustion By-Products net effects assessment incorporates information from the Air Quality Existing Conditions Report (**Supporting Document 1-1**) and details of the Project design provided in the CDR (**Supporting Document 2**) in order to assess the net environmental effects of the three Alternative Methods. The detailed net effects assessment is provided in the Air Quality Effects Assessment Report (**Supporting Document 3-1**).

To identify the potential effects of the Project on Air Quality – Landfill Gas and Combustion By-Products, the conceptual design of each Alternative Method for the landfill optimization was examined to determine if it will have an effect on Air Quality – Landfill Gas and Combustion By-Products through changes in:

- Off-site POI air concentrations of indicator compounds at identified receptors in the immediate vicinity of the site, and community;
- Frequency of any exceedance of applicable standards, limits, or guidelines at identified receptors; and
- Number of off-site identified receptors potentially affected.

The key indicator contaminants for Air Quality – Landfill Gas and Combustion By-Products are: Vinyl Chloride (CAS# 75-01-4); Benzene (CAS# 71-43-2); 1,2-Dichloroethane (CAS# 107-06-2); Total Reduced Sulphurs (TRS); Hydrogen Sulphide (H2S) (CAS# 7783-06-4); Ammonia; (CAS# 7664-41-7); Nitrogen Oxides (NOx) / Nitrogen Dioxide (NO2) (CAS# 10102-44-0); Dioxins and Furans (D&F as toxic equivalency (TEQ)); and Sulphur Dioxide (SO2) (CAS# 7446-09-5). A summary of the contaminants for Air Quality – Landfill Gas and Combustion By-Products and their applicable criteria are provided in **Table 6-4**.

Table 6-4. Air Quality – Landfill Gas and Combustion By-Products Assessment Criteria for Key Indicator Contaminants

Contaminant	Averaging Period	Air Quality Criteria (µg/m³)	Source
Vinyl Chloride	24-hour	1.0	AAQC & O.Reg. 419/05
	Annual	0.2	AAQC
Benzene	24-hour	2.3	AAQC
	Annual	0.45	AAQC & O.Reg. 419/05
1,2-Dichloroethane	24-hour	2	AAQC & O.Reg. 419/05
	Annual	0.4	AAQC
Ammonia	24-hour	100	AAQC
Hydrogen Sulphide (H_2S)	10-minute	13	AAQC & O.Reg. 419/05
	24-hour	7	AAQC & O.Reg. 419/05
Total Reduced Sulphurs (TRS)	10-minute	13	AAQC & O.Reg. 419/05
	24-hour	7	AAQC & O.Reg. 419/05

Contaminant	Averaging Period	Air Quality Criteria (µg/m³)	Source
Dioxins and Furans (D&F)	24-hour	0.1 pg TEQ/m³	AAQC
Nitrogen Oxides/Nitrogen Dioxides (NO_X/NO_2)	1-hour	400	AAQC & O.Reg. 419/05
	24-hour	200	AAQC & O.Reg. 419/05
Sulphur Dioxide (SO_2)	1-hour	100	AAQC & O.Reg. 419/05
	Annual	10	AAQC & O.Reg. 419/05

Of these contaminants, D&F, NO_X/NO_2, and SO_2 are related to combustion, while the remainder are related to LFG.

For the effects assessment of Air Quality – Landfill Gas and Combustion By-Products, the same receptors and study areas outlined in **Section 6.2.1.1** apply.

Sources of LFG and combustion by-products considered in the effects assessment are:

- Fugitive emissions of LFG through the surface of the landfill, through both final cap and interim cover areas;
- Volatile Organic Compounds (VOCs) and ammonia from the leachate collection and treatment system;
- VOCs from contaminated soils;
- Uncombusted LFG compounds emitted from the landfill flares;
- Uncombusted LFG compounds emitted from the RNG facility thermal oxidizers and flares; and
- Tailpipe emissions from mobile equipment.

The assumptions outlined in **Section 6.2.1.1** apply to the effects assessment. In addition, it was assumed that the time constant, percent degradable organic carbon, and other parameters that define the rate of LFG generation will not change during the lifespan of the Project. Details of LFG generation, collection, and treatment are provided in **Supporting Document 2**.

Future Baseline Conditions

Characterization of the Future Baseline Conditions assumed that all currently approved landfill activities were in operation, including the RNG Facility and the leachate treatment facility. Future Baseline Conditions consider landfill operations in the year 2031.

The modelling results and frequency analysis are provided in the Air Quality Effects Assessment Report (**Supporting Document 3-1**). Since predicted concentrations without background for all LFG contaminants (benzene, vinyl chloride, 1,2-dichloroethane, H_2S and TRS) are below 10% of their criteria, isopleths for LFG contaminants are not provided.

Off-Site POI Air Concentrations

Benzene, vinyl chloride, 1,2-dichloroethane, ammonia, SO_2, NO_x, and D&F are predicted to be below their applicable criteria at all off-site locations with background included. Predicted concentrations of H_2S are below applicable criteria at all discrete receptors for its 24-hour averaging period criteria. Ten-minute averaging period H_2S, 10-minute TRS, and 24-hour TRS are predicted to exceed applicable criteria with background included; however, these elevated concentrations are the result of high background concentrations with very little contribution coming from landfill activities.

Predicted concentrations of H_2S for the 10-minute averaging period exceed the applicable criteria due to elevated background concentrations, and cumulative concentrations are dominated by elevated background concentrations. The maximum landfill contribution to the predicted POI occurs at receptor STR1 with a predicted concentration of 0.8 µg/m³ or 5.9% of the criteria, which accounts for approximately 3.3% of the predicted cumulative concentration.

Predicted concentrations of TRS for the 10-minute and 24-hour averaging periods exceed the applicable criteria, and cumulative concentrations are dominated by elevated background concentrations. For the 10-minute TRS averaging period, the maximum contribution to the predicted POI occurs at receptor R4 with a predicted concentration of 1.2 µg/m³ or 9.0% of the criteria, which accounts for approximately 2.6% of the predicted cumulative concentration. For the 24-hour TRS averaging period, the maximum contribution to predicted POI at a discrete receptor occurs at R9 with a concentration of 0.15 µg/m³ or 2.2% of the criteria, which accounts for approximately 1.4% of the predicted cumulative concentration.

Frequency of Exceedance of Applicable Criteria

Background concentrations for 10-minute H_2S as well as 10-minute and 24-hour TRS were above the applicable criteria on their own, and modelled contributions from the landfill were relatively small compared to background; consequently, no frequencies of exceedance due to landfill contributions were calculated.

Number of Receptors Affected

Since background concentrations for 10-minute H_2S, and 10-minute and 24-hour TRS were above the applicable criteria, all receptors were affected.

Alternative Methods

The net effects assessment for Air Quality – Landfill Gas and Combustion By-Products under all three Alternative Methods is presented in **Table 6-5**.

The LFG collection system as described in **Supporting Document 2** has a collection efficiency of approximately 75% for areas without final cover and 90% for areas with final cover. This is higher than was assumed for Future Baseline Conditions due to the implementation of early vertical gas wells and a 1.85-m-thick layer of clay in the final cover. Therefore, off-site concentrations of contaminants from LFG may decrease.

Modelled operations of LFG flares, boilers, and generators are not expected to change under any of the Alternative Methods, with this equipment assumed to be operating at capacity, and PM emissions associated with combustion sources are expected to remain consistent with Future Baseline Conditions.

Off-Site POI Air Concentrations

Overall, the Alternative Methods may increase off-site concentrations compared to Future Baseline Conditions at discrete receptors due to increased annual production of LFG over the lifespan of the landfill, although this may be offset by the increased LFG capture efficiency due to improvements in the LFG capture system as noted in the CDR. Overall, no net effects from LFG and Combustion By-Products are expected.

Frequency of Exceedance of Applicable Criteria

As noted above, the Alternative Methods have the potential to change predicted concentrations of LFG and combustion by-products at discrete receptors; however, the model predicted concentrations were dominated by the ambient background concentrations under Future Baseline Conditions, and this is expected to continue for the Alternative Methods. Therefore, it is expected that the frequency of exceedance at discrete receptors will not change compared to Future Baseline Conditions.

Number of Receptors Affected

As noted above, the model predicted concentrations were dominated by the ambient background concentrations under Future Baseline Conditions, and this is expected to continue for the Alternative Methods; therefore, it is expected that the number of discrete receptors affected will not change compared to Future Baseline Conditions.

Table 6-5. Air Quality – Landfill Gas and Combustion By-Products Net Effects Assessment – Alternative Methods 1, 2, and 3

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Air Quality – Landfill Gas and Combustion By-Products	Off-site POI air concentrations of indicator compounds at identified receptors in the immediate vicinity of the site, and community (within 5 km).	• Annual waste filling rate / total additional tonnage determines the annual production of LFG. • Phasing and schedule of site development determines location of landfilling activity at the working face. • LFG generation is expected to increase during the operational life of the landfill and peak at closure. • LFG collection and treatment is expected to expand progressively as landfilling activity evolves. • LFG estimation parameters are based on the composition of municipal solid waste which is assumed to remain unchanged over the lifespan of the proposed landfill expansion. • Discrete receptors are assumed to be unchanged over the lifespan of the proposed landfill expansion. • Background concentrations which can represent a significant percentage of the cumulative concentration for some contaminants are assumed to remain unchanged over the lifespan of the proposed landfill expansion. • Meteorological conditions, including wind speeds and temperatures, which form the basis for dispersion modelling are assumed to remain unchanged over the lifespan of the proposed landfill expansion.	• None	• None	• None
	Frequency of any exceedance of applicable standards, limits, or guidelines at identified receptors.		• None	• None	• None
	Number of off-site receptors potentially affected (e.g., residential properties, public facilities, businesses/farms, institutions).		• None	• None	• None

6.2.1.3 Air Quality – Blowing Litter

The Air Quality – Blowing Litter net effects assessment incorporates information from the Air Quality Existing Conditions Report (**Supporting Document 1-1**) and details of the Project design provided in the CDR (**Supporting Document 2**) in order to assess the net environmental effects of the three Alternative Methods. The detailed net effects assessment is provided in the Air Quality Effects Assessment Report (**Supporting Document 3-1**).

To identify the potential effects of the Project on Air Quality – Blowing Litter, the conceptual design of each Alternative Method for the landfill optimization was examined to determine if it will have an effect on Air Quality – Blowing Litter through changes in the extent of zones potentially impacted by blowing litter; and the number of off-site identified receptors potentially affected.

Litter typically consists of loose, lightweight materials that can be picked up by the wind such as paper products, empty plastic bags, and cardboard. These materials are commonly found at the active face where freshly deposited waste is exposed to the wind. The effects on Air Quality – Blowing Litter were assessed qualitatively as there are no applicable criteria. The assumptions outlined in **Section 6.2.1.1** apply to the effects assessment. Control of wind-blown litter at the working face is managed using the Litter BMPP, the details of which are provided in the Air Quality Existing Conditions Report (**Supporting Document 1-1**).

Background data indicates that potential blowing litter impacts are expected to occur within 500 m of the landfill and to a lesser degree limited to within 1 km. Five (5) rural residences and the cemetery are located within 500 m of the landfill. Between 500 m and 1 km of the landfill, there are 12 discrete receptors; however, only R3, R5 and R6 are located in the predominant wind direction.

Future Baseline Conditions

Under Future Baseline Conditions, high winds that could potentially cause litter to blow toward the five (5) rural residences are expected to occur infrequently, less than 2% of the time or approximately 7 days per year.

WM has installed permanent litter fences along the northern property boundary which provide additional control, further reducing the potential litter effects. Portable wind fences are also utilized at the active face to assist in reducing the potential for wind-blown litter.

Extent of Zones Potentially Impacted

Between a distance of 500 m and 1 km there are 12 discrete receptors; however, only R3, R5, and R6 are located in the predominant wind direction. Given the separation distance, the impact in the area is expected to be low. Thus, the potential for litter effects at these receptors is expected to be low. Other residences in the area are farther than 1 km from the proposed landfill and have little or no potential for blowing litter impacts.

Even with litter controls in place, litter events do occur from time to time. In order to ensure a thorough and rapid response, the Litter BMPP includes a protocol to dispatch a site crew to the impacted zone for cleanup. This protocol extends to adjacent properties as well as main roadways and is expected to sufficiently manage the potential for blowing litter.

Wind speeds increase at higher elevations; however, it is important to note that current landfilling operations already occur above grade and are operating in higher wind speed conditions. Although landfilling operations at higher elevations will be exposed to higher wind speeds, the magnitude of the change in frequency of potential litter events is not expected to be substantial. Overall, current litter control practices are expected to effectively handle the potential for wind-blown litter. As operations continue at higher elevations, the potential for wind-blown litter will continue to be evaluated by the operators, and the litter control practices adjusted as needed.

Number of Receptors Affected

Receptors R2 and R4 are located to the northeast of the landfill in the predominant wind direction; despite this, the probability for winds greater than the thresholds for litter are 5% of the time, or 18 days per year. Receptors R7, R9, and STR1 are located to the west/southwest of the landfill site. These receptors are not located in the predominant wind direction, the frequency of winds exceeding the litter thresholds are predicted to range from <1% to 3% of the time, or less than 11 days per year. Therefore, based on a combination of the frequency of winds and the litter controls in place, the potential for litter impacts at the receptors within 500 m of the landfill is low.

Alternative Methods

The net effects assessment for Air Quality – Blowing Litter under all three Alternative Methods is presented in **Table 6-6**.

Extent of Zones Potentially Impacted

Potential blowing litter zones were established for Future Baseline Conditions based on distance from the landfill perimeter. Since the landfill footprint remains the same between the Alternative Methods and Future Baseline Conditions, there is no change to the zones potentially impacted by blowing litter.

Number of Receptors Affected

The meteorological data used for Future Baseline Conditions to determine the number and location of off-site receptors potentially affected by blowing litter is assumed to be unchanged for the Alternative Methods. The increase in height proposed for the Alternative Methods may increase the potential for higher wind speeds at the landfill's working face, and this may increase the frequency of potential litter events; however, continuation of the current litter management practices would continue to manage blowing litter effectively. Therefore, it is expected that the number of receptors affected will not change compared to Future Baseline Conditions.

Table 6-6. Air Quality – Blowing Litter Net Effects Assessment – Alternative Methods 1, 2, and 3

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Air Quality – Blowing Litter	Extent of zones potentially impacted by blowing litter.	• Landfill footprint is unchanged, so the distance to receptors and the extent of each litter zone remain the same. • Existing Management using litter fencing • Positioning of mobile wind screens • Application of daily cover	• None	• None	• None
	Number of off-site receptors potentially affected (e.g., residential properties, public facilities, businesses/farms odour sensitive area(s), institutions).	• Discrete receptors unchanged so the number of receptors and their locations in the existing litter zones remain the same. • Meteorological conditions remain unchanged with no significant increase in wind speed over the lifespan of the proposed landfill expansion.	• None	• None	• None

6.2.1.4 Odour

The Odour net effects assessment incorporates information from the Air Quality Existing Conditions Report (**Supporting Document 1-1**) and details of the Project design provided in the CDR (**Supporting Document 2**) in order to assess the net environmental effects of the three Alternative Methods. The detailed net effects assessment is provided in the Air Quality Effects Assessment Report (**Supporting Document 3-1**).

To identify the potential effects of the Project on Odour, the conceptual design of each Alternative Method for the landfill optimization was examined to determine if it will have an effect on Odour through changes in:

- Off-site odour concentrations (odour units) at identified odour sensitive receptors in the immediate vicinity of the site;
- Frequency of any odour levels above defined odour benchmarks; and
- Number of off-site identified receptors potentially affected.

Odour was assessed at identified odour sensitive receptors using dispersion modelling in odour units per cubic metre (OU/m³). An odour unit (OU) is defined as the quantity of odourous substance that, when dispersed in 1 m³ of odour free air, becomes just detectable by a "normal" human observer. Odour does not have any applicable standards or guidelines, instead odour was compared to the MECP guidance document, "Methodology for Modelling Assessments of Contaminants with 10-Minute Average Standards and Guidelines under O.Reg. 419/05" (MECP, 2016d). This guidance document indicates that odour concentrations that are greater than 1 OU/m³ are considered acceptable at sensitive receptor locations, as long as the frequency of exceedance is less than 0.5% of the time. The average odour detection threshold is 1 OU/m³, although odours at this level are not necessarily a nuisance. Odour concentrations that may cause a complaint typically range from 3 to 5 OU/m³.

For the effects assessment of Odour, the same receptors and study areas outlined in **Section 6.2.1.1** apply. Sources of odour from landfill operations considered in the effects assessment are:

- LFG and waste odours from the landfill and waste acceptance activities: active face, interim cover areas;
- Leachate odours from the leachate collection, storage, and treatment system; and,
- Hydrocarbon odours from contaminated soils.

An Odour BMPP was designed to minimize odour emissions from landfill operations. The BMPP outlines details on standard operating procedures, mitigation measures, and training to control key operations typically associated with odour emissions. Key control measures outlined in the Odour BMPP include:

- Screening of incoming loads to identify highly odourous loads and applying cover material immediately once placed in the active face;

- Applying a minimum of 0.15 m of daily cover or an alternative cover system to the active face on a daily basis;
- When required, applying tear resistant tarping capable of odour and vapour suppression to the active face (when daily cover is unavailable);
- Providing interim cover areas with 0.3 m of interim cover, graded to promote precipitation run-off;
- Including 2.0 m of material in the final cap;
- Installing and maintaining an LFG collection system;
- Destruction of LFG through LFG and RNG flares;
- Completion of “walkabouts” using total hydrocarbon (THC) analyzers by trained employees to identify odourous areas;
- Routine inspection of interim and final cap areas to ensure damage or erosion areas can be remediated as soon as possible; and
- Training of relevant staff.

Future Baseline Conditions

For the purposes of the effects assessment, the predicted site-wide odours from TCEC operations were compared to both the 1 OU/m³ detection threshold and the 3 OU/m³ recognition and 5 OU/m³ annoyance thresholds. The working face and the extension of the southern access haul route were placed towards the northeast corner of the approved landfill footprint as an approximation of where activity could occur toward the end of Expansion Landfill Phase 8 and 9.

The modelling results, frequency analysis, and concentration isopleth are provided in the Air Quality Effects Assessment Report (**Supporting Document 3-1**).

Predicted Off-site Odour Concentrations

The maximum predicted concentrations at all receptors are predicted to exceed the MECP odour guideline objective of 1 OU/m³ under Future Baseline Conditions. Exceedances of 3 OU/m³ were predicted at two receptors, R2 and R4 under Future Baseline Conditions. No exceedances of 5 OU/m³ were predicted at any of the receptors.

Frequency of Odour Levels Above Defined Odour Benchmarks

Exceedances of the 1 OU/m³ guideline under Future Baseline Conditions were predicted to occur at a frequency greater than 0.5% of the time at receptors R2 through R7. The highest overall frequency of exceedance of 1 OU/m³ is 1% or approximately 84 hours per year which is predicted at R4 and R7.

Exceedances of the 3 OU/m³ recognition threshold under Future Baseline Conditions were predicted to occur less than 0.5% of the time at receptors R2 and R4. The highest

overall frequency of exceedance of 3 OU/m³ is 0.01% or approximately 1 hour per year which is predicted at R4.

Number of Receptors Affected

Exceedances of the 1 OU/m³ guideline at a frequency greater than 0.5% of the time is predicted to occur at receptors R2 through R7 (i.e., 6 receptors affected).

Exceedances of 3 OU/m³ were predicted at two receptors, R2 and R4; however, the frequency of exceedance is less than 0.5% of the time.

No exceedances of 5 OU/m³ were predicted at any of the receptors.

Alternative Methods

The net effects assessment under all three Alternative Methods is presented in **Table 6-7**.

Operations will move around the landfill site over the life of the landfill, and the effects assessment considered three future operational stages for each Alternative Method as discussed in **Section 6.2.1.1**, with the working face moving in closer proximity to receptors in the west, northwest, and northeast at different times.

Predicted Off-site Odour Concentrations

The activities at the working face and emissions of LFG can be a source of odour; therefore, it is expected that off-site odour concentrations at discrete receptors may increase compared to the Future Baseline Conditions due to the closer proximity of the working face to discrete receptors and increases in LFG emissions.

Frequency of Odour Levels Above Defined Odour Benchmarks

As stated above, the Alternative Methods have the potential to increase predicted concentrations of odour at discrete receptors; therefore, it is expected that the frequency of exceedance at discrete receptors may increase compared to Future Baseline Conditions.

Number of Receptors Affected

As stated above, the Alternative Methods have the potential to increase predicted concentrations of odour at discrete receptors; therefore, it is expected that the number of affected discrete receptors may increase compared to Future Baseline Conditions.

Table 6-7. Odour Net Effects Assessment – Alternative Methods 1, 2, and 3

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Odour	Off-site odour concentrations (OUs) at identified odour sensitive receptors in the immediate vicinity of the site.	• Phasing and schedule of site development determines location of landfilling activity at the working face, and the areas that may be under interim or final cover. • LFG collection and treatment is expected to expand progressively as landfilling activity evolves. • LFG estimation parameters are based on the composition of municipal solid waste which is assumed to remain unchanged over the lifespan of the proposed landfill expansion. • Discrete receptors are assumed to be unchanged over the lifespan of the proposed landfill expansion. • Meteorological conditions, including wind speeds and temperatures, which form the basis for dispersion modelling are assumed to remain unchanged over the lifespan of the proposed landfill expansion.	• Predicted odour concentrations may exceed criteria at discrete receptor locations	• None	• Predicted odour concentrations may exceed criteria at discrete receptor locations
	Frequency of any odour levels above defined odour benchmarks.		• Frequency of odour levels above defined odour benchmarks may increase.	• None	• Frequency of odour levels above defined odour benchmarks may increase.
	Number of off-site receptors potentially affected (e.g., residential properties, public facilities, businesses/farms odour sensitive area(s), institutions).		• The number of discrete receptors with predicted odour concentrations exceeding criteria may increase.	• None	• The number of discrete receptors with predicted odour concentrations exceeding criteria may increase.

6.2.1.5 Noise

The Noise net effects assessment incorporates information from the Noise Existing Conditions Report (**Supporting Document 1-2**) and details of the Project design provided in the CDR (**Supporting Document 2**) in order to assess the net environmental effects of the three Alternative Methods. The detailed net effects assessment is provided in the Noise Effects Assessment Report (**Supporting Document 3-2**).

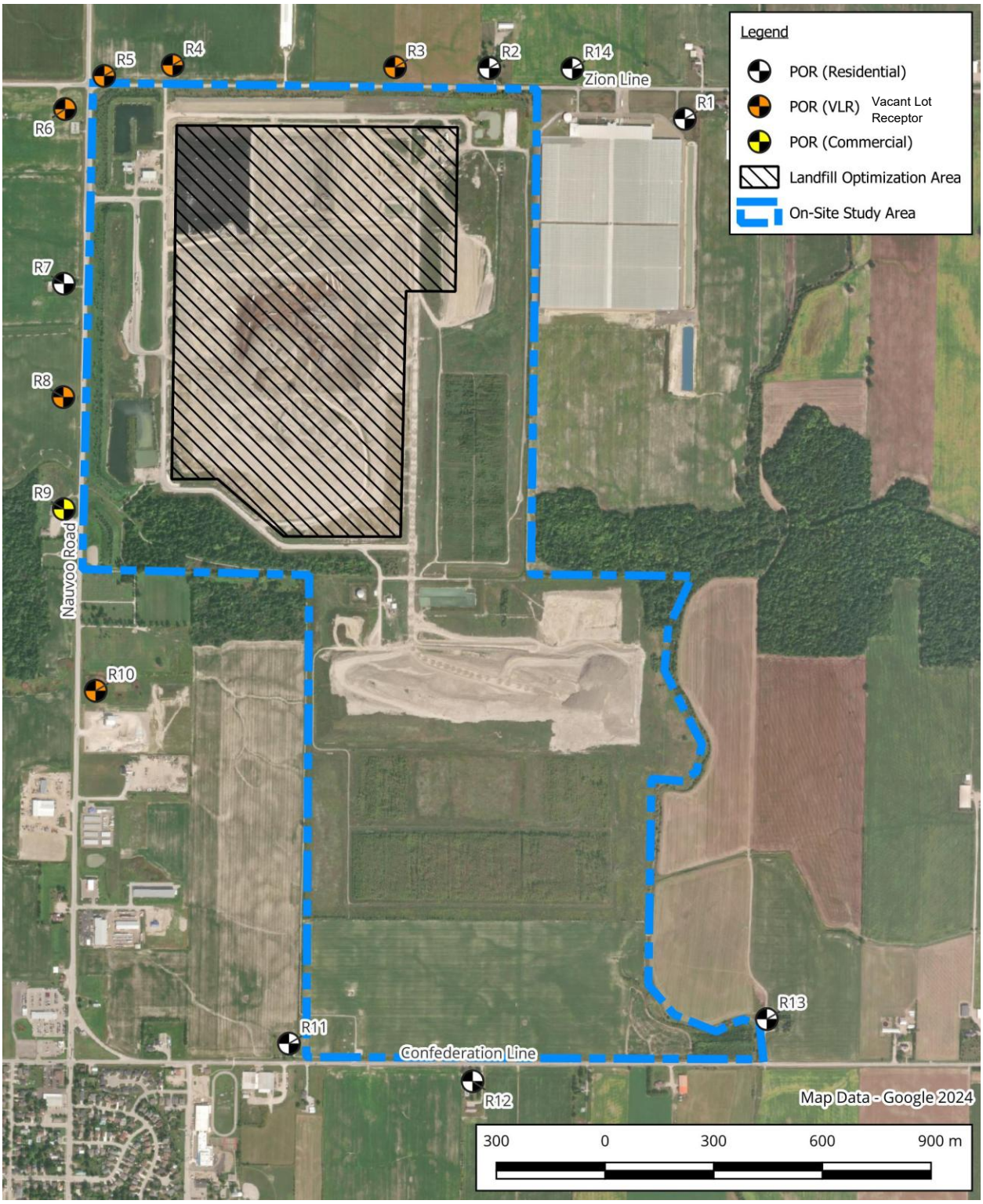
Activities related to construction/rehabilitation, operation of the landfill, and ancillary sources, and the off-site haul route can result in an increase in off-site noise levels. Noise effects were assessed through changes to predicted site-related noise levels (measured in dBA or dBAI), and change in sound levels (dB). Sources of landfilling and construction noise include the use of construction equipment and conveyances. Ancillary facilities include the public waste drop-off, generators used for non-emergency purposes, flares, and the RNG Facility. Emergency sources of noise include the emergency generators. Pest control devices relevant to noise can include a propane cannon, and pyrotechnics described as bangers, crackers, whistlers and screamers.

The MECP specifies different noise guidelines based on the type of noise source. The applicable sound level limit for existing landfilling activities and pest control devices are provided in the MECP Noise Guidelines for Landfill Sites (Landfill Noise Guidelines) (MOE, 1998), while the sound level limits that will be applicable for ancillary activities are provided in MECP Publication NPC-300: Environmental Noise Guideline - Stationary and Transportation Sources - Approval and Planning (MOE, 2013). Where background ambient sound levels are elevated due to sources such as road traffic, higher limits that match the elevated background sound levels can be used.

For the Noise effects assessment, the general Off-site Study Area was modified to incorporate the area within 1 km of the primary haul route between Highway 402 and the TCEC site entrance (**Section 4**, **Figure 4-7**). Critical Points of Reception (PORs) for Noise were selected in accordance with guidance included in NPC-300. The key representative locations are shown on **Figure 6-2**. These 14 PORs are a mixture of homes and vacant lot receptors that will have the greatest potential impact from the landfill, being all located adjacent to the On-Site Study Area within the Off-site Study Area. In accordance with NPC-300, all POR locations were identified as having a Class 2 acoustic environment.

The POR locations were modelled at two heights, 1.5 m and 4.5 m, which represent single and two storey structures respectively. The two heights are not applicable to all PORs considered, such as R1, R7, R11 and R14 which are single storey homes and only have results presented at 1.5 m.

Figure 6-2. Key Representative Noise-Sensitive POR Locations



Details of the modelling and assumptions included in the Noise effects assessment are provided in **Supporting Document 3-2**. Background sound was modelled using ORNAMENT (MOE, 1998) following the requirements of Publication NPC-206 Sound Levels Due to Road Traffic (MOE, 1995). The background road traffic noise includes only the contribution of vehicles from non-landfilling activities. The haul route traffic was not included in the traffic noise modelling for background sound. It was assumed that there would be no changes to the types and quantities of mobile equipment, haul trucks, haul routes, operating hours, emergency sources, or pest control devices.

Future Baseline Conditions

Future baseline noise conditions for identified PORs were determined by examining the surrounding Project area and considering known and quantifiable future noise sources. The two main primary drivers for future baseline noise are as follows:

- traffic volumes unrelated to the Project (future background traffic); and
- existing ancillary sources of the landfill which will remain in operation.

Predicted Site-Related Noise Levels

The predicted future baseline sound levels and the contributions from the existing and approved ancillary sources are provided in **Table 6-8**. Noise from the ancillary sources were found to comply with NPC-300 stationary sound level limits at all identified PORs for the standard Class 2 limits. All predicted future ambient sound levels meet landfilling and stationary source noise guidelines. Ancillary noise levels are generally also compliant with the Class 3 nighttime exclusion limits, with the exception of receptor R10, located east of Nauvoo Road, where the predicted levels exceed the applicable limit by 2 dB. Accordingly, it is anticipated that ancillary noise would meet Class 3 exclusion limits at all receptors situated west of Nauvoo Road, where ambient sound levels drop below the exclusion criteria.

Table 6-8. Predicted Cumulative Traffic / Landfill Sound Levels for Future Baseline Conditions

POR	Future Daytime (07:00 - 19:00) Background Sound Level Due to Traffic [1] (dBA)		Existing Ancillary Sources [2] (1.5 m / 4.5 m)	Future Daytime (07:00 - 19:00) Cumulative Sound Level Due to Traffic and TCEC Ancillary Sources [3] (dBA)	
	Current (1.5 m / 4.5 m)	2032 (1.5 m / 4.5 m)		Current (1.5 m / 4.5 m)	2032 (1.5 m / 4.5 m)
R1[4]	37 / -	37 / -	31 / -	38 / -	38 / -
R2	40 / 41	41 / 41	32 / 33	41 / 42	41 / 42
R3	41 / 41	41 / 42	30 / 32	41 / 42	41 / 42
R4	45 / 46	46 / 47	31 / 33	46 / 47	47 / 48
R5	57 / 57	58 / 59	29 / 34	57 / 58	58 / 59
R6	53 / 54	55 / 55	32 / 34	53 / 54	55 / 56
R7[4]	54 / -	56 / -	35 / -	54 / -	56 / -
R8	55 / 55	56 / 57	37 / 39	55 / 56	56 / 57
R9	56 / 57	57 / 58	38 / 39	56 / 57	57 / 58
R10	55 / 56	57 / 57	40 / 42	55 / 56	57 / 57
R11[4]	47 / -	48 / -	32 / -	47 / -	48 / -
R12	46 / 47	47 / 47	32 / 32	46 / 47	47 / 47
R13	40 / 41	41 / 42	30 / 31	41 / 41	41 / 42
R14[4]	43 / -	40 / -	32 / -	43 / -	41 / -

Notes:

[1] Based on lowest hour non-landfill related traffic provided by HDR. Modelled in ORNAMENT.

[2] The Project Stationary sources including flares and RNG facility along with the leachate treatment facility which will remain in operation for each alternative and the 'Do Nothing' alternative.

[3] Future baseline conditions are the logarithmic sum of the calculated background ambient sound levels from non-landfill related road traffic and landfill stationary source contributions. Representative of the future 'Do Nothing' alternative.

[4] POR is a single storey residence. Only the 1.5 m reception point is presented

Alternative Method 1

The net effects assessment for Alternative Method 1 is presented in **Table 6-9**.

Predicted Site-Related Noise Levels

The reintroduction of landfilling equipment near the perimeter of the landfill under Alternative Method 1 poses the greatest potential for increased off-site noise, especially along the west and north boundaries where nearby PORs may experience noise levels that exceed daytime guidelines. Alternative Method 1 has the greatest potential for increased off-site noise due to landfilling sources because the modifications to the existing side slope extend to the landfill limits and Alternative Method 1 has the least separation distance between landfilling noise sources and the PORs.

Although Alternative Method 1 has a more gradual slope (3H:1V) than the other Alternative Methods, its slope redevelopment begins at the landfill limit. As a result, Alternative Method 1 maintains a higher ground elevation for at least the first 100 m from the perimeter. This relatively higher elevation near the perimeter makes mitigating potential noise exceedances more challenging.

Mitigation measures are to either construct temporary operational berms or limit the amount of equipment near the perimeter of the landfill. The operational berms from the 2005 EA were recommended to be 4 m in height and were required when working along the perimeter of the landfill. Similar berm mitigations would be required for Alternative Method 1 to result in no net effects by meeting daytime landfilling guideline limits.

Change in Sound Levels

The greatest potential change in off-site noise levels is the reintroduction of landfilling equipment along the perimeter of the approved landfill extents. Changes in sound levels will be driven proportionally by the impacts of off-site noise levels for Alternative Method 1.

Table 6-9. Noise Net Effects Assessment – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Noise	• Predicted site-related noise levels (measured in dBA or dBAI) • Changes in sound levels (dB)	• Landfilling equipment working the perimeter of the landfill potentially increasing off-site noise levels. • The quantity of haul trucks arriving at the Project will remain approximately the same. On-site hauling volumes represent the greatest number of vehicles in any given hour. • The on-site traffic to the working face will follow the same starting route, entering the landfill from Nauvoo Road, proceeding to the scale facility. • Operating hours for the receiving of waste and on-site hauling will not change.	• Noise level may exceed applicable landfilling noise guidelines during daytime hours • Changes in Sound Levels may be rated as significant	• Construction of localized berms along the perimeter of the landfill. • Limit the number of active equipment near the perimeter of the landfill	• Landfill and construction equipment will be positioned significantly closer to the site perimeter and at marginally higher ground elevations compared to other Alternative Methods, resulting in a comparatively greater impact at the nearest POR. Noise levels to meet applicable landfilling noise guidelines during daytime hours, with considerable mitigation measures.

Alternative Method 2

The net effects assessment for Alternative Method 2 is presented in **Table 6-10**.

Predicted Site-Related Noise Levels

The reintroduction of landfilling equipment near the perimeter of the landfill under Alternative Method 2 poses the greatest potential for increased off-site noise, especially along the west and north boundaries where nearby PORs may experience noise levels that exceed daytime guidelines. The modifications to the existing side slope begin approximately 50 m inside the landfill limits, offering additional separation distance between landfilling noise sources and the PORs.

Although Alternative Method 2 has a steeper slope (2.5H:1V) than Alternative Method 1, the lower ground elevation near the perimeter makes mitigating potential noise exceedances less challenging.

Mitigation measures are to either construct temporary operational berms or limit the amount of equipment near the perimeter of the landfill. The operational berms from the 2005 EA were recommended to be 4 m in height and were required when working along the perimeter of the landfill. Similar mitigations would be required for Alternative Method 2 to result in no net effects by meeting daytime landfilling guideline limits.

Change in Sound Levels

The greatest potential change in off-site noise levels is the reintroduction of landfilling equipment along the perimeter of the approved landfill extents. Changes in sound levels will be driven proportionally by the impacts of off-site noise levels for Alternative Method 2.

Table 6-10. Noise Net Effects Assessment – Alternative Method 2

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Noise	• Predicted site-related noise levels (measured in dBA or dBAI) • Changes in sound levels (dB)	• Landfilling equipment working within 50m of the perimeter of the landfill potentially increasing off-site noise levels. • The quantity of haul trucks arriving at the Project will remain approximately the same. On-site hauling volumes represent the greatest number of vehicles in any given hour. • The on-site traffic to the working face will follow the same starting route, entering the landfill from Nauvoo Road, proceeding to the scale facility. • Operating hours for the receiving of waste and on-site hauling will not change.	• Noise level may exceed applicable landfilling noise guidelines during daytime hours • Changes in Sound Levels may be rated as significant	• Construction of localized berms along the perimeter of the landfill. • Limit the number of active equipment near the perimeter of the landfill	• Noise levels to meet applicable landfilling noise guidelines during daytime hours, with some mitigation measures.

Alternative Method 3

The net effects assessment for Alternative Method 3 is presented in **Table 6-11**.

Predicted Site-Related Noise Levels

The reintroduction of landfilling equipment near the perimeter of the landfill under Alternative Method 3 poses the greatest potential for increased off-site noise, especially along the west and north boundaries where nearby PORs may experience noise levels that exceed daytime guidelines. The modifications to the existing side slope begin approximately 50 m inside the landfill limits, offering additional separation distance between landfilling noise sources and the PORs.

Although Alternative Method 3 has a steeper slope (2.5H:1V) than Alternative Method 1, the lower ground elevation near the perimeter makes mitigating potential noise exceedances less challenging.

Mitigation measures are to either construct temporary operational berms or limit the amount of equipment near the perimeter of the landfill. The operational berms from the 2005 EA were recommended to be 4 m in height and were required when working along the perimeter of the landfill. Similar mitigations would be required for Alternative Method 3 to result in no net effects by meeting daytime landfilling guideline limits.

Change in Sound Levels

The greatest potential change in off-site noise levels is the reintroduction of landfilling equipment along the perimeter of the approved landfill extents. Changes in sound levels will be driven proportionally by the impacts of off-site noise levels for Alternative Method 3.

Table 6-11. Noise Net Effects Assessment – Alternative Method 3

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Noise	• Predicted site-related noise levels (measured in dBA or dBAI • Changes in sound levels (dB)	• Landfilling equipment working within 50m of the perimeter of the landfill potentially increasing off-site noise levels. • The quantity of haul trucks arriving at the Project will remain approximately the same. On-site hauling volumes represent the greatest number of vehicles in any given hour. • The on-site traffic to the working face will follow the same starting route, entering the landfill from Nauvoo Road, proceeding to the scale facility. • Operating hours for the receiving of waste and on-site hauling will not change.	• Noise level may exceed applicable landfilling noise guidelines during daytime hours • Changes in Sound Levels may be rated as significant	• Construction of localized berms along the perimeter of the landfill. • Limit the number of active equipment near the perimeter of the landfill	• Noise levels to meet applicable landfilling noise guidelines during daytime hours, with some mitigation measures.

6.2.2 Hydrogeology

Hydrogeology considers Groundwater Quantity and Groundwater Quality. The Hydrogeology net effects assessment incorporates information from the Hydrogeology Existing Conditions Report (**Supporting Document 1-3**) and details of the Project design provided in the CDR (**Supporting Document 2**) in order to assess the net environmental effects of the three Alternative Methods. The detailed net effects assessment is provided in the Hydrogeology Effects Assessment Report (**Supporting Document 3-3**).

The study areas for Hydrogeology correspond with the general study areas defined for the EA (**Section 4, Figure 4-1**).

6.2.2.1 Groundwater Quality

Contaminants associated with waste disposal at the TCEC have the potential to enter the groundwater and impact on-site groundwater. Acceptable Groundwater Quality, which is 80% of the Guideline B-7 criteria for the Primary Leachate Indicator List (PLIL) parameters, must be shown at the TCEC boundaries.

To identify the potential effects of the Project on Groundwater Quality, the conceptual design of each Alternative Method for the landfill optimization was examined to determine the predicted effects on Groundwater Quality on-site from increased waste quantities disposed within the Expansion Landfill, and the predicted CLS.

Assumptions used in the Groundwater Quality effects assessment are as follows: Leachate generation and management are described in **Supporting Document 2,** and no changes to operations are anticipated; application of irrigation liquid that satisfies the treated leachate effluent criteria to the Poplar Plantation is not expected to adversely affect shallow groundwater quality based on compliance with Effluent Trigger Concentration Criteria; RNG Facility condensate will be managed according to the applicable ECA; current waste disposal and cover placement practices will continue.

Future Baseline Conditions

Predicted Effects on On-site Groundwater Quality

Groundwater quality is expected to remain acceptable under Future Baseline Conditions. Leachate concentrations in the closed Old Landfill are projected to decrease over time, while those in the Expansion Landfill will increase initially as waste is added, then decline post-closure. Leachate and groundwater monitoring programs will continue and will effectively detect potential effects to groundwater quality, including differentiation between leachate-related and non-leachate-related effects using the Trigger Mechanism Assessment Process. As previously noted, the irrigation of the Poplar Plantation is not expected to adversely affect shallow groundwater quality due to compliance with established criteria.

Predicted Contaminating Lifespan

The CLS of the Expansion Landfill under Future Baseline Conditions is predicted to increase from 69 years (under Existing Conditions) to 102 years with the addition of waste to fill the approved landfill capacity, which increases the duration of the existing risk of potential negative effects to Groundwater Quality at the TCEC.

Alternative Method 1

The net effects assessment for Alternative Method 1 is presented in **Table 6-12**.

Alternative Method 1 will not result in a change to the waste footprint, and no changes are proposed to the landfill base design, the annual fill rate, leachate collection and management processes, the site boundaries, or buffer widths. There will be an increase in landfill finished cap surface area.

The peak leachate generation rate for Alternative Method 1 is predicted to be 120,500 m³/year. With respect to Groundwater Quality on-site the hydraulic trap effect is anticipated to remain in effect from Future Baseline Conditions through Alternative Method 1 as there are no proposed changes to the designed footprint or leachate management practices of the Expansion Landfill. Within the Expansion Landfill, leachate mounding is not expected to develop based on the landfill's design.

Predicted Effects on On-site Groundwater Quality

The increase in waste mass from Alternative Method 1 is not expected to cause adverse effects to off-site Groundwater Quality; however, Alternative Method 1 will result in a 5% increase in peak annual leachate generation compared to Future Baseline Conditions, due to a larger landfill cap surface area. This additional leachate volume introduces the potential for increased risk to groundwater quality at the TCEC.

With the continuation of leachate management practices, no mitigative measures are required as there are no negative effects predicted as it relates to Groundwater Quality. Groundwater Quality (e.g., analytical testing for leachate and groundwater) should continue to be monitored at the TCEC in accordance with the relevant conditions of the Waste and Sewage ECAs.

Predicted Contaminating Lifespan

The increase in waste volume under Alternative Method 1 will increase the Expansion Landfill's CLS, thus prolonging the Groundwater Quality's exposure to potential risks from leachate impacts. The CLS of the Expansion Landfill is predicted to increase by 61 years under Alternative Method 1 relative to Future Baseline Conditions, resulting in a CLS of 163 years post-closure.

Table 6-12. Groundwater Quality Net Effects Assessment – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Groundwater Quality	Predicted effects on Groundwater Quality on-site from increased waste quantities disposed within the Expansion Landfill	Key Design Considerations: • Increase in waste volume of 14.3 million m³ without change in waste footprint. • Increase in landfill finished cap surface area in consideration of leachate generation rates. • Peak leachate generation rate of 120,500 cubic metres per year (m³/year). • No proposed changes to the landfill base design as well as leachate collection and management for the Expansion Landfill. • The existing TCEC property boundaries and buffer width will remain the same. Key Assumptions: • With respect to Groundwater Quality on-site the hydraulic trap effect is anticipated to remain in effect from Future Baseline Conditions through into Alternative Method 1 as there are no proposed changes to the designed footprint or leachate management practices of the Expansion Landfill into Future Baseline Conditions. • Within the Expansion Landfill, leachate mounding is not expected to develop based on the landfill's design. • Landfilling operational conditions are expected to remain the same under Alternative Method 1 and be consistent with current-approved Future Baseline operational requirements. • No changes to the annual fill rate. • The approach to managing (disposing) leachate generated at the TCEC will remain the same as that presented for Future Baseline Conditions.	• With respect to Groundwater Quality off-site, the impact of the increase in mass of the Expansion Landfill waste mound is not predicted to have an adverse effect off-site to groundwater conditions. • Peak annual leachate generation rates for Alternative Method 1 are approximately 5% greater than that predicted under Future Baseline Conditions (from the CDR [**Supporting Document 2**]). The increase in landfill cap surface area under Alternative Method 1 will generate a greater volume of leachate (5% more) compared to Future Baseline Conditions thus having the potential for an increased risk for Groundwater Quality impacts at the TCEC.	• With the continuation of leachate management practices, no mitigative measures are required as there are no negative effects predicted as it relates to Groundwater Quality. To verify this prediction WM should continue to monitor Groundwater Quality (e.g., analytical testing for leachate and groundwater) at the TCEC in accordance with the relevant conditions of the Waste and Sewage ECAs.	• None, so long as the hydraulic trap design is maintained as required under the Waste and Sewage ECAs.

Table 6-12. Groundwater Quality Net Effects Assessment – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
	Predicted CLS	Key Design Considerations: • Increase in waste volume of 14.3 million m^3 without change in waste footprint. • The existing TCEC property boundaries and buffer width will remain the same. Key Assumptions: • With respect to Groundwater Quality on-site the hydraulic trap effect is anticipated to remain in effect from Future Baseline Conditions through into Alternative Method 1 as there are no proposed changes to the designed footprint or leachate management practices of the Expansion Landfill into Future Baseline Conditions. • Within the Expansion Landfill, leachate mounding is not expected to develop based on the landfill's design. • Landfilling operational conditions are expected to remain the same under Alternative Method 1 and be consistent with current-approved Future Baseline operational requirements. • No changes to the annual fill rate. • The approach to managing (disposing) leachate generated at the TCEC will remain the same as that presented for Future Baseline Conditions.	• The increase in waste volume under Alternative Method 1 will increase the Expansion Landfill's CLS, thus prolonging the Groundwater Quality's exposure to potential risks from leachate impacts. • The CLS of the Expansion Landfill is predicted to increase by 61 years under Alternative Method 1 relative to a CLS of 102 years under Future Baseline Conditions, which increases the duration of the existing risk of potential negative effects to Groundwater Quality at the TCEC.	• Groundwater environmental monitoring programs will continue into the CLS of the Expansion Landfill.	• Under any of the Alternative Methods chosen, the at-Capacity CLS is calculated to be 163 years post-closure.

Alternative Method 2

The net effects assessment for Alternative Method 2 is presented in **Table 6-13**.

Alternative Method 2 will not result in a change to the waste footprint, and no changes are proposed to the landfill base design, the annual fill rate, leachate collection and management processes, the site boundaries, or buffer widths. There will be an increase in landfill finished cap surface area.

The peak leachate generation rate for Alternative Method 2 is predicted to be 119,000 m³/year. With respect to Groundwater Quality on-site the hydraulic trap effect is anticipated to remain in effect from Future Baseline Conditions through Alternative Method 2 as there are no proposed changes to the designed footprint or leachate management practices of the Expansion Landfill. Within the Expansion Landfill, leachate mounding is not expected to develop based on the landfill's design.

Predicted Effects on On-site Groundwater Quality

The increase in waste mass from Alternative Method 2 is not expected to cause adverse effects to off-site Groundwater Quality; however, Alternative Method 2 will result in a 3% increase in peak annual leachate generation compared to Future Baseline Conditions, due to a larger landfill cap surface area. This additional leachate volume introduces the potential for increased risk to groundwater quality at the TCEC.

With the continuation of leachate management practices, no mitigative measures are required as there are no negative effects predicted as it relates to Groundwater Quality. Groundwater Quality (e.g., analytical testing for leachate and groundwater) should continue to be monitored at the TCEC in accordance with the relevant conditions of the Waste and Sewage ECAs.

Predicted Contaminating Lifespan

The increase in waste volume under Alternative Method 2 will increase the Expansion Landfill's CLS, thus prolonging the Groundwater Quality's exposure to potential risks from leachate impacts. The CLS of the Expansion Landfill is predicted to increase by 61 years under Alternative Method 2 relative to Future Baseline Conditions, resulting in a CLS of 163 years post-closure.

Table 6-13. Groundwater Quality Net Effects Assessment – Alternative Method 2

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Groundwater Quality	Predicted effects on Groundwater Quality on-site from increased waste quantities disposed within the expansion landfill	Key Design Considerations: • Increase in waste volume of 14.3 million m^3 without change in waste footprint. • Increase in landfill finished cap surface area in consideration of leachate generation rates. • Peak leachate generation rate of 119,000 m^3/year. • No proposed changes to the landfill base design as well as leachate collection and management for the Expansion Landfill. • The existing TCEC property boundaries and buffer width will remain the same. Key Assumptions: • With respect to Groundwater Quality on-site the hydraulic trap effect is anticipated to remain in effect from Future Baseline Conditions through into Alternative Method 2 as there are no proposed changes to the designed footprint or leachate management practices of the Expansion Landfill into Future Baseline Conditions. • Within the Expansion Landfill, leachate mounding is not expected to develop based on the landfill's design. • Landfilling operational conditions are expected to remain the same under Alternative Method 2 and be consistent with current-approved Future Baseline operational requirements. • No changes to the annual fill rate. • The approach to managing (disposing) leachate generated at the TCEC will remain the same as that presented for Future Baseline Conditions.	• With respect to Groundwater Quality off-site, the impact of the increase in mass of the Expansion Landfill waste mound is not predicted to have an adverse effect off-site to groundwater conditions. • Peak annual leachate generation rates for Alternative Method 2 are approximately 3% greater than that predicted under Future Baseline Conditions (from the CDR (**Supporting Document 2**)). The increase in landfill cap surface area under Alternative Method 2 will generate a greater volume of leachate (3% more) compared to Future Baseline Conditions thus having the potential for an increased risk for Groundwater Quality impacts at the TCEC.	• With the continuation of leachate management practices, no mitigative measures are required as there are no negative effects predicted as it relates to Groundwater Quality. To verify this prediction WM should continue to monitor Groundwater Quality (e.g., analytical testing for leachate and groundwater) at the TCEC in accordance with the relevant conditions of the Waste and Sewage ECAs.	• None, so long as the hydraulic trap design is maintained as required under the Waste and Sewage ECAs.

Table 6-13. Groundwater Quality Net Effects Assessment – Alternative Method 2

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
	Predicted CLS	Key Design Considerations: • Increase in waste volume of 14.3 million m^3 without change in waste footprint. • The existing TCEC property boundaries and buffer width will remain the same. Key Assumptions: • With respect to Groundwater Quality on-site the hydraulic trap effect is anticipated to remain in effect from Future Baseline Conditions through into Alternative Method 2 as there are no proposed changes to the designed footprint or leachate management practices of the Expansion Landfill into Future Baseline Conditions. • Within the Expansion Landfill, leachate mounding is not expected to develop based on the landfill's design. • Landfilling operational conditions are expected to remain the same under Alternative Method 2 and be consistent with current-approved Future Baseline operational requirements. • No changes to the annual fill rate. • The approach to managing (disposing) leachate generated at the TCEC will remain the same as that presented for Future Baseline Conditions.	• The increase in waste volume under Alternative Method 2 will increase the Expansion Landfill's CLS, thus prolonging the Groundwater Quality's exposure to potential risks from leachate impacts. • The CLS of the Expansion Landfill is predicted to increase by 61 years under Alternative Method 2 relative to a CLS of 102 years under Future Baseline Conditions, which increases the duration of the existing risk of potential negative effects to Groundwater Quality at the TCEC.	• Groundwater environmental monitoring programs will continue into the CLS of the Expansion Landfill.	• Under any of the Alternative Methods chosen, the at-Capacity CLS is calculated to be 163 years post-closure

Alternative Method 3

The net effects assessment for Alternative Method 3 is presented in **Table 6-14**.

Alternative Method 3 will not result in a change to the waste footprint, and no changes are proposed to the landfill base design, the annual fill rate, leachate collection and management processes, the site boundaries, or buffer widths. There will be an increase in landfill finished cap surface area.

The peak leachate generation rate for Alternative Method 3 is predicted to be 118,500 m³/year. With respect to Groundwater Quality on-site the hydraulic trap effect is anticipated to remain in effect from Future Baseline Conditions through Alternative Method 3 as there are no proposed changes to the designed footprint or leachate management practices of the Expansion Landfill. Within the Expansion Landfill, leachate mounding is not expected to develop based on the landfill's design.

Predicted Effects on On-site Groundwater Quality

The increase in waste mass from Alternative Method 3 is not expected to cause adverse effects to off-site Groundwater Quality; however, Alternative Method 3 will result in a 3% increase in peak annual leachate generation compared to Future Baseline Conditions, due to a larger landfill cap surface area. This additional leachate volume introduces the potential for increased risk to groundwater quality at the TCEC.

With the continuation of leachate management practices, no mitigative measures are required as there are no negative effects predicted as it relates to Groundwater Quality. Groundwater Quality (e.g., analytical testing for leachate and groundwater) should continue to be monitored at the TCEC in accordance with the relevant conditions of the Waste and Sewage ECAs.

Predicted Contaminating Lifespan

The increase in waste volume under Alternative Method 3 will increase the Expansion Landfill's CLS, thus prolonging the Groundwater Quality's exposure to potential risks from leachate impacts. The CLS of the Expansion Landfill is predicted to increase by 61 years under Alternative Method 3 relative to Future Baseline Conditions, resulting in a CLS of 163 years post-closure.

Table 6-14. Groundwater Quality Net Effects Assessment – Alternative Method 3

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Groundwater Quality	Predicted effects on Groundwater Quality on-site from increased waste quantities disposed within the expansion landfill	Key Design Considerations: • Increase in waste volume of 14.3 million m³ without change in waste footprint. • Increase in landfill finished cap surface area in consideration of leachate generation rates. • Peak leachate generation rate of 118,500 m³/year. • No proposed changes to the landfill base design as well as leachate collection and management for the Expansion Landfill. • The existing TCEC property boundaries and buffer width will remain the same. Key Assumptions: • With respect to Groundwater Quality on-site the hydraulic trap effect is anticipated to remain in effect from Future Baseline Conditions through into Alternative Method 3 as there are no proposed changes to the designed footprint or leachate management practices of the Expansion Landfill into Future Baseline Conditions. • Within the Expansion Landfill, leachate mounding is not expected to develop based on the landfill's design. • Landfilling operational conditions are expected to remain the same under Alternative Method 3 and be consistent with current-approved Future Baseline operational requirements. • No changes to the annual fill rate. • The approach to managing (disposing) leachate generated at the TCEC will remain the same as that presented for Future Baseline Conditions.	• With respect to Groundwater Quality off-site, the impact of the increase in mass of the Expansion Landfill waste mound is not predicted to have an adverse effect off-site to groundwater conditions. • Peak annual leachate generation rates for Alternative Method 3 are approximately 3% greater than that predicted under Future Baseline Conditions (from the CDR (WSP, 2025)). The increase in landfill cap surface area under Alternative Method 3 will generate a greater volume of leachate (3% more) compared to Future Baseline Conditions thus having the potential for an increased risk for Groundwater Quality impacts at the TCEC.	• With the continuation of leachate management practices, no mitigative measures are required as there are no negative effects predicted as it relates to Groundwater Quality. To verify this prediction WM should continue to monitor Groundwater Quality (e.g., analytical testing for leachate and groundwater) at the TCEC in accordance with the relevant conditions of the Waste and Sewage ECAs.	• None, so long as the hydraulic trap design is maintained as required under the Waste and Sewage ECAs.

Table 6-14. Groundwater Quality Net Effects Assessment – Alternative Method 3

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
	Predicted CLS	Key Design Considerations: • Increase in waste volume of 14.3 million m³ without change in waste footprint. • The existing TCEC property boundaries and buffer width will remain the same. Key Assumptions: • With respect to Groundwater Quality on-site the hydraulic trap effect is anticipated to remain in effect from Future Baseline Conditions through into Alternative Method 3 as there are no proposed changes to the designed footprint or leachate management practices of the Expansion Landfill into Future Baseline Conditions. • Within the Expansion Landfill, leachate mounding is not expected to develop based on the landfill's design. • Landfilling operational conditions are expected to remain the same under Alternative Method 3 and be consistent with current-approved Future Baseline operational requirements. • No changes to the annual fill rate. • The approach to managing (disposing) leachate generated at the TCEC will remain the same as that presented for Future Baseline Conditions.	• The increase in waste volume under Alternative Method 3 will increase the Expansion Landfill's CLS, thus prolonging the Groundwater Quality's exposure to potential risks from leachate impacts. • The CLS of the Expansion Landfill is predicted to increase by 61 years under Alternative Method 3 relative to a CLS of 102 years under Future Baseline Conditions, which increases the duration of the existing risk of potential negative effects to Groundwater Quality at the TCEC.	• Groundwater environmental monitoring programs will continue into the CLS of the Expansion Landfill.	• Under any of the Alternative Methods chosen, the at-Capacity CLS is calculated to be 163 years post-closure

6.2.2.2 Groundwater Quantity

The Project has the potential to affect the established hydraulic trap design for the Expansion Landfill and understood groundwater flow patterns on-site and off-site. To identify the potential effects of the Project on Groundwater Quantity, the conceptual design of each Alternative Method for the landfill optimization was examined to determine the predicted effects on groundwater flow and Quantity both on-site and off-site.

Assumptions used in the Groundwater Quantity effects assessment are as follows: there will be no changes to the landfill footprint or liner system and the hydraulic trap will be maintained; and no changes to the annual fill rate are anticipated.

Future Baseline Conditions

Predicted Effects on Groundwater Quantity and Flow

Groundwater flow and potentiometric pressures are expected to remain stable under Future Baseline Conditions, and the hydraulic trap condition of the Expansion Landfill is expected to continue.

Alternative Method 1

The net effects assessment for Alternative Method 1 is presented in **Table 6-15**.

Alternative Method 1 will not result in a change to the waste footprint, and no changes are proposed to the landfill base design, the annual fill rate, or leachate collection and management processes. There will be an increase in landfill finished cap surface area.

The peak leachate generation rate for Alternative Method 1 is predicted to be 120,500 m³/year. With respect to Groundwater Quality on-site the hydraulic trap effect is anticipated to remain in effect from Future Baseline Conditions through Alternative Method 1 as there are no proposed changes to the designed footprint or leachate management practices of the Expansion Landfill. Within the Expansion Landfill, leachate mounding is not expected to develop based on the landfill's design.

Predicted Effects on Groundwater Quantity and Flow

The increased mass of the Expansion Landfill under Alternative Method 1 is not expected to adversely affect off-site groundwater flow or quantity. The increase in landfill cap surface area under Alternative Method 1 will generate a greater volume of leachate (5% more) compared to Future Baseline Conditions; however, Alternative Method 1 is not predicted to result in a negative potential effect to groundwater quantity and flow relative to Future Baseline Conditions.

With the continuation of leachate management practices, no mitigative measures are required as there are no negative effects predicted as it relates to Groundwater Quantity. Groundwater Quantity (e.g., liquid levels for both leachate and groundwater) should continue to be monitored at the TCEC in accordance with the relevant conditions of the Waste and Sewage ECAs.

Table 6-15. Groundwater Quantity Net Effects Assessment – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Groundwater Quantity	Predicted effect of Landfill Optimization on Groundwater flow and Quantity both on-site and off-site.	Key Design Considerations: • Increase in waste volume of 14.3 million m³ without change in waste footprint. • Increase in landfill finished cap surface area in consideration of leachate generation rates. • Peak leachate generation rate of 120,500 m³/year. • No proposed changes to the landfill base design as well as leachate collection and management for the Expansion Landfill. • The existing TCEC property boundaries and buffer width will remain the same. Key Assumptions: • With respect to Groundwater flow/quantity on-site the hydraulic trap effect is anticipated to remain in effect from Future Baseline Conditions through into Alternative Method 1 as there are no proposed changes to the designed footprint or leachate management practices of the Expansion Landfill into Future Baseline Conditions. • Within the Expansion Landfill, leachate mounding is not expected to develop based on the landfill's design. • Landfilling operational conditions are expected to remain the same under Alternative Method 1 and be consistent with current-approved Future Baseline operational requirements. • No changes to the annual fill rate. • The approach to managing (disposing) leachate generated at the TCEC will remain the same as that presented for Future Baseline Conditions.	• With respect to Groundwater flow and Quantity off-site, the impact of the increase in mass of the Expansion Landfill waste mound is not predicted to have an adverse effect off-site to groundwater conditions. • Under Alternative Method 1, there is no negative potential effect to Groundwater flow and Quantity relative to Existing and Future Baseline Conditions. • Peak annual leachate generation rates for Alternative Method 1 are approximately 5% greater than that predicted under Future Baseline Conditions (from the CDR (**Supporting Document 2**)). The increase in landfill cap surface area under Alternative Method 1 will generate a greater volume of leachate (5% more) compared to Future Baseline Conditions.	• With the continuation of leachate management practices, no mitigative measures are required as there are no negative effects predicted as it relates to Groundwater Quantity. To verify this prediction, Groundwater Quantity (e.g., liquid levels for both leachate and groundwater) should continue to be monitored at the TCEC in accordance with the relevant conditions of the Waste and Sewage ECAs.	• None, so long as the hydraulic trap design is maintained as required under the Waste and Sewage ECAs.

Alternative Method 2

The net effects assessment for Alternative Method 2 is presented in **Table 6-16**.

Alternative Method 2 will not result in a change to the waste footprint, and no changes are proposed to the landfill base design, the annual fill rate, or leachate collection and management processes. There will be an increase in landfill finished cap surface area.

The peak leachate generation rate for Alternative Method 2 is predicted to be 119,000 m³/year. With respect to Groundwater Quality on-site the hydraulic trap effect is anticipated to remain in effect from Future Baseline Conditions through Alternative Method 2 as there are no proposed changes to the designed footprint or leachate management practices of the Expansion Landfill. Within the Expansion Landfill, leachate mounding is not expected to develop based on the landfill's design.

Predicted Effects on Groundwater Quantity and Flow

The increased mass of the Expansion Landfill under Alternative Method 2 is not expected to adversely affect off-site groundwater flow or quantity. The increase in landfill cap surface area under Alternative Method 2 will generate a greater volume of leachate (3% more) compared to Future Baseline Conditions; however, Alternative Method 2 is not predicted to result in a negative potential effect to groundwater quantity and flow relative to Future Baseline Conditions.

With the continuation of leachate management practices, no mitigative measures are required as there are no negative effects predicted as it relates to Groundwater Quantity. Groundwater Quantity (e.g., liquid levels for both leachate and groundwater) should continue to be monitored at the TCEC in accordance with the relevant conditions of the Waste and Sewage ECAs.

Table 6-16. Groundwater Quantity Net Effects Assessment – Alternative Method 2

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Groundwater Quantity	Predicted effect of Landfill Optimization on Groundwater flow and Quantity both on-site and off-site.	Key Design Considerations: • Increase in waste volume of 14.3 million m³ without change in waste footprint. • Increase in landfill finished cap surface area in consideration of leachate generation rates. • Peak leachate generation rate of 119,000 m³/year. • No proposed changes to the landfill base design as well as leachate collection and management for the Expansion Landfill. • The existing TCEC property boundaries and buffer width will remain the same. Key Assumptions: • With respect to Groundwater flow/quantity on-site the hydraulic trap effect is anticipated to remain in effect from Future Baseline Conditions through into Alternative Method 2 as there are no proposed changes to the designed footprint or leachate management practices of the Expansion Landfill into Future Baseline Conditions. • Within the Expansion Landfill, leachate mounding is not expected to develop based on the landfill's design. • Landfilling operational conditions are expected to remain the same under Alternative Method 2 and be consistent with current-approved Future Baseline operational requirements. • No changes to the annual fill rate. • The approach to managing (disposing) leachate generated at the TCEC will remain the same as that presented for Future Baseline Conditions.	• With respect to Groundwater flow and Quantity off-site, the impact of the increase in mass of the Expansion Landfill waste mound is not predicted to have an adverse effect off-site to groundwater conditions. • Under Alternative Method 2, there is no negative potential effect to Groundwater flow and Quantity relative to Existing and Future Baseline Conditions. • Peak annual leachate generation rates for Alternative Method 2 are approximately 3% greater than that predicted under Future Baseline Conditions (from the CDR (**Supporting Document 2**)). The increase in landfill cap surface area under Alternative Method 2 will generate a greater volume of leachate (3% more) compared to Future Baseline Conditions.	• With the continuation of leachate management practices, no mitigative measures are required as there are no negative effects predicted as it relates to Groundwater Quantity. To verify this prediction WM should continue to monitor Groundwater Quantity (e.g., liquid levels for both leachate and groundwater) at the TCEC in accordance with the relevant conditions of the Waste and Sewage ECAs.	• None, so long as the hydraulic trap design is maintained as required under the Waste and Sewage ECAs.

Alternative Method 3

The net effects assessment for Alternative Method 3 is presented in **Table 6-17**.

Alternative Method 3 will not result in a change to the waste footprint, and no changes are proposed to the landfill base design, the annual fill rate, or leachate collection and management processes. There will be an increase in landfill finished cap surface area.

The peak leachate generation rate for Alternative Method 3 is predicted to be 118,500 m³/year. With respect to Groundwater Quality on-site the hydraulic trap effect is anticipated to remain in effect from Future Baseline Conditions through Alternative Method 3 as there are no proposed changes to the designed footprint or leachate management practices of the Expansion Landfill. Within the Expansion Landfill, leachate mounding is not expected to develop based on the landfill's design.

Predicted Effects on Groundwater Quantity and Flow

The increased mass of the Expansion Landfill under Alternative Method 3 is not expected to adversely affect off-site groundwater flow or quantity. The increase in landfill cap surface area under Alternative Method 3 will generate a greater volume of leachate (3% more) compared to Future Baseline Conditions; however, Alternative Method 3 is not predicted to result in a negative potential effect to groundwater quantity and flow relative to Future Baseline Conditions.

With the continuation of leachate management practices, no mitigative measures are required as there are no negative effects predicted as it relates to Groundwater Quantity. Groundwater Quantity (e.g., liquid levels for both leachate and groundwater) should continue to be monitored at the TCEC in accordance with the relevant conditions of the Waste and Sewage ECAs.

Table 6-17. Groundwater Quantity Net Effects Assessment – Alternative Method 3

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Groundwater Quantity	Predicted effect of Landfill Optimization on Groundwater flow and Quantity both on-site and off-site	Key Design Considerations: • Increase in waste volume of 14.3 million m³ without change in waste footprint. • Increase in landfill finished cap surface area in consideration of leachate generation rates. • Peak leachate generation rate of 118,500 m³/year. • No proposed changes to the landfill base design as well as leachate collection and management for the Expansion Landfill. • The existing TCEC property boundaries and buffer width will remain the same. Key Assumptions: • With respect to Groundwater flow/quantity on-site the hydraulic trap effect is anticipated to remain in effect from Future Baseline Conditions through into Alternative Method 3 as there are no proposed changes to the designed footprint or leachate management practices of the Expansion Landfill into Future Baseline Conditions. • Within the Expansion Landfill, leachate mounding is not expected to develop based on the landfill's design. • Landfilling operational conditions are expected to remain the same under Alternative Method 3 and be consistent with current-approved Future Baseline operational requirements. • No changes to the annual fill rate. • The approach to managing (disposing) leachate generated at the TCEC will remain the same as that presented for Future Baseline Conditions.	• With respect to Groundwater flow and Quantity off-site, the impact of the increase in mass of the Expansion Landfill waste mound is not predicted to have an adverse effect off-site to groundwater conditions. • Under Alternative Method 3, there is no negative potential effect to Groundwater flow and Quantity relative to Existing and Future Baseline Conditions. • Peak annual leachate generation rates for Alternative Method 3 are approximately 3% greater than that predicted under Future Baseline Conditions (from the CDR [**Supporting Document 2**]). The increase in landfill cap surface area under Alternative Method 3 will generate a greater volume of leachate (3% more) compared to Future Baseline Conditions.	• With the continuation of leachate management practices, no mitigative measures are required as there are no negative effects predicted as it relates to Groundwater Quantity. To verify this prediction WM should continue to monitor Groundwater Quantity (e.g., liquid levels for both leachate and groundwater) at the TCEC in accordance with the relevant conditions of the Waste and Sewage ECAs.	• None, so long as the hydraulic trap design is maintained as required under the Waste and Sewage ECAs.

6.2.3 Surface Water Environment

The Surface Water Environment considers Surface Water Quality and Surface Water Quantity.

6.2.3.1 Surface Water Quality

The Surface Water Quality net effects assessment incorporates information from the Surface Water Quality Existing Conditions Report (**Supporting Document 1-4**) and details of the Project design provided in the CDR (**Supporting Document 2**) in order to assess the net environmental effects of the three Alternative Methods. The detailed net effects assessment is provided in the Surface Water Quality Effects Assessment Report (**Supporting Document 3-4**).

To identify the potential effects of the Project on Surface Water Quality, the conceptual design of each Alternative Method for the landfill optimization was examined to determine if it will have an effect on:

- Surface Water Quality on-site prior to off-site discharge through:
    - Changes in TSS and heavy metal concentrations within the surface water due to erosional effects from exposed clayey soil surfaces (soil-related metal constituents can be heavily influenced where TSS concentrations are elevated).
    - PLIL constituent concentration trends (due to leachate seeps) in the surface watercourses and sedimentation ponds.
- Surface Water Quality within the roadside ditch of the northbound lane of Nauvoo Road from the TCEC to Hwy 402 in the Off-Site Study Area from changes to PAHs as a result of track-out of ASR material from waste hauling truck traffic.

The study areas for Surface Water Quality correspond with the general study areas defined for the EA (**Section 4, Figure 4-1**). The On-site Study Area encompasses the TCEC, where surface water is managed through drainage features such as ditches, swales, and four sedimentation ponds. Runoff from operational areas of the TCEC is typically directed to these sedimentation ponds for management. The Off-site Study Area includes the northbound roadside ditch of Nauvoo Road from approximately 1 km north to 500 m south of the TCEC site entrance.

The Surface Water Quality effects assessment considers the following:

- Slope grading proposed for the vertical expansion of the Expansion Landfill with consideration toward the potential of increased erosional effects to Surface Water Quality.
- Increase in waste mound height and the associated cap surface area as it relates to leachate seep probability.
- No proposed changes to the landfill base design as well as leachate collection and management for the Expansion Landfill.

- The existing TCEC property boundaries and buffer width will remain the same under any of the Alternative Methods.

Minor changes to surface water infrastructure (e.g., swales, ditches, sedimentation ponds) under each Alternative Method are not expected to significantly affect surface water quality, as flow rates and volumes are similar to the approved Future Baseline Conditions.

The current design of Sedimentation Ponds 1–4 is sufficient to handle flow conditions under both the Future Baseline and all Alternative Methods, including climate change scenarios; therefore, their capacity to attenuate chemical constituents is not expected to change.

Leachate mounding is not expected within the Expansion Landfill due to its design. Operational practices (e.g., leachate management, waste disposal, cover placement) will remain unchanged from current operations. Daily and interim cover will continue to be applied during operations through to closure, consistent with current and approved practices. In addition, no changes are anticipated to the annual fill rate.

Irrigation liquid that satisfies the Amended ECA for an Industrial Sewage Works No. 8117-CUSNXX (Sewage ECA) Effluent Trigger Concentration Criteria for application onto the trees of the Poplar Plantation is not expected to cause adverse effects to Surface Water Quality. The condensate captured by the RNG Facility will be managed per the Sewage ECA.

Future Baseline Conditions

There are changes that will occur at the TCEC between Existing Conditions and Future Baseline Conditions. For Surface Water Quality, Future Baseline Conditions consider that the Expansion Landfill has reached the current MECP-approved design with respect to the horizontal footprint and peak height of 280 masl. The difference between Existing Conditions and Future Baseline Conditions, with respect to Surface Water Quality, relates to the full build-out of the northeastern portion of the current approved Expansion Landfill footprint. With the construction of Cells 6B and 6C, as well as Cells 8A and 8B, the Expansion Landfill footprint will increase from the Existing Conditions of 55.8 ha to Future Baseline Conditions of 75.4 ha which will result in some minor drainage realignment within the northeastern portion of the TCEC (swale lengths to Ponds 2 and 4 and addition of a culvert under the servicing road).

Predicted Effects on Surface Water Quality On-Site Prior to Off-Site Discharge

It is expected that Surface Water Quality overall will also not significantly change or be impacted by minor runoff conveyance modifications, which are expected to negligibly impact flow to Sedimentation Ponds 2 and 4. Also, flow to Sedimentation Ponds 1 and 3 would not be expected to be impacted as there are no expected upstream conveyance modifications.

Under Future Baseline Conditions, it is expected that surface water flow will continue to be precipitation dependent and ephemeral, i.e., typically noted following snowmelt or prolonged periods of precipitation. Historically, adequate flowing conditions have

generally been noted following precipitation measurements of 10 mm or more in a 24-hour period, which is expected to continue under Future Baseline Conditions. Occasional 'no flow' scenarios are anticipated to continue to occur during drier periods from late spring to early fall when lacking precipitation results in drier ground surface conditions such that it will absorb most of the precipitation.

Under Future Baseline Conditions, Surface Water Quality monitoring is expected to be divided into four (4) programs: 1) compliance monitoring (to evaluate erosion and leachate effects); 2) the Poplar System monitoring (to assess irrigation impacts from phytoremediation); 3) the Poplar Plantation monitoring (to evaluate irrigation water quality); and 4) Compost and Waste Diversion Area monitoring (to assess runoff quality). Monitoring is initiated after 10 mm or greater precipitation occurs within 24 hours, and samples are taken within 24 hours. The Poplar System monitoring includes additional storm event monitoring during irrigation periods.

Historical Surface Water Quality monitoring data is well understood and has indicated that Surface Water Quality is generally not negatively impacted by the TCEC.

EROSIONAL EFFECTS ON TSS AND HEAVY METAL CONCENTRATIONS IN SURFACE WATER

Minor deviations in Surface Water Quality occur over time which primarily relate to erosional effects from exposed soil surfaces during periods of construction activity (e.g., infrastructure construction, waste cell excavation, soil and material movement, etc.).

LEACHATE SEEP IMPACTS TO SURFACE WATER QUALITY

Expansion Landfill leachate shows increasing trends in several parameters (e.g., chloride, ammonia, boron), but concentrations remain below predicted peak values. The selected Primary and Secondary Leachate Indicator List (PLIL and SLIL) parameters for evaluating potential leachate effects on Surface Water Quality as outlined in the 2007 EMP will remain relevant based on leachate constituent concentrations remaining below the predicted peak leachate values in the 2008 D&O Report.

The PLIL parameter concentrations generally satisfy the Trigger Mechanisms that form part of the Surface Water Quality evaluation procedures for the TCEC. As a result, the Surface Water Quality routinely satisfies the triggering mechanisms for acceptable off-site discharge. As the Trigger Mechanisms as per the current MECP-approved process (e.g., Waste and Sewage ECAs) are well developed, this process will not change under Future Baseline Conditions, but will form the initial assessment of the PLIL Trigger Concentrations. Proposed improvements to the assessment process include refined trigger criteria to better distinguish between leachate and erosion effects, and verification monitoring when multiple PLIL concentrations exceed the identified thresholds. The improvements, further detailed in **Supporting Document 3-4**, are intended to discern intermittent operational effects from erosional effects, and further, to discern leachate effects more effectively than the current evaluation.

Predicted Effects from PAHs on Surface Water Quality within the Roadside Ditch

There are no predicted net effects to Surface Water Quality in the Off-Site Study Area, from ASR track out under Future Baseline Conditions based on the findings of the Surface Water Quality Existing Conditions Report (**Supporting Document 1-4**). Since 2022, WM has implemented a rigorous routine inspection for track out ASR and cleanup where warranted. On-site and off-site ASR cleanup efforts are completed as needed and consist of sweeping, scraping with light equipment, hand raking/picking, along the roadways, road shoulders, and within the ditches. It is noted that the vegetative growth within Nauvoo Road's roadside ditch is cut as part of cleanup activities such that ASR does not remain entangled in tall vegetation in ditches.

The above noted inspection and cleanup of ASR track out, would continue under Future Baseline Conditions, but would eventually cease upon landfill closure as ASR would no longer be brought to site and the ASR that had been brought to the site would be covered with the final cap and would not have the potential to track out.

Alternative Method 1

The net effects assessment for Alternative Method 1 is presented in **Table 6-18**.

The evaluation of Surface Water Quality under Alternative Method 1 considers the same considerations applied to evaluation of the TCEC under the Future Baseline Conditions. Alternative Method 1 is predicted to potentially have an effect because of the following:

- Increased erosional effects in consideration of steeper sideslopes, exposed sideslopes during construction, and larger surface area of the finished landfill cap.
- Increased waste mound height increases the cap surface area and probability for leachate seeps to occur as a result of perched leachate scenarios. Also, removal of interim clayey soil cap for Landfill Optimization along the sideslopes also increases the potential for perched leachate related effects to Surface Water Quality while this area of the waste mound is not completed with interim or final cap.
- Increased waste mound height, thereby increasing landfill operational life, increases the duration of ASR disposal and management at the TCEC, which increases the potential for ASR to be tracked off-site along the north bound lane of Nauvoo Road to Highway 402.

Predicted Effects on Surface Water Quality On-Site Prior to Off-Site Discharge

EROSIONAL EFFECTS ON TSS AND HEAVY METAL CONCENTRATIONS IN SURFACE WATER

The increase in landfill height and surface area of the landfill cap could lead to greater erosion. The steeper side slopes of Alternative Method 1 may increase the risk of precipitation-induced erosion, leading to elevated Total Suspended Solids (TSS) and soil-related metals (e.g., zinc, chromium, nickel) in surface water.

Mitigation measures include the continued use of sediment control measures (e.g., straw bales, silt fencing, vegetative cover), routine inspections and sediment removal from ditches and ponds, and topsoil and seeding of interim cover areas to reduce erosion. With mitigation measures, no net effects to Surface Water Quality from erosion are predicted for Alternative Method 1.

LEACHATE SEEP IMPACTS TO SURFACE WATER QUALITY

The increased waste mound height and cap surface area may raise the probability of leachate seeps, and in the short-term, there is the potential for perched leachate conditions to be encountered during interim cap stripping.

Mitigation measures include routine inspections (e.g., weekly during operations, monthly post-closure) to detect and repair seeps, and immediate repair of any identified seeps to prevent runoff into surface water systems. With mitigation measures, no net effects to Surface Water Quality from leachate seeps are predicted for Alternative Method 1.

Predicted Effects from PAHs on Surface Water Quality within the Roadside Ditch

The longer operational life under Alternative Method 1 could extend the period of ASR use, increasing the potential for PAH contamination in the roadside ditch along Nauvoo Road. Mitigation measures include rigorous inspection and cleanup of ASR track-out, including sweeping, scraping, and vegetation management, and containment of ASR within the landfill working face to minimize exposure to truck tires.

Table 6-18. Surface Water Quality Net Effects Assessment – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Surface Water Quality	Predicted effects on Surface Water Quality on-site prior to off-site discharge (Erosional effects on TSS and heavy metal concentrations in surface water)	Key Design Considerations: • Slope grading and cap surface area proposed for the vertical expansion of the Expansion Landfill with consideration toward the potential of increased erosional effects to Surface Water Quality. • No proposed changes to the landfill base design as well as leachate collection and management for the Expansion Landfill. • The existing TCEC property boundaries and buffer width will remain the same. Key Assumptions: • Under Alternative Method 1, the slight alterations to the surface water management infrastructure (e.g., swales, ditching, and sedimentation ponds)) are not considered to significantly impact Surface Water Quality as flow rates and volumes are similar to the approved Future Baseline Conditions. • Sedimentation Ponds 1 to 4 current designs are sufficient to manage Future Baseline flow conditions, as well as each Alternative Method even when considering climate change (Section 5.1.1 of the CDR), thus, the sedimentation ponds' capacities to attenuate chemical constituents are not expected to change. • Stormwater is currently, and will continue to be, managed on-site through swales and sedimentation ponds prior to off-site discharge. • Landfilling operational conditions are expected to remain the same under Alternative Method 1 and be consistent with current-approved Future Baseline operational requirements.	• Potential effects to Surface Water Quality (e.g., elevated TSS and select heavy metals) resulting from precipitation-induced erosion of exposed clayey soil on-site.	• Continue to operate and monitor Surface Water Quality at the TCEC in accordance with the relevant Conditions of the Waste and Sewage ECAs. • Install/maintain sediment control measures (e.g., straw bale/rock check dams, silt fencing, add vegetative controls, etc.) at various locations within the surface water drainage network. As-required sediment control measure placements and replacements based on Site conditions. • Supplement the northern component of the drainage network with erosion control measures as the landfill expands north prior to initiating Expansion Landfill Optimization. • Complete as-required sediment removal where sediment builds up in the surface water drainage network (e.g., at check dams, silt fencing, retention ponds, etc.). • Place topsoil and seed over areas of the Expansion Landfill side slopes completed with interim cover, where appropriate (e.g., 2 years).	• None. Presuming the mitigation measures presented herein are implemented and maintained as required, the risk for impacts to Surface Water Quality due to erosional effects will be effectively managed.

Table 6-18. Surface Water Quality Net Effects Assessment – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
				• Inspect areas of soil stockpiling for erosion. Where necessary, erosion control measures would be installed to protect the drainage network from unacceptable sediment loading (e.g., silt fencing, straw bales, rock check dams, add vegetative controls, etc.).	
	Predicted effects on Surface Water Quality on-site prior to off-site discharge (Leachate seep impacts to Surface Water Quality)	Key Design Considerations: • Increase in waste mound height and the associated cap surface area as it relates to leachate seep probability. • No proposed changes to the landfill base design as well as leachate collection and management for the Expansion Landfill. • The existing TCEC property boundaries and buffer width will remain the same. Key Assumptions: • Within the Expansion Landfill, leachate mounding is not expected to develop based on the landfill's design. • Landfilling operational conditions are expected to remain the same under Alternative Method 1 and be consistent with current-approved Future Baseline operational requirements. • The approach to managing (disposing) leachate generated at the TCEC will remain the same as that presented for Future Baseline Conditions.	• In the short-term, there is the potential for perched leachate conditions to be encountered during interim cap stripping. • In the long-term, the probability of leachate seepage is proportional to the increase in cap surface area and landfill height (e.g., more cap/height, more chances of leachate seepage).	• Continue to operate and monitor Surface Water Quality at the TCEC in accordance with the relevant Conditions of the Waste and Sewage ECAs. • Seep repairs, when identified, should be repaired immediately and if possible, prior to seepage entering and/or running off landfill sideslopes and into the surface water drainage network. • Routine inspections (e.g., monthly during post-closure) of the landfill surface are expected to provide sufficient frequency to identify and, if necessary, address leachate seepage.	• None. There is no expected net effect to Surface Water Quality from leachate impacts with the implementation of a seepage monitoring and repair program under Alternative Method 1.

Table 6-18. Surface Water Quality Net Effects Assessment – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
	Predicted effects from polyaromatic hydrocarbons (PAHs) on Surface Water Quality within the roadside ditch of the northbound lane of Nauvoo Road from the Site to Hwy 402 in the off-Site Study Area	Key Design Considerations: • No proposed changes to the landfill base design as well as leachate collection and management for the Expansion Landfill. • The existing TCEC property boundaries and buffer width will remain the same. Key Assumptions: • Landfilling operational conditions are expected to remain the same under Alternative Method 1 and be consistent with current-approved Future Baseline operational requirements.	• There are no predicted net effects to Surface Water Quality in the Off-Site Study Area, from ASR track out as long as mitigation measures continue to be carried out.	• WM actively implements a rigorous routine inspection and where warranted, cleanup of ASR track out. On-site and off-site ASR cleanup efforts are completed as needed and consist of sweeping, scraping with light equipment, hand raking/picking, along the roadways, road shoulders, and within the ditches. It is noted that the vegetative growth within Nauvoo Road's roadside ditch is cut as part of cleanup activities such that ASR does not remain entangled in tall vegetation in ditches.	• None (as long as the Mitigation Measures continue to be carried out).

Alternative Method 2

The net effects assessment for Alternative Method 2 is presented in **Table 6-19**.

The evaluation of Surface Water Quality under Alternative Method 2 considers the same considerations applied to evaluation of the TCEC under the Future Baseline Conditions. Alternative Method 2 is predicted to potentially have an effect because of the following:

- Increased erosional effects in consideration of steeper sideslopes, exposed sideslopes during construction, and larger surface area of the finished landfill cap.
- Increased waste mound height increases the cap surface area and probability for leachate seeps to occur as a result of perched leachate scenarios. Also, removal of interim clayey soil cap for Landfill Optimization along the sideslopes also increases the potential for perched leachate related effects to Surface Water Quality while this area of the waste mound is not completed with interim or final cap.
- Increased waste mound height, thereby increasing landfill operational life, increases the duration of ASR disposal and management at the TCEC, which increases the potential for ASR to be tracked off-site along the north bound lane of Nauvoo Road to Highway 402.

Predicted Effects on Surface Water Quality On-Site Prior to Off-Site Discharge

EROSIONAL EFFECTS ON TSS AND HEAVY METAL CONCENTRATIONS IN SURFACE WATER

The increase in landfill height and surface area of the landfill cap could lead to greater erosion. The steeper side slopes of Alternative Method 2 may increase the risk of precipitation-induced erosion, leading to elevated TSS and soil-related metals (e.g., zinc, chromium, nickel) in surface water.

Mitigation measures include the continued use of sediment control measures (e.g., straw bales, silt fencing, vegetative cover), routine inspections and sediment removal from ditches and ponds, and topsoil and seeding of interim cover areas to reduce erosion. With mitigation measures, no net effects to Surface Water Quality from erosion are predicted for Alternative Method 2.

LEACHATE SEEP IMPACTS TO SURFACE WATER QUALITY

The increased waste mound height and cap surface area may raise the probability of leachate seeps, and in the short-term, there is the potential for perched leachate conditions to be encountered during interim cap stripping.

Mitigation measures include routine inspections (e.g., weekly during operations, monthly post-closure) to detect and repair seeps, and immediate repair of any identified seeps to prevent runoff into surface water systems. With mitigation measures, no net effects to Surface Water Quality from leachate seeps are predicted for Alternative Method 2.

Predicted Effects from PAHs on Surface Water Quality within the Roadside Ditch

The longer operational life under Alternative Method 2 could extend the period of ASR use, increasing the potential for PAH contamination in the roadside ditch along Nauvoo Road. Mitigation measures include rigorous inspection and cleanup of ASR track-out, including sweeping, scraping, and vegetation management, and containment of ASR within the landfill working face to minimize exposure to truck tires.

Table 6-19. Surface Water Quality Net Effects Assessment – Alternative Method 2

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Surface Water Quality	Predicted effects on Surface Water Quality on-site prior to off-site discharge (Erosional effects on TSS and heavy metal concentrations in surface water)	Key Design Considerations: • Slope grading and cap surface area proposed for the vertical expansion of the Expansion Landfill with consideration toward the potential of increased erosional effects to Surface Water Quality. • No proposed changes to the landfill base design as well as leachate collection and management for the Expansion Landfill. • The existing TCEC property boundaries and buffer width will remain the same. Key Assumptions: • Under Alternative Method 2, the slight alterations to the surface water management infrastructure (e.g., swales, ditching, and sedimentation ponds)) are not considered to significantly impact Surface Water Quality as flow rates and volumes are similar to the approved Future Baseline Conditions. • Sedimentation Ponds 1 to 4 current designs are sufficient to manage Future Baseline flow conditions, as well as each Alternative Method even when considering climate change (Section 5.1.1 of the CDR), thus, the sedimentation ponds' capacities to attenuate chemical constituents are not expected to change. • Stormwater is currently, and will continue to be, managed on-site through swales and sedimentation ponds prior to off-site discharge. • Landfilling operational conditions are expected to remain the same under Alternative Method 2 and be consistent with current-approved Future Baseline operational requirements.	• Potential effects to Surface Water Quality (e.g., elevated TSS and select heavy metals) resulting from precipitation-induced erosion of exposed clayey soil on-site.	• Continue to operate and monitor Surface Water Quality at the TCEC in accordance with the relevant Conditions of the Waste and Sewage ECAs. • Install/maintain sediment control measures (e.g., straw bale/rock check dams, silt fencing, add vegetative controls, etc.) at various locations within the surface water drainage network. As-required sediment control measure placements and replacements based on Site conditions. • Supplement the northern component of the drainage network with erosion control measures as the landfill expands north prior to initiating Expansion Landfill Optimization. • Complete as-required sediment removal where sediment builds up in the surface water drainage network (e.g., at check dams, silt fencing, retention ponds, etc.). • Place topsoil and seed over areas of the Expansion Landfill side slopes completed with interim cover, where appropriate (e.g., 2 years).	• None. Presuming the mitigation measures presented herein are implemented and maintained as required, the risk for impacts to Surface Water Quality due to erosional effects will be effectively managed.

Table 6-19. Surface Water Quality Net Effects Assessment – Alternative Method 2

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
				• Inspect areas of soil stockpiling for erosion. Where necessary, erosion control measures would be installed to protect the drainage network from unacceptable sediment loading (e.g., silt fencing, straw bales, rock check dams, add vegetative controls, etc.).	
	Predicted effects on Surface Water Quality on-site prior to off-site discharge (Leachate seep impacts to Surface Water Quality)	Key Design Considerations: • Increase in waste mound height and the associated cap surface area as it relates to leachate seep probability. • No proposed changes to the landfill base design as well as leachate collection and management for the Expansion Landfill. • The existing TCEC property boundaries and buffer width will remain the same. Key Assumptions: • Within the Expansion Landfill, leachate mounding is not expected to develop based on the landfill's design. • Landfilling operational conditions are expected to remain the same under Alternative Method 2 and be consistent with current-approved Future Baseline operational requirements. • The approach to managing (disposing) leachate generated at the TCEC will remain the same as that presented for Future Baseline Conditions.	• In the short-term, there is the potential for perched leachate conditions to be encountered during interim cap stripping. • In the long-term, the probability of leachate seepage is proportional to the increase in cap surface area and landfill height (e.g., more cap/height, more chances of leachate seepage).	• Continue to operate and monitor Surface Water Quality at the TCEC in accordance with the relevant Conditions of the Waste and Sewage ECAs. • Seep repairs, when identified, should be repaired immediately and if possible, prior to seepage entering and/or running off landfill sideslopes and into the surface water drainage network. • Routine inspections (e.g., monthly during post-closure) of the landfill surface are expected to provide sufficient frequency to identify and, if necessary, address leachate seepage.	• None. There is no expected net effect to Surface Water Quality from leachate impacts with the implementation of a seepage monitoring and repair program under Alternative Method 2.

Table 6-19. Surface Water Quality Net Effects Assessment – Alternative Method 2

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
	Predicted effects from polyaromatic hydrocarbons (PAHs) on Surface Water Quality within the roadside ditch of the northbound lane of Nauvoo Road from the Site to Hwy 402 in the Off-Site Study Area	Key Design Considerations: • No proposed changes to the landfill base design as well as leachate collection and management for the Expansion Landfill. • The existing TCEC property boundaries and buffer width will remain the same. Key Assumptions: • Landfilling operational conditions are expected to remain the same under Alternative Method 2 and be consistent with current-approved Future Baseline operational requirements.	• There are no predicted net effects to Surface Water Quality in the Off-Site Study Area, from ASR track out as long as mitigation measures continue to be carried out.	• WM actively implements a rigorous routine inspection and where warranted, cleanup of ASR track out. On-site and off-site ASR cleanup efforts are completed as needed and consist of sweeping, scraping with light equipment, hand raking/picking, along the roadways, road shoulders, and within the ditches. It is noted that the vegetative growth within Nauvoo Road's roadside ditch is cut as part of cleanup activities such that ASR does not remain entangled in tall vegetation in ditches.	• None (as long as the Mitigation Measures continue to be carried out).

Alternative Method 3

The net effects assessment for Alternative Method 3 is presented in **Table 6-20**.

The evaluation of Surface Water Quality under Alternative Method 3 considers the same considerations applied to evaluation of the TCEC under the Future Baseline Conditions. Alternative Method 3 is predicted to potentially have an effect because of the following:

- Increased erosional effects in consideration of steeper sideslopes, exposed sideslopes during construction, and larger surface area of the finished landfill cap.
- Increased waste mound height increases the cap surface area and probability for leachate seeps to occur as a result of perched leachate scenarios. Also, removal of interim clayey soil cap for Landfill Optimization along the sideslopes also increases the potential for perched leachate related effects to Surface Water Quality while this area of the waste mound is not completed with interim or final cap.
- Increased waste mound height, thereby increasing landfill operational life, increases the duration of ASR disposal and management at the TCEC, which increases the potential for ASR to be tracked off-site along the north bound lane of Nauvoo Road to Highway 402.

Predicted Effects on Surface Water Quality On-Site Prior to Off-Site Discharge

EROSIONAL EFFECTS ON TSS AND HEAVY METAL CONCENTRATIONS IN SURFACE WATER

The increase in landfill height and surface area of the landfill cap could lead to greater erosion. The steeper side slopes of Alternative Method 3 may increase the risk of precipitation-induced erosion, leading to elevated TSS and soil-related metals (e.g., zinc, chromium, nickel) in surface water.

Mitigation measures include the continued use of sediment control measures (e.g., straw bales, silt fencing, vegetative cover), routine inspections and sediment removal from ditches and ponds, and topsoil and seeding of interim cover areas to reduce erosion. With mitigation measures, no net effects to Surface Water Quality from erosion are predicted for Alternative Method 3.

LEACHATE SEEP IMPACTS TO SURFACE WATER QUALITY

The increased waste mound height and cap surface area may raise the probability of leachate seeps, and in the short-term, there is the potential for perched leachate conditions to be encountered during interim cap stripping.

Mitigation measures include routine inspections (e.g., weekly during operations, monthly post-closure) to detect and repair seeps, and immediate repair of any identified seeps to prevent runoff into surface water systems. With mitigation measures, no net effects to Surface Water Quality from leachate seeps are predicted for Alternative Method 3.

Predicted Effects from PAHs on Surface Water Quality within the Roadside Ditch

The longer operational life under Alternative Method 3 could extend the period of ASR use, increasing the potential for PAH contamination in the roadside ditch along Nauvoo Road. Mitigation measures include rigorous inspection and cleanup of ASR track-out, including sweeping, scraping, and vegetation management, and containment of ASR within the landfill working face to minimize exposure to truck tires.

Table 6-20. Surface Water Quality Net Effects Assessment – Alternative Method 3

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Surface Water Quality	Predicted effects on Surface Water Quality on-site prior to off-site discharge (Erosional effects on TSS and heavy metal concentrations in surface water)	Key Design Considerations: • Slope grading and cap surface area proposed for the vertical expansion of the Expansion Landfill with consideration toward the potential of increased erosional effects to Surface Water Quality. • No proposed changes to the landfill base design as well as leachate collection and management for the Expansion Landfill. • The existing TCEC property boundaries and buffer width will remain the same. Key Assumptions: • Under Alternative Method 3, the slight alterations to the surface water management infrastructure (e.g., swales, ditching, and sedimentation ponds) are not considered to significantly impact Surface Water Quality as flow rates and volumes are similar to the approved Future Baseline Conditions. • Sedimentation Ponds 1 to 4 current designs are sufficient to manage Future Baseline flow conditions, as well as each Alternative Method even when considering climate change (Section 5.1.1 of the CDR), thus, the sedimentation ponds' capacities to attenuate chemical constituents are not expected to change. • Stormwater is currently, and will continue to be, managed on-site through swales and sedimentation ponds prior to off-site discharge. • Landfilling operational conditions are expected to remain the same under Alternative Method 3 and be consistent with current-approved Future Baseline operational requirements.	• Potential effects to Surface Water Quality (e.g., elevated TSS and select heavy metals) resulting from precipitation-induced erosion of exposed clayey soil on-site.	• Continue to operate and monitor Surface Water Quality at the TCEC in accordance with the relevant Conditions of the Waste and Sewage ECAs. • Install/maintain sediment control measures (e.g., straw bale/rock check dams, silt fencing, add vegetative controls, etc.) at various locations within the surface water drainage network. As-required sediment control measure placements and replacements based on Site conditions. • Supplement the northern component of the drainage network with erosion control measures as the landfill expands north prior to initiating Expansion Landfill Optimization. • Complete as-required sediment removal where sediment builds up in the surface water drainage network (e.g., at check dams, silt fencing, retention ponds, etc.). • Place topsoil and seed over areas of the Expansion Landfill side slopes completed with interim cover, where appropriate (e.g., 2 years).	• None. Presuming the mitigation measures presented herein are implemented and maintained as required, the risk for impacts to Surface Water Quality due to erosional effects will be effectively managed.

Table 6-20. Surface Water Quality Net Effects Assessment – Alternative Method 3

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
				• Inspect areas of soil stockpiling for erosion. Where necessary, erosion control measures would be installed to protect the drainage network from unacceptable sediment loading (e.g., silt fencing, straw bales, rock check dams, add vegetative controls, etc.).	
	Predicted effects on Surface Water Quality on-site prior to off-site discharge (Leachate seep impacts to Surface Water Quality)	Key Design Considerations: • Increase in waste mound height and the associated cap surface area as it relates to leachate seep probability. • No proposed changes to the landfill base design as well as leachate collection and management for the Expansion Landfill. • The existing TCEC property boundaries and buffer width will remain the same. Key Assumptions: • Within the Expansion Landfill, leachate mounding is not expected to develop based on the landfill's design. • Landfilling operational conditions are expected to remain the same under Alternative Method 3 and be consistent with current-approved Future Baseline operational requirements. • The approach to managing (disposing) leachate generated at the TCEC will remain the same as that presented for Future Baseline Conditions.	• In the short-term, there is the potential for perched leachate conditions to be encountered during interim cap stripping. • In the long-term, the probability of leachate seepage is proportional to the increase in cap surface area and landfill height (e.g., more cap/height, more chances of leachate seepage).	• Continue to operate and monitor Surface Water Quality at the TCEC in accordance with the relevant Conditions of the Waste and Sewage ECAs. • Seep repairs, when identified, should be repaired immediately and if possible, prior to seepage entering and/or running off landfill sideslopes and into the surface water drainage network. • Routine inspections (e.g., monthly during post-closure) of the landfill surface are expected to provide sufficient frequency to identify and, if necessary, address leachate seepage.	• None. There is no expected net effect to Surface Water Quality from leachate impacts with the implementation of a seepage monitoring and repair program under Alternative Method 3.

Table 6-20. Surface Water Quality Net Effects Assessment – Alternative Method 3

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
	Predicted effects from polyaromatic hydrocarbons (PAHs) Surface Water Quality within the roadside ditch of the northbound lane of Nauvoo Road from the Site to Hwy 402 in the off-Site Study Area	Key Design Considerations: • No proposed changes to the landfill base design as well as leachate collection and management for the Expansion Landfill. • The existing TCEC property boundaries and buffer width will remain the same. Key Assumptions: • Landfilling operational conditions are expected to remain the same under Alternative Method 3 and be consistent with current-approved Future Baseline operational requirements.	• There are no predicted net effects to Surface Water Quality in the Off-Site Study Area, from ASR track out as long as mitigation measures continue to be carried out.	• WM actively implements a rigorous routine inspection and where warranted, cleanup of ASR track out. On-site and off-site ASR cleanup efforts are completed as needed and consist of sweeping, scraping with light equipment, hand raking/picking, along the roadways, road shoulders, and within the ditches. It is noted that the vegetative growth within Nauvoo Road's roadside ditch is cut as part of cleanup activities such that ASR does not remain entangled in tall vegetation in ditches.	• None (as long as the Mitigation Measures continue to be carried out).

6.2.3.2 Surface Water Quantity

The Surface Water Quantity net effects assessment incorporates information from the Surface Water Quantity Existing Conditions Report (**Supporting Document 1-5**) and details of the Project design provided in the CDR (**Supporting Document 2**) in order to assess the net environmental effects of the three Alternative Methods. The detailed net effects assessment is provided in the Surface Water Quantity Effects Assessment Report (**Supporting Document 3-5**).

To identify the potential effects of the Project on Surface Water Quantity, the conceptual design of each Alternative Method for the landfill optimization was examined to determine if it will result in changes in runoff volumes and peak flows, and changes to drainage areas on-site and off-site. The occurrence and degree of off-site effects to surface water flows was also predicted.

The study areas for Surface Water Quantity correspond with the general study areas defined for the EA (**Section 4, Figure 4-1**).

The landfill optimization will impact the stormwater management (SWM) system in two ways:

Change in catchment areas within the landfill site; and

Decrease in time of concentration.

Key design considerations include the change in the catchment areas for each Alternative Method and the change in time of concentration leading to a change in surface runoff travelling to the SWM ponds, any changes to their function, and any changes to the flows leaving the system. The four existing SWM ponds, existing swales, and catchments D, E, F, H, I, and J will not be physically altered in any way from their existing characteristics. Additionally, existing monitoring is expected to continue for the landfill site.

Future Baseline Conditions

The Surface Water Quantity existing conditions are described in **Section 4.6.2**, including the existing catchment areas. The Future Baseline Conditions for Surface Water Quantity are assumed to be the same as Existing Conditions.

Alternative Method 1

The net effects assessment for Alternative Method 1 is presented in **Table 6-21**.

Change in Runoff Volumes and Peak Flows

The change in side slopes for Alternative Method 1 will not change total runoff volume from the landfill site; however, the timing of peak flows and the redistribution of catchment areas is expected to increase or decrease some of the peak flows leaving through the site outlets. Only four (4) outlets will experience changes in peak flows (Outlets A, B, C, and G). All other outlets show exactly the same peak flows leaving the site since the change in delineation of the catchments only occurred within the

optimization area of the landfill. The changes for the 100-year 4-hour Chicago storm compared to Existing Conditions are as follows:

- Outlet A: increase of 6%;
- Outlet B: decrease of 4%;
- Outlet C: decrease of 19%; and
- Outlet G: increase of 11%.

SWM Pond 3 discharges flows to Outlets A and B, which show an increase and decrease of 6% and 4%, respectively. Outlet G shows an approximate increase of 11% in flows when compared to Future Baseline Conditions; however, it should be noted that the swales conveying the flows to Outlet G have sufficient capacity and are able to safely convey the flows downstream.

All four SWM ponds have enough capacity to store the 100-year flows and do not require alteration or enlargement. The existing swales around the landfill site are also able to safely convey the 25-year design storm without overtopping; hence, modification to the existing cross-section geometries is not warranted. The relocated swales and new culvert will also be able to convey these flows appropriately when constructed.

Changes in Drainage Areas On-Site and Off-Site

As a result of the new grading for Alternative Method 1, the catchment delineation within the landfill optimization area will change when compared to Future Baseline Conditions. Changes in catchment areas within the landfill optimization area are between -23% and 37% when compared to Future Baseline Conditions.

Changes in off-site drainage areas are not anticipated for Alternative Method 1 because the site outlets will not change and the existing drainage areas are able to accommodate the changes in peak flows from the outlets.

Predicted Occurrence and Degree of Off-Site Effects

The downstream receiver of flows from Outlet A is the Auld-Redmond Drain and the downstream receiver of flows from Outlet G is the Gilliland-Geerts Drain. For Alternative Method 1, both outlets show an increase in peak flows up to 11%. Mitigation is not required as the peak flows are less than 1 m^3/s for Outlets A, B, and C, and 1.8 m^3/s for Outlet G. The off-site drainage areas will not be altered as a result of Alternative Method 1.

Table 6-21. Surface Water Quantity Net Effects Assessment – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Surface Water Quantity	Change in runoff volumes and peak flows resulting from steeper and longer side slopes	• Increase of final landfill side slopes from 4H:1V to 3H:1V between the original grade and elevation 320 masl, about 16 m in grade change, transitioning to a 20H:1V upper slope to a peak elevation of 324.5 masl over the Expansion Landfill footprint. • Changes in catchment areas within the landfill optimization area. • Four SWM ponds, existing swales and catchments D, E, F, H, I, and J will not be physically altered. • No change in total runoff volume from the landfill site.	• The timing of peak flows and the redistribution of catchment areas is expected to increase or decrease some of the peak flows leaving through the outlets. • Outlets A and G show an increase in peak flow compared to existing levels (up to 11%), while Outlets B and C demonstrate a decrease (up to 19%).	• No mitigation measures required.	• Increase in peak flows of up to 11% from Future Baseline Conditions.
	Changes in drainage areas on-site and off-site	• Changes in catchment areas within the landfill optimization area. • Four SWM ponds, existing swales and catchments D, E, F, H, I, and J will not be physically altered. • No change in off-site areas.	• Changes in catchment areas within the landfill optimization area are between -23% and 37% when compared to Future Baseline Conditions. • No change in off-site areas.	• No mitigation measures required.	• Changes in catchment areas within the landfill optimization area are between -23% and 37% when compared to Future Baseline Conditions. • No change in off-site areas.
	Predicted occurrence and degree of off-site effects	• Changes in catchment areas within the landfill optimization area. • No change in off-site areas. • No change in total runoff volume from the landfill site. • Existing monitoring is expected to continue for the landfill site.	• Increase in peak flows of up to 11% from Future Baseline Conditions. Peak flows are less than 1 m^3/s for Outlets A, B and C and 1.8 m^3/s for Outlet G.	• No mitigation measures required.	• Increase in peak flows of up to 11% from Future Baseline Conditions.

Alternative Method 2

The net effects assessment for Alternative Method 2 is presented in **Table 6-22**.

Change in Runoff Volumes and Peak Flows

The change in side slopes for Alternative Method 2 will not change total runoff volume from the landfill site; however, the timing of peak flows and the redistribution of catchment areas is expected to increase or decrease some of the peak flows leaving through the site outlets. Only four (4) outlets will experience changes in peak flows (Outlets A, B, C, and G). All other outlets show exactly the same peak flows leaving the site since the change in delineation of the catchments only occurred within the optimization area of the landfill. The changes for the 100-year 4-hour Chicago storm compared to Existing Conditions are as follows:

- Outlet A: increase of 7%;
- Outlet B: decrease of 4%;
- Outlet C: decrease of 19%; and
- Outlet G: increase of 10%.

SWM Pond 3 discharges flows to Outlets A and B, which show an increase and decrease of 7% and 4%, respectively. Outlet G shows an approximate increase of 10% in flows when compared to Future Baseline Conditions; however, it should be noted that the swales conveying the flows to Outlet G have sufficient capacity and are able to safely convey the flows downstream.

All four SWM ponds have enough capacity to store the 100-year flows and do not require alteration or enlargement. The existing swales around the landfill site are also able to safely convey the 25-year design storm without overtopping; hence, modification to the existing cross-section geometries is not warranted. The relocated swales and new culvert will also be able to convey these flows appropriately when constructed.

Changes in Drainage Areas On-Site and Off-Site

As a result of the new grading for Alternative Method 2, the catchment delineation within the landfill optimization area will change when compared to Future Baseline Conditions. Changes in catchment areas within the landfill optimization area are between -22% and 34% when compared to Future Baseline Conditions.

Changes in off-site drainage areas are not anticipated for Alternative Method 2 because the site outlets will not change and the existing drainage areas are able to accommodate the changes in peak flows from the outlets.

Predicted Occurrence and Degree of Off-Site Effects

The downstream receiver of flows from Outlet A is the Auld-Redmond Drain and the downstream receiver of flows from Outlet G is the Gilliland-Geerts Drain. For

Alternative Method 2, both outlets show an increase in peak flows up to 11%. Mitigation is not required as the peak flows are less than 1 m^3/s for Outlets A, B, and C, and 1.8 m^3/s for Outlet G. The off-site drainage areas will not be altered as a result of Alternative Method 2.

Table 6-22. Surface Water Quantity Net Effects Assessment – Alternative Method 2

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Surface Water Quantity	Change in runoff volumes and peak flows resulting from steeper and longer side slopes	• Increase of final landfill side slopes from 4H:1V to 2.5H:1V between elevation 250 masl and elevation 310 masl, about 60 m in grade change, transitioning to a 20H:1V upper slope to a peak elevation of 319 masl over the Expansion Landfill footprint. • Changes in catchment areas within the landfill optimization area. • Four SWM ponds, existing swales and catchments D, E, F, H, I, and J will not be physically altered. • No change in total runoff volume from the landfill site.	• The timing of peak flows and the redistribution of catchment areas is expected to increase or decrease some of the peak flows leaving through the outlets. • Outlets A and G show an increase in peak flows compared to existing levels (up to 10%), while Outlets B and C demonstrate a decrease (up to 19%).	• No mitigation measures required.	• Increase in peak flows of up to 10% from Future Baseline Conditions.
	Changes in drainage areas on-site and off-site	• Changes in catchment areas within the landfill optimization area. • Four SWM ponds, existing swales and catchments D, E, F, H, I, and J will not be physically altered. • No change in off-site areas.	• Changes in catchment areas within the landfill optimization area are between -22% and 34% when compared to Future Baseline Conditions. • No change in off-site areas.	• No mitigation measures required.	• Changes in catchment areas within the landfill optimization area are between -22% and 34% when compared to Future Baseline Conditions. • No change in off-site areas.
	Predicted occurrence and degree of off-site effects	• Changes in catchment areas within the landfill optimization area. • No change in off-site areas. • No change in total runoff volume from the landfill site. • Existing monitoring is expected to continue for the landfill site.	• Increase in peak flows of up to 10% from Future Baseline Conditions. Peak flows are less than 1 m^3/s for Outlets A, B and C and 1.8 m^3/s for Outlet G.	• No mitigation measures required.	• Increase in peak flows of up to 10% from Future Baseline Conditions.

Alternative Method 3

The net effects assessment for Alternative Method 3 is presented in **Table 6-23**.

Change in Runoff Volumes and Peak Flows

The change in side slopes for Alternative Method 3 will not change total runoff volume from the landfill site; however, the timing of peak flows and the redistribution of catchment areas is expected to increase or decrease some of the peak flows leaving through the site outlets. Only four (4) outlets will experience changes in peak flows (Outlets A, B, C, and G). All other outlets show exactly the same peak flows leaving the site since the change in delineation of the catchments only occurred within the optimization area of the landfill. The changes for the 100-year 4-hour Chicago storm compared to Existing Conditions are as follows:

- Outlet A: increase of 5%;
- Outlet B: decrease of 4%;
- Outlet C: decrease of 19%; and
- Outlet G: increase of 11%.

SWM Pond 3 discharges flows to Outlets A and B, which show an increase and decrease of 5% and 4%, respectively. Outlet G shows an approximate increase of 11% in flows when compared to Future Baseline Conditions; however, it should be noted that the swales conveying the flows to Outlet G have sufficient capacity and are able to safely convey the flows downstream.

All four SWM ponds have enough capacity to store the 100-year flows and do not require alteration or enlargement. The existing swales around the landfill site are also able to safely convey the 25-year design storm without overtopping; hence, modification to the existing cross-section geometries is not warranted. The relocated swales and new culvert will also be able to convey these flows appropriately when constructed.

Changes in Drainage Areas On-Site and Off-Site

As a result of the new grading for Alternative Method 3, the catchment delineation within the landfill optimization area will change when compared to Future Baseline Conditions. Changes in catchment areas within the landfill optimization area are between -24% and 36% when compared to Future Baseline Conditions.

Changes in off-site drainage areas are not anticipated for Alternative Method 3 because the site outlets will not change and the existing drainage areas are able to accommodate the changes in peak flows from the outlets.

Predicted Occurrence and Degree of Off-Site Effects

The downstream receiver of flows from Outlet A is the Auld-Redmond Drain and the downstream receiver of flows from Outlet G is the Gilliland-Geerts Drain. For

Alternative Method 3, both outlets show an increase in peak flows up to 11%. Mitigation is not required as the peak flows are less than 1 m^3/s for Outlets A, B, and C, and 1.8 m^3/s for Outlet G. The off-site drainage areas will not be altered as a result of Alternative Method 3.

Table 6-23. Surface Water Quantity Net Effects Assessment – Alternative Method 3

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Surface Water Quantity	Change in runoff volumes and peak flows resulting from steeper and longer side slopes	• Increase of final landfill side slopes from 4H:1V to 2.5H:1V between the elevation 260 masl and elevation 360 masl, about 100 m in grade change, to a peak elevation of 360 masl over the Expansion Landfill footprint. • Changes in catchment areas within the landfill optimization area. • Four SWM ponds, existing swales and catchments D, E, F, H, I, and J will not be physically altered. • No change in total runoff volume from the landfill site.	• The timing of peak flows and the redistribution of catchment areas is expected to increase or decrease some of the peak flows leaving through the outlets. • Outlets A and G show an increase in peak flow compared to existing levels (up to 11%), while Outlets B and C demonstrate a decrease (up to 19%).	• No mitigation measures required.	• Increase in peak flows of up to 11% from Future Baseline Conditions.
	Changes in drainage areas on-site and off-site	• Changes in catchment areas within the landfill optimization area. • Four SWM ponds, existing swales and catchments D, E, F, H, I, and J will not be physically altered. • No change in off-site areas.	• Changes in catchment areas within the landfill optimization area are between -24% and 36% when compared to Future Baseline Conditions. • No change in off-site areas.	• No mitigation measures required.	• Changes in catchment areas within the landfill optimization area are between -24% and 36% when compared to Future Baseline Conditions. • No change in off-site areas.
	Predicted occurrence and degree of off-site effects	• Changes in catchment areas within the landfill optimization area. • No change in off-site areas. • No change in total runoff volume from the landfill site. • Existing monitoring is expected to continue for the landfill site.	• Increase in peak flows of up to 10% from Future Baseline Conditions. Peak flows are less than 1 m^3/s for Outlets A, B and C and 1.8 m^3/s for Outlet G.	• No mitigation measures required.	• Increase in peak flows of up to 11% of Future Baseline Conditions.

6.2.4 Ecological Environment

The Ecological Environment considers Terrestrial Ecosystems and Aquatic Ecosystems.

The Ecological Environment net effects assessment incorporates information from the Ecological Environment Existing Conditions Report (**Supporting Document 1-6**) and details of the Project design provided in the CDR (**Supporting Document 2**) in order to assess the net environmental effects of the three Alternative Methods. The detailed net effects assessment is provided in the Ecological Environment Effects Assessment Report (**Supporting Document 3-6**).

To identify the potential effects of the Project on the Ecological Environment, the conceptual design of each Alternative Method for the landfill optimization was examined to determine if it will have an effect on:

- Terrestrial Ecosystems through changes in vegetation communities and species, wildlife habitat, and wildlife, including rare, threatened or endangered species; and
- Aquatic Ecosystems through changes in aquatic habitat, including fish habitat, and changes in aquatic biota, including rare, threatened or endangered species.

For the Ecological Environment, the general Off-site Study Area defined for the EA was extended to include the Gilliland-Geerts Drain downstream and westward of the TCEC to Underpass Road (**Section 4, Figure 4-13**).

Assumptions used in the Ecological Environment effects assessment include: noise mitigation will continue as per current operations, the Project site development footprint will be within the approved Expansion Landfill footprint, bird management will continue as per current operations, and there will be no changes to traffic patterns, operating hours, or typical equipment used at the TCEC.

6.2.4.1 Terrestrial Ecosystems

Terrestrial ecosystems within the On-site Study Area are characterized by active landfill areas, sedimentation ponds, Poplar (*Populus* spp.) tree phytoremediation systems, soil storage and maintenance facilities, a leachate storage area, and agricultural lands. No vegetation communities (including woodlands and wetlands) or rare, threatened or endangered species were identified in the approved limit of the Expansion Landfill. Natural vegetation communities within the On-site Study Area are very limited, and the Off-site Study Area is dominated by agricultural fields interspersed with residential and commercial properties, a cemetery, woodlots, and riparian areas surrounding municipal drains and watercourses. The On-site and Off-site Study Areas contain unevaluated wetlands, areas identified on Lambton County and Warwick Township OPs as Significant Woodland, and several species of vascular flora considered ‘Rare’ in Lambton County.

No wildlife habitat (including significant wildlife habitat) or rare, threatened or endangered species were identified in the approved limit of the Expansion Landfill; however, confirmed Significant Wildlife Habitat (SWH) types occur within both Study

Areas including: amphibian breeding habitat (woodland); terrestrial crayfish habitat; and breeding habitat for the Species of Conservation Concern (SCC) Western Chorus Frog. Within the On-site Study Area, potential breeding habitat may also be present for two other SCC, Eastern Wood-Pewee and Wood Thrush. Within the Off-site Study Area, breeding habitat for Eastern Wood-Pewee was confirmed, and potential habitat was identified for three additional bird SCC: Wood Thrush, Canada Warbler, and Tufted Titmouse. Candidate Amphibian Breeding Habitat (Wetland) and Bat Maternity Colony SWH may also be present within the Off-site Study Area.

Natural features within the On-site and Off-site Study Areas have the potential to support habitat for Species at Risk (SAR) listed as Threatened or Endangered and protected under the provincial *Endangered Species Act*, 2007 (ESA), including Bobolink, Eastern Hog-nosed Snake, Eastern Small-footed Myotis, Little Brown Myotis, Northern Myotis, Tri-colored Bat, Eastern Red Bat, Hoary Bat, and Silver-haired Bat.

Overall use of the active landfill area by avifaunal scavengers appears to be low. Multiple avifaunal scavengers were documented within the approved limit of the Expansion Landfill. Multiple acoustic devices, in addition to a bird of prey, are used to scare away these birds from the active landfill. These acoustic devices also reduce the potential for birds and other wildlife drinking from the ponds.

Future Baseline Conditions

Landfill operations will continue until the landfill has reached its full horizontal footprint and currently approved height of 280 masl. All existing natural heritage features will remain on the landscape, and wildlife in the area is also expected to remain stable, as wildlife have adapted to the landfill operations, since its construction in 1972, over the last 53 years.

Vegetation Communities and Species

The current ecological conditions as described above are expected to persist and be present under Future Baseline Conditions when the Project begins. A poplar plantation and poplar system are also present within the On-site Study Area, which are not expected to become saturated. The poplar system has been monitored annually, with no indication of chemical build-up in the roots, stems, or leaves. As poplar trees are short-lived, trees are regularly harvested and replanted. As no chemical build-up has been documented, this wood can be used for beneficial use, such as mulch.

Wildlife and Wildlife Habitat

The current ecological conditions as described above are expected to persist and be present under Future Baseline Conditions when the Project begins.

Alternative Method 1

The net effects assessment for Alternative Method 1 is presented in **Table 6-24**.

Vegetation Communities and Species

Vegetation can be directly affected by a landfill expansion through removal, and indirectly affected through leachate seeps, LFG emissions, increased surface water (flooding), and stormwater runoff (erosion and sedimentation). Leachate and stormwater can contaminate groundwater and surface water with toxic pollutants that can impact vegetation. LFG contributes to climate change, which can lead to an increase in temperatures and extreme weather, causing stress to vegetation.

No vegetation communities or species were identified within the Expansion Landfill footprint, so no direct impacts to vegetation communities and species are anticipated. While vegetation communities and species exist in the On-site and Off-site Study Areas, no excavation will occur outside the Expansion Landfill footprint, so no direct impacts are anticipated to vegetation communities and species.

Indirect impacts to vegetation communities and species are not anticipated as Alternative Method 1 is not expected to affect the functionality of the management systems in place for leachate seeps, LFG production, and stormwater runoff. Although stormwater peak flow timing may change, modelling shows that existing stormwater ponds can handle 100-year flow scenarios under Alternative Method 1.

Wildlife and Wildlife Habitat

Wildlife and wildlife habitat can be directly affected by a landfill expansion through removal and indirectly by leachate seeps, LFG emissions, increased surface water (flooding), and stormwater runoff (erosion and sedimentation). Leachate and stormwater can contaminate groundwater and surface water with toxic pollutants that can impact wildlife by altering habitat and food sources, and polluting drinking water. LFG contributes to climate change, which can lead to an increase in temperatures and extreme weather, causing stress to wildlife, vegetation (wildlife habitat), altering seasonal behaviours and weather triggers, or death.

No vegetation communities were identified in the approved limit of the landfill; therefore, no wildlife habitat is present within the active landfill area and no direct impacts to wildlife and wildlife habitat is anticipated. Avifaunal scavengers at the landfill will continue to be managed following current protocols using deterrents.

Since no excavation for the Project will be conducted outside of the Expansion Landfill footprint, no direct impacts to wildlife and wildlife habitat within the On-site and Off-site Study Areas are anticipated. Indirect impacts to wildlife and wildlife habitat are also not anticipated as Alternative Method 1 is not expected to affect the functionality of the management systems in place for leachate seeps, LFG production, and stormwater runoff. Although stormwater peak flow timing may change, modelling shows that existing stormwater ponds can handle 100-year flow scenarios under Alternative Method 1.

No off-site indirect impacts to wildlife and wildlife habitat from noise are anticipated due to the implementation of noise mitigation measures.

Table 6-24. Terrestrial Ecosystems Net Effects Assessment – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Terrestrial Ecosystems	Predicted effects on vegetation communities and species including rare, threatened, or endangered species	Key Design Considerations: • Leachate seeps in the On-site and Off-site Study Areas. • LFG production. • Increase in surface water quantity. • Stormwater runoff in the On-site and Off-site Study Areas. • Noise mitigation will continue as per current operations. • Site development footprint will be within the approved Expansion Landfill footprint. • Landfill operations – bird management will continue as per current operations. Assumptions: • No changes to traffic patterns • No changes to typical equipment used • No changes to operating hours	• None	• None	• None
	Predicted effects on wildlife and wildlife habitat including rare, threatened, or endangered species	Key Design Considerations: • Leachate seeps in the On-site and Off-site Study Areas. • LFG production. • Increase in surface water quantity. • Stormwater runoff in the On-site and Off-site Study Areas. • Noise mitigation will continue as per current operations. • Site development footprint will be within the approved Expansion Landfill footprint. • Landfill operations – bird management will continue as per current operations. Assumptions: • No changes to traffic patterns • No changes to typical equipment used • No changes to operating hours	• Continued operation of landfill will prolong the attractiveness of the area for avifaunal scavengers.	• Continued implementation of Gull Management Plan using acoustic deterrent devices and a bird of prey.	• Minimal with identified mitigation measures.

Alternative Method 2

The net effects assessment for Alternative Method 2 is presented in **Table 6-25**.

Vegetation Communities and Species

No vegetation communities or species were identified within the Expansion Landfill footprint, so no direct impacts to vegetation communities and species are anticipated. While vegetation communities and species exist in the On-site and Off-site Study Areas, no excavation will occur outside the Expansion Landfill footprint, so no direct impacts are anticipated to vegetation communities and species.

Indirect impacts to vegetation communities and species are not anticipated as Alternative Method 2 is not expected to affect the functionality of the management systems in place for leachate seeps, LFG production, and stormwater runoff. Although stormwater peak flow timing may change, modelling shows that existing stormwater ponds can handle 100-year flow scenarios under Alternative Method 2.

Wildlife and Wildlife Habitat

No vegetation communities were identified in the approved limit of the landfill; therefore, no wildlife habitat is present within the active landfill area and no direct impacts to wildlife and wildlife habitat is anticipated. Avifaunal scavengers at the landfill will continue to be managed following current protocols using deterrents.

Since no excavation for the Project will be conducted outside of the Expansion Landfill footprint, no direct impacts to wildlife and wildlife habitat within the On-site and Off-site Study Areas are anticipated. Indirect impacts to wildlife and wildlife habitat are also not anticipated as Alternative Method 2 is not expected to affect the functionality of the management systems in place for leachate seeps, LFG production, and stormwater runoff. Although stormwater peak flow timing may change, modelling shows that existing stormwater ponds can handle 100-year flow scenarios under Alternative Method 2.

No off-site indirect impacts to wildlife and wildlife habitat from noise are anticipated due to the implementation of noise mitigation measures.

Table 6-25. Terrestrial Ecosystems Net Effects Assessment – Alternative Method 2

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Terrestrial Ecosystems	Predicted effects on vegetation communities and species including rare, threatened, or endangered species	Key Design Considerations: • Leachate seeps in the On-site and Off-site Study Areas. • LFG production. • Increase in surface water quantity. • Stormwater runoff in the On-site and Off-site Study Areas. • Noise mitigation will continue as per current operations. • Site development footprint will be within the approved Expansion Landfill footprint. • Landfill operations – bird management will continue as per current operations. Assumptions: • No changes to traffic patterns • No changes to typical equipment used • No changes to operating hours	• None	• None	• None
	Predicted effects on wildlife and wildlife habitat including rare, threatened, or endangered species	Key Design Considerations: • Leachate seeps in the On-site and Off-site Study Areas. • LFG production. • Increase in surface water quantity • Stormwater runoff in the On-site and Off-site Study Areas. • Noise mitigation will continue as per current operations. • Site development footprint will be within the approved Expansion Landfill footprint. • Landfill operations – bird management will continue as per current operations. Assumptions: • No changes to traffic patterns • No changes to typical equipment used • No changes to operating hours	• Continued operation of landfill will prolong the attractiveness of the area for avifaunal scavengers.	• Continued implementation of Gull Management Plan using acoustic deterrent devices and a bird of prey.	• Minimal with identified mitigation measures.

Alternative Method 3

The net effects assessment for Alternative Method 3 is presented in **Table 6-26**.

Vegetation Communities and Species

No vegetation communities or species were identified within the Expansion Landfill footprint, so no direct impacts to vegetation communities and species are anticipated. While vegetation communities and species exist in the On-site and Off-site Study Areas, no excavation will occur outside the Expansion Landfill footprint, so no direct impacts are anticipated to vegetation communities and species.

Indirect impacts to vegetation communities and species are not anticipated as Alternative Method 3 is not expected to affect the functionality of the management systems in place for leachate seeps, LFG production, and stormwater runoff. Although stormwater peak flow timing may change, modelling shows that existing stormwater ponds can handle 100-year flow scenarios under Alternative Method 3.

Wildlife and Wildlife Habitat

No vegetation communities were identified in the approved limit of the landfill; therefore, no wildlife habitat is present within the active landfill area and no direct impacts to wildlife and wildlife habitat is anticipated. Avifaunal scavengers at the landfill will continue to be managed following current protocols using deterrents.

Since no excavation for the Project will be conducted outside of the Expansion Landfill footprint, no direct impacts to wildlife and wildlife habitat within the On-site and Off-site Study Areas are anticipated. Indirect impacts to wildlife and wildlife habitat are also not anticipated as Alternative Method 3 is not expected to affect the functionality of the management systems in place for leachate seeps, LFG production, and stormwater runoff. Although stormwater peak flow timing may change, modelling shows that existing stormwater ponds can handle 100-year flow scenarios under Alternative Method 3.

No off-site indirect impacts to wildlife and wildlife habitat from noise are anticipated due to the implementation of noise mitigation measures.

Table 6-26. Terrestrial Ecosystems Net Effects Assessment – Alternative Method 3

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Terrestrial Ecosystems	Predicted effects on vegetation communities and species including rare, threatened, or endangered species	Key Design Considerations: • Leachate seeps in the On-site and Off-site Study Areas. • LFG production. • Increase in surface water quantity. • Stormwater runoff in the On-site and Off-site Study Areas. • Noise mitigation will continue as per current operations. • Site development footprint will be within the approved Expansion Landfill footprint. • Landfill operations – bird management will continue as per current operations. Assumptions: • No changes to traffic patterns • No changes to typical equipment used • No changes to operating hours	• None	• None	• None
	Predicted effects on wildlife and wildlife habitat including rare, threatened, or endangered species	Key Design Considerations: • Leachate seeps in the On-site and Off-site Study Areas. • LFG production. • Increase in surface water quantity. • Stormwater runoff in the On-site and Off-site Study Areas. • Noise mitigation will continue as per current operations. • Site development footprint will be within the approved Expansion Landfill footprint. • Landfill operations – bird management will continue as per current operations. Assumptions: • No changes to traffic patterns • No changes to typical equipment used • No changes to operating hours	• Continued operation of landfill will prolong the attractiveness of the area for avifaunal scavengers.	• Continued implementation of Gull Management Plan using acoustic deterrent devices and a bird of prey.	• Minimal with identified mitigation measures.

6.2.4.2 Aquatic Ecosystems

Aquatic ecosystems are mainly found within the Off-site Study Area; however, the On-site Study Area drains to aquatic features within both the Brown Creek and Bear Creek Headwaters subwatersheds. Other than a small portion of Brown Creek present as a naturalized watercourse south of Confederation Line, all aquatic features within the Off-site Study Area are constructed open or closed (i.e., tiled) municipal drains with a history of channelization and other anthropogenic modifications.

Open channel features include Kersey Drain (the channelized reach of Brown Creek), Cameron Drain, Burchill Drain, Gilliland-Geerts Drain, Gilliland-Geerts Drain Branch, and Brown-Jarriott Drain. Perennial or seasonal direct fish habitat of moderate to good quality is present within all features except for Gilliland-Geerts Drain Branch and Burchill Drain, which were determined to provide indirect fish habitat only. Kersey Drain provides the best quality habitat and supports the most diverse fish community when compared with other assessed features. No aquatic habitat associated with Brown Creek (Kersey Drain) or the municipal drains was identified in the approved limit of the Expansion Landfill. The Vankessel Drain is within the approved limit of the Expansion Landfill but is now closed and therefore does not provide aquatic habitat. Due to the stormwater quality treatment purpose of the on-site SWM ponds, and fenced nature of the site they are not considered to present suitable habitat for native fish and wildlife within the On-site Study Area. Aquatic ecosystems within the Off-site Study Area provide habitat for fish species with both coolwater and warmwater thermal regime tolerances.

No aquatic biota, including rare, threatened, or endangered species were identified in the approved limit of the Expansion Landfill. No aquatic SAR or SCC were documented in the On-site or Off-site Study Areas.

Future Baseline Conditions

Aquatic Habitat

The current ecological conditions as described above are expected to persist and be present under Future Baseline Conditions when the Project begins.

Existing on-site stormwater is managed through a series of ponds and stormwater swales to maintain peak site runoff at pre-development levels, providing water quality treatment at a 75% TSS removal rate, as established by the Stormwater Management Planning and Design Manual (MOE, 2003). This level of treatment is understood to minimize the risk of impacts to downstream aquatic habitat features resulting from surface runoff and sediment transfer. Resulting stormwater flows meet Provincial Water Quality Standards minimizing the risk of impacts to downstream aquatic resources. As such, no negative impacts to downstream resources and fish habitat are anticipated under Future Baseline Conditions.

Aquatic Biota

The current ecological conditions as described are expected to persist and be present under Future Baseline Conditions when the Project begins.

The proposed systems meet the "Enhanced" level of stormwater protection as per the MOE's (2003) SWM planning and design manual to minimize the risks associated with sediment release. As such, no negative impacts to downstream resources are anticipated. Post construction water quality monitoring will be completed to ensure the SWM system is functioning as designed.

Alternative Method 1

The net effects assessment for Alternative Method 1 is presented in **Table 6-27**.

Aquatic Habitat

Aquatic habitat can be directly affected by a landfill expansion through removal and indirectly by leachate seeps, LFG emissions, increased surface water (flooding), and stormwater runoff (erosion and sedimentation). Leachate and stormwater can contaminate groundwater and surface water with toxic pollutants that can impact aquatic vegetation. LFG contributes to climate change, which can lead to an increase in temperatures and extreme weather, causing stress to vegetation, increases water temperature, and causes drought or flooding. No direct aquatic habitat features are located within the footprint of the Expansion Landfill, therefore, no direct impacts to aquatic habitat are anticipated.

Multiple watercourses that provide aquatic habitat are present in the On-site and Off-site Study Areas; however, since no excavation for the Project will be conducted outside of the Expansion Landfill footprint, no direct impacts to aquatic habitat within the On-site and Off-site Study Areas are anticipated. Indirect impacts to aquatic habitat, or downstream aquatic habitat features, are also not anticipated as Alternative Method 1 is not expected to affect the functionality of the management systems in place for leachate seeps, LFG production, and stormwater runoff. Although stormwater peak flow timing may change, modelling shows that existing stormwater ponds can handle 100-year flow scenarios under Alternative Method 1. As such no indirect impacts are anticipated to downstream aquatic habitat features.

Aquatic Biota

Aquatic biota can be directly affected by a landfill expansion through removal and indirectly by leachate seeps, LFG emissions, increased surface water (flooding), and stormwater runoff (erosion and sedimentation). Leachate and stormwater can contaminate groundwater and surface water with toxic pollutants that can impact aquatic biota by altering habitat and food sources, and contaminating water. LFG contributes to climate change, which can lead to an increase in temperatures and extreme weather, causing stress to vegetation (aquatic and riparian habitat) and aquatic biota, increases water temperature, and causes drought or flooding, thereby changing habitat for aquatic biota.

No direct aquatic habitat features are located within the footprint of the Expansion Landfill, therefore, no direct impacts to aquatic biota are anticipated. Multiple watercourses that support aquatic biota are present in the On-site and Off-site Study Areas; however, since no excavation for the Project will be conducted outside of the Expansion Landfill footprint, no direct impacts to aquatic habitat within the On-site and Off-site Study Areas are anticipated. Indirect impacts to aquatic habitat, or downstream aquatic habitat features, are also not anticipated as Alternative Method 1 is not expected to affect the functionality of the management systems in place for leachate seeps, LFG production, and stormwater runoff.

Although stormwater peak flow timing may change, modelling shows that existing stormwater ponds can handle 100-year flow scenarios under Alternative Method 1. The 75% TSS removal rate achieved by the existing SWM systems minimize the risk of impacts to downstream aquatic habitat features resulting from surface runoff and sediment transfer. No indirect impacts to downstream aquatic habitat features as a result of changes to stormwater runoff are anticipated.

Table 6-27. Aquatic Ecosystems Net Effects Assessment – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Aquatic Ecosystems	Predicted effects on aquatic habitat, including fish habitat	Key Design Considerations: • Leachate seeps in the On-site and Off-site Study Areas. • LFG production. • Increase in surface water quantity. • Stormwater runoff in the On-site and Off-site Study Areas. • Noise mitigation will continue as per current operations. • Site development footprint will be within the approved Expansion Landfill footprint. • Landfill operations – bird management will continue as per current operations. Assumptions: • No changes to traffic patterns • No changes to typical equipment used • No changes to operating hours	• None	• None	• None
	Predicted effects on aquatic biota including rare, threatened, or endangered species	Key Design Considerations: • Leachate seeps in the On-site and Off-site Study Areas. • LFG production. • Increase in surface water quantity. • Stormwater runoff in the On-site and Off-site Study Areas, and downstream aquatic habitat features • Noise mitigation will continue as per current operations. • Site development footprint will be within the approved Expansion Landfill footprint. • Landfill operations – bird management will continue as per current operations. Assumptions: • No changes to traffic patterns • No changes to typical equipment used • No changes to operating hours	• None	• None	• None

Alternative Method 2

The net effects assessment for Alternative Method 2 is presented in **Table 6-28**.

Aquatic Habitat

No direct aquatic habitat features are located within the footprint of the Expansion Landfill, therefore, no direct impacts to aquatic habitat are anticipated.

Multiple watercourses that provide aquatic habitat are present in the On-site and Off-site Study Areas; however, since no excavation for the Project will be conducted outside of the Expansion Landfill footprint, no direct impacts to aquatic habitat within the On-site and Off-site Study Areas are anticipated. Indirect impacts to aquatic habitat, or downstream aquatic habitat features, are also not anticipated as Alternative Method 2 is not expected to affect the functionality of the management systems in place for leachate seeps, LFG production, and stormwater runoff. Although stormwater peak flow timing may change, modelling shows that existing stormwater ponds can handle 100-year flow scenarios under Alternative Method 2. As such no indirect impacts are anticipated to downstream aquatic habitat features.

Aquatic Biota

No direct aquatic habitat features are located within the footprint of the Expansion Landfill, therefore, no direct impacts to aquatic biota are anticipated. Multiple watercourses that support aquatic biota are present in the On-site and Off-site Study Areas; however, since no excavation for the Project will be conducted outside of the Expansion Landfill footprint, no direct impacts to aquatic habitat within the On-site and Off-site Study Areas are anticipated. Indirect impacts to aquatic habitat, or downstream aquatic habitat features, are also not anticipated as Alternative Method 2 is not expected to affect the functionality of the management systems in place for leachate seeps, LFG production, and stormwater runoff.

Although stormwater peak flow timing may change, modelling shows that existing stormwater ponds can handle 100-year flow scenarios under Alternative Method 2. The 75% TSS removal rate achieved by the existing SWM systems minimize the risk of impacts to downstream aquatic habitat features resulting from surface runoff and sediment transfer. No indirect impacts to downstream aquatic habitat features as a result of changes to stormwater runoff are anticipated.

Table 6-28. Aquatic Ecosystems Net Effects Assessment – Alternative Method 2

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Aquatic Ecosystems	Predicted effects on aquatic habitat, including fish habitat	Key Design Considerations: • Leachate seeps in the On-site and Off-site Study Areas. • LFG production. • Increase in surface water quantity. • Stormwater runoff in the On-site and Off-site Study Areas. • Noise mitigation will continue as per current operations. • Site development footprint will be within the approved Expansion Landfill footprint. • Landfill operations – bird management will continue as per current operations. Assumptions: • No changes to traffic patterns • No changes to typical equipment used • No changes to operating hours	• None	• None	• None
	Predicted effects on aquatic biota including rare, threatened, or endangered species	Key Design Considerations: • Leachate seeps in the On-site and Off-site Study Areas. • LFG production. • Increase in surface water quantity. • Stormwater runoff in the On-site and Off-site Study Areas, and downstream aquatic habitat features. • Noise mitigation will continue as per current operations. • Site development footprint will be within the approved Expansion Landfill footprint. • Landfill operations – bird management will continue as per current operations. Assumptions: • No changes to traffic patterns • No changes to typical equipment used • No changes to operating hours	• None	• None	• None

Alternative Method 3

The net effects assessment for Alternative Method 3 is presented in **Table 6-29**.

Aquatic Habitat

No direct aquatic habitat features are located within the footprint of the Expansion Landfill, therefore, no direct impacts to aquatic habitat are anticipated.

Multiple watercourses that provide aquatic habitat are present in the On-site and Off-site Study Areas; however, since no excavation for the Project will be conducted outside of the Expansion Landfill footprint, no direct impacts to aquatic habitat within the On-site and Off-site Study Areas are anticipated. Indirect impacts to aquatic habitat, or downstream aquatic habitat features, are also not anticipated as Alternative Method 3 is not expected to affect the functionality of the management systems in place for leachate seeps, LFG production, and stormwater runoff. Although stormwater peak flow timing may change, modelling shows that existing stormwater ponds can handle 100-year flow scenarios under Alternative Method 3. As such no indirect impacts are anticipated to downstream aquatic habitat features.

Aquatic Biota

No direct aquatic habitat features are located within the footprint of the Expansion Landfill, therefore, no direct impacts to aquatic biota are anticipated. Multiple watercourses that support aquatic biota are present in the On-site and Off-site Study Areas; however, since no excavation for the Project will be conducted outside of the Expansion Landfill footprint, no direct impacts to aquatic habitat within the On-site and Off-site Study Areas are anticipated. Indirect impacts to aquatic habitat, or downstream aquatic habitat features, are also not anticipated as Alternative Method 3 is not expected to affect the functionality of the management systems in place for leachate seeps, LFG production, and stormwater runoff.

Although stormwater peak flow timing may change, modelling shows that existing stormwater ponds can handle 100-year flow scenarios under Alternative Method 3. The 75% TSS removal rate achieved by the existing SWM systems minimize the risk of impacts to downstream aquatic habitat features resulting from surface runoff and sediment transfer. No indirect impacts to downstream aquatic habitat features as a result of changes to stormwater runoff are anticipated.

Table 6-29. Aquatic Ecosystems Net Effects Assessment – Alternative Method 3

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Aquatic Ecosystems	Predicted effects on aquatic habitat, including fish habitat	Key Design Considerations: • Leachate seeps in the On-site and Off-site Study Areas. • LFG production. • Increase in surface water quantity. • Stormwater runoff in the On-site and Off-site Study Areas. • Noise mitigation will continue as per current operations. • Site development footprint will be within the approved Expansion Landfill footprint. • Landfill operations – bird management will continue as per current operations. Assumptions: • No changes to traffic patterns • No changes to typical equipment used • No changes to operating hours	• None	• None	• None
	Predicted effects on aquatic biota including rare, threatened, or endangered species	Key Design Considerations: • Leachate seeps in the On-site and Off-site Study Areas. • LFG production. • Increase in surface water quantity. • Stormwater runoff in the On-site and Off-site Study Areas, and downstream aquatic habitat features. • Noise mitigation will continue as per current operations. • Site development footprint will be within the approved Expansion Landfill footprint. • Landfill operations – bird management will continue as per current operations. Assumptions: • No changes to traffic patterns • No changes to typical equipment used • No changes to operating hours	• None	• None	• None

6.2.5 Social Environment

The Social Environment component of the Socio-Economic Environment considers Human Health and Effects on the Local Community.

6.2.5.1 Human Health

The Human Health net effects assessment incorporates information from the Human Health Existing Conditions Report (**Supporting Document 1-7**) and details of the Project design provided in the CDR (**Supporting Document 2**). The study areas for Human Health correspond with the general study areas defined for the EA (**Section 4, Figure 4-1**). Based on an examination of the three Alternative Methods, it is unlikely that any of the Alternative Methods would alter the conclusions of the Human Health Effects Assessment. As such, the Human Health Effects Assessment focuses on a comparison of the potential environmental effects of the Preferred Alternative to the 2005 HHRA. The detailed net effects assessment is provided in the Human Health Effects Assessment Report (**Supporting Document 3-7**).

The approach for the Human Health Effects Assessment was not to complete a reassessment of risk on a pathway-by-pathway point of view, other than the primary pathway of inhalation of air, soils and dusts; rather, the effects assessment evaluated whether there have been significant changes in chemicals or emissions from the TCEC compared to those modelled as part of the Human Health Risk Assessment (HHRA) conducted as part of the 2005 Warwick Landfill EA, and whether any of the exposure assumptions have changed, or the toxicological knowledge surrounding a given chemical has changed. By evaluating changes in emissions, the effects assessment can qualitatively evaluate the implications on each of the exposure pathways evaluated in the 2005 HHRA to determine whether the conclusions would still hold.

The effects assessment of the Preferred Alternative is presented in **Section 8**.

6.2.5.2 Effects on the Local Community

Effects on the Local Community are part of the Social Environment component of the Socio-Economic Environment. The Socio-Economic Environment net effects assessment incorporates information from the Socio-Economic Environment Existing Conditions Report (**Supporting Document 1-8**) and details of the Project design provided in the CDR (**Supporting Document 2**) in order to assess the net environmental effects of the three Alternative Methods. The detailed net effects assessment is provided in the Socio-Economic Environment Effects Assessment Report (**Supporting Document 3-8**).

For the Social Environment, the general Off-site Study Area was expanded to encompass the village of Watford (**Section 4, Figure 4-16**). To identify the potential effects of the Project on the Social Environment, the conceptual design of each of the three Alternative Methods for the landfill optimization was examined to determine if it will have an effect on the local community through changes in the number of residents and residences (e.g., receptors), number and type of local businesses, nuisance

effects (litter, dust, noise, odour, traffic, visual), predicted changes to use and enjoyment of property, level of satisfaction with living/working in the community, and confidence in TCEC operations.

The Social Environment assessment relies on the results of other discipline assessments, specifically Air Quality, Noise, Transportation, Land Use, and Visual Landscape.

Future Baseline Conditions

The Future Baseline Conditions for the social environment are summarized below.

Number of Residents and Residences

Watford has a population of 1,563 residents and has experienced a minor population growth of 1.8% since 2016. There are currently 648 residences located within Watford and approximately 33 residences located outside of Watford within the Social Off-site Study Area. Planned residential developments in Watford will allow for a population increase in the area, which has not been experienced in at least two decades. These developments include the: Ontario Street subdivision; Watford Quality Care; Castell Homes Subdivision; and Richfield Homes subdivision. Assuming these planned developments are constructed by 2031, this would add 247 additional households to the Social Off-site Study Area for a total of 895 households, which would bring an additional 593 people to the Social Off-site Study Area, resulting in an overall population of 2,156 people in Watford.

Number and Type of Local Businesses

The Sarnia-Lambton Economic Partnership (SLEP) currently lists 87 businesses with an address in Watford and 9 businesses with an address in the Township of Warwick, for a total of 96 businesses. Based on the addresses in the SLEP database, one business (WM) is located within the On-site Study Area, and 57 businesses are located within the Social Off-site Study Area. A large industrial park, the Warwick Industrial Park, is planned to the west of the southern portion of the TCEC site within the Social Off-site Study Area, and currently vacant lands are identified for commercial and industrial use to the north, south, and east of Watford. Given that no development plans have been submitted for the Watford Industrial Park or the vacant commercial and industrial lands at this time, it is assumed that no additional industrial development will occur within the Social Off-site Study Area before the Project begins in 2031.

Nuisance Effects

Nuisance effects from the Expansion Landfill under future baseline conditions can include disturbance from noise, dust, odour, litter, traffic, and changes to the visual landscape.

ODOUR

Odour associated with landfill operations has the potential for nuisance effects at sensitive off-site receptors. The odour receptor locations are shown on **Figure 4-7**.

According to the Community Survey, 69% of respondents were very concerned about odour from landfill operations at the TCEC.

The average odour detection threshold is 1 OU/m³, although odours at this level are not necessarily a nuisance. Odour concentrations that may cause a complaint due to their ability to annoy typically range from 3 to 5 OU/m³. Under Future Baseline Conditions, the maximum predicted concentrations at all receptors exceed the MECP odour guideline objective of 1 OU/m³ with exceedances at a frequency greater than 0.5% of the time at receptors R2 through R7. The highest overall frequency of exceedance of 1 OU/m³ is 1% (approximately 84 hours per year) which is predicted at R4 and R7. Exceedances of 3 OU/m³ were predicted at two receptors, R2 and R4, with a frequency of less than 0.5%. The highest overall frequency of exceedance of 3 OU/m³ is 0.01% (approximately 1 hour per year) which is predicted at R4. No exceedances of 5 OU/m³ were predicted at any of the receptors.

A total of 233 odour-related complaints were received from 2009 through 2024, and the number of complaints has been decreasing since 2019. Under normal operations, the primary sources of odour are activities at the active face and areas of the landfill that are temporarily covered or undergoing intermediate cover placement. Areas under final cover are not expected to be significant contributors to odour. Odour is managed at the site in accordance with the Odour BMPP.

LITTER

A potential nuisance created by the landfill is wind-blown litter, which typically consists of loose, lightweight materials that can be picked up by the wind such as paper products, empty plastic bags, and cardboard.

There are five rural residences and a cemetery located within 500 m of the landfill (i.e., the potential litter impact zone). Under Future Baseline Conditions, high winds that could carry litter toward these areas are expected to occur infrequently, less than 2% of the time (approximately 7 days per year). Although some residences are in the predominant wind direction, the likelihood of winds exceeding litter thresholds is only about 5%. To further reduce litter, permanent and portable wind fences have been installed.

A total of 15 litter-related complaints were received from 2009 through 2024, with no complaints received in 2024. Control of wind-blown litter is managed using the Litter BMPP.

DUST

Based on the responses to the Community Survey, 22% of respondents were very concerned about dust from landfill operations. The evaluation of dust is dependent primarily on the location of the internal haul routes and the quantity of on-site traffic. Since the landfill waste filling rate will be maintained at its current permitted tonnage of 1.4 million tonnes per year, the quantity of haul traffic is expected to remain consistent with existing conditions.

Overall, predicted concentrations for Future Baseline Conditions were below their respective criteria for annual TSP, annual $PM_{2.5}$, and 24-hour $PM_{2.5}$ at all receptor locations. Predicted concentrations of 24-hour TSP exceeded applicable criteria at receptors R2 to R7 and R9, with the maximum frequency of exceedance being 1.6% (approximately 6 days per year) at R4. Similarly, predicted concentrations of 24-hour PM_{10} exceeded applicable criteria at receptors R2, R3, R4, R7, and R9, with the maximum frequency of exceedance being 0.9% (approximately 3 days per year) at R4.

A total of 10 dust and track-out related complaints were received from 2009 through 2024, with no complaints received in 2024. Dust at the TCEC is managed in accordance with the Dust BMPP.

NOISE

Based on the results of the Community Survey, 31% of respondents were not concerned about noise from existing operations. The acoustic environment is significantly influenced by road traffic noise, which elevates the background sound levels.

The predicted cumulative sound levels, which are the logarithmic addition of the predicted future sound levels and contributions from existing and approved ancillary sources, meet all guidelines for landfilling and stationary source noise. Future daytime cumulative sound level due to traffic and TCEC ancillary sources were between 37 and 57 dBA for Current, 37 and 58 dBA for 2032, and 38 and 59 dBA for 2043.

The TCEC has a Noise Management Plan to mitigate noise from operations. There have not been any noise complaints for the TCEC since 2012.

TRAFFIC

Based on the results of the Community Survey, 45% of respondents were very concerned about traffic from landfill operations. The transportation network in the study area will remain unchanged under the 2032 and 2043 Future Baseline Conditions. North-south volumes on Nauvoo Road are expected to grow at a 2% compounded annual growth rate (CAGR), while side streets are projected to grow at 1% CAGR. Site traffic volumes are assumed to remain the same as current levels for both 2032 and 2043, with no change in inbound weigh scale processing time.

VISUAL IMPACT

According to the results of the Community Survey, 32% of respondents are very concerned about the visual impact of the existing Expansion Landfill. Future baseline conditions align with the completion of Year 26 of the approved Expansion Landfill. The existing screening berms will remain unchanged, and the trees on these berms are expected to grow to a height of around 22 m. The maximum landfill elevation will be 280 m above sea level (approximately 40 m above the current ground level).

Use and Enjoyment of Property

The use and enjoyment of property under Future Baseline Conditions is not expected to change from existing conditions.

Existing sensitive land uses within the Social Off-site Study Area will continue to operate as they currently do. The Settlement Area limits of the Village of Watford are expected to remain as per existing conditions. Any new land uses within 500 m of the landfill area will require consultation with the Province before receiving *Planning Act* approval to mitigate potential land use incompatibility issues. The landfill is expected to remain consistent with the Provincial Planning Statement, provincial land use and resource management plans, and municipal land use policies, plans, and zoning by-laws, including municipal setbacks.

Some planned residential developments within Watford, which have already received draft or site plan approval, may begin or complete construction before the Project starts. These developments include the Ontario Street Subdivision, Watford Quality Care subdivision, Castell Homes Subdivision, and Richfield Homes subdivision.

Various community amenities exist within the Social Off-site Study Area including elementary schools, churches, retirement homes, parks, trails, and a community centre. The most used facilities in the Township of Warwick are the East Lambton Community Complex, and the baseball diamonds and running track at Centennial Park, and the least used facilities by the residents that responded to the survey are the horseshoe pits and BMX park at Centennial Park, Bluebird Parkette, and Nauvoo Park. There may be improvements to community recreational facilities in the future; however, no plans are currently identified.

Level of Satisfaction with Living/Working in the Community

Based on the results of the Community and Economic Surveys conducted for the EA in September 2023, residents are overall satisfied with living in the Township of Warwick and are likely to stay and retire within the Township, and recommend the Township to others as a place to live. Based on survey results, the likelihood of younger residents staying in the community will be dependent upon the availability of employment opportunities and housing in the area.

Based on survey results, satisfaction appears to be tied to proximity to home, access to surrounding cities, and low development charges. These factors are not likely to change from existing conditions; therefore, the level of satisfaction with living/working in the community is expected to be the same under Future Baseline Conditions.

Confidence in TCEC Operations

In response to the Community Survey, 30% of respondents stated that they are confident or somewhat confident in current landfill operations, while 33% are neither confident nor unconfident. Reasons provided for being confident or somewhat confident included knowledge of the landfill being tightly monitored by several agencies, while reasons provided for being unconfident or somewhat unconfident included concern regarding the long-term ramifications on the residents of Watford,

suggestion for more testing and monitoring and more communication, feelings that the landfill has a lack of benefit to the community, and concerns about environmental impacts and odour management.

Based on the results of the Economic Survey, 60% of businesses responded that they are confident in current landfill operations, while 20% are somewhat unconfident. Reasons provided for being somewhat unconfident included odour, birds, traffic, and low host community fees.

Under Future Baseline Conditions, the Expansion Landfill will continue to operate as per existing conditions; therefore, confidence in TCEC operations is unlikely to change from existing conditions.

Alternative Method 1

The net effects assessment for Alternative Method 1 is presented in **Table 6-30**.

Number of Residents and Residences

Alternative Method 1 is not anticipated to result in any changes to the number of employment positions at the TCEC, and the development will occur within the approved Expansion Landfill footprint, so no residential land acquisition is required; consequently, no changes to population (number of residents and residences) are anticipated within the Social Off-site Study Area as a result of the Project.

Number and Type of Local Businesses

Alternative Method 1 is not expected to change the number and type of local businesses. Procurement and provision of products and services are expected to continue as per current operations, and no business activities will be displaced by Project activities.

Nuisance Effects

Nuisance effects from the Project can include disturbance from odour, litter, dust, noise, traffic, and changes to the visual landscape. The assessment of nuisance effects for Alternative Method 1 is provided below by type of effect.

ODOUR

According to the responses to the Community Survey, 72% of respondents are very concerned about odour resulting from the Project, and 69% of respondents are very concerned that an increase in landfill-related odour may impact them personally.

Alternative Method 1 has the potential to increase predicted concentrations of odour at discrete receptors; therefore, it is expected that the frequency of exceedance at discrete receptors may increase, and the number of affected discrete receptors may increase compared to Future Baseline Conditions. No additional mitigation measures to address changes in odour as a result of the Project were identified. WM will continue to implement the Odour BMPP to address odour issues.

LITTER

Based on the responses to the Community Survey, 52% of respondents are concerned that an increase in litter resulting from the Project may impact them directly. The proposed height increase in Alternative Method 1 could lead to higher wind speeds at the landfill's working face, potentially raising the frequency of litter events; however, the Litter BMPP is anticipated to effectively control blowing litter in Alternative Method 1. As a result, the number of affected receptors is expected to remain unchanged compared to Future Baseline Conditions.

DUST

According to the results of the Community Survey, 35% of respondents are concerned about dust from the Project, while 54% are concerned that an increase in Project-related air emissions, including dust, may impact them directly.

Alternative Method 1 has the potential to increase predicted concentrations of dust at discrete receptors at some points during site operation; therefore, it is expected that the frequency of exceedance at discrete receptors may increase, and the number of affected discrete receptors may increase compared to Future Baseline Conditions. The Dust BMPP will continue to be implemented to address dust emissions from landfill operations.

NOISE

Based on the results of the Community Survey, 26% of respondents are very concerned about noise from the Project, and 31% are very concerned that Project-related noise may impact them directly.

The most significant potential change in off-site noise levels arise from the reintroduction of landfilling equipment along the perimeter of the approved landfill extents. This could lead to noise levels at receptors exceeding daytime landfilling guidelines, particularly along the west and north portions of the landfill when equipment is closest. Alternative Method 1 has the greatest potential for increased offsite noise due to modifications extending to the landfill limits.

To mitigate these effects, two primary strategies have been proposed. The first strategy is to construct temporary operational berms. Another mitigation strategy is to limit equipment near the perimeter; reducing the number of equipment, such as compactors and dozers operating near the landfill perimeter, which would help meet daytime landfilling noise guidelines. With these mitigations, Alternative Method 1 will result in no net effects to noise.

TRAFFIC

According to the Community Survey, 47% of respondents were very concerned about Project-related traffic. Alternative Method 1 is not expected to have an effect on traffic. There will be no changes from current operations. Background traffic growth being the primary factor influencing future traffic volumes.

VISUAL IMPACT

According to the results of the Community Survey, 39% of respondents were very concerned about the visual effects of the Project, and 44% are very concerned about changes to their rural views.

The Visual Landscape Effects Assessment (**Section 6.2.7**) determined the magnitude of visual effects for each of the six identified receptors. Simulated views of Alternative Method 1 were developed, and Combined Effect Values (CEV) were determined based on visible landfill area, distance to the site, horizontal angle of view, and visual absorption capacity. The total CEV for Alternative Method 1 is 78. Viewpoints 1, 3, and 5 are considered high CEV. Viewpoints 2 and 4 are considered moderate CEV, and viewpoint 6 is considered low CEV.

Since the existing vegetated screening berms are not proposed to be altered, they will continue to grow and increase in height from the present day to the completion of Phase 5. The increase in the size and density of the trees will enhance the visual screening function of the vegetated berms.

Use and Enjoyment of Property

Since Alternative Method 1 involves a vertical expansion, it is not anticipated to significantly impact existing land uses. The separation distance from Watford, along with the existing buffer zones, is expected to mitigate potential impacts such as noise and air quality issues to residents, off-site recreational resources, and sensitive land uses, provided that appropriate mitigation measures and nuisance controls are maintained or enhanced. Agricultural operations, which dominate the area surrounding the TCEC, are expected to experience minimal impact from the Project. The existing waste disposal footprint will not change.

For planned land uses, the existing approved waste disposal footprint will remain unchanged, ensuring that setback distances between the landfill and any planned developments are maintained. Future land uses near the landfill, particularly industrial uses, are expected to be compatible.

In the Community Survey, residents were asked how likely it would be that they would decrease their use of outdoor recreational facilities as a result of the Project. Forty-nine percent (49%) of residents said it was likely or somewhat likely. Based on the results of the Odour effects assessment (**Section 6.2.1.4**), recreational resources to the south of the TCEC site, such as the adjacent trail, may experience an increase in odour at the start of landfilling; however, the extent of the odour exceedance decreases as the landfill is developed since the working face will move from west to east. The Odour BMPP will continue to be implemented.

Although Alternative Method 1 could result in a minor increase in odour concentrations at off-site recreational resources to the south of the landfill footprint (e.g., the trail), the increased concentrations are unlikely to result in an overall change in use of property.

Consequently, changes to use and enjoyment of property from Alternative Method 1 are anticipated to be minor.

Level of Satisfaction with Living/Working in the Community

In the Community Survey, residents were asked how satisfied they are with the Township of Warwick as a place to live; 84% of respondents indicated that they were satisfied or somewhat satisfied with the Township as a place to live. When residents were asked about the likelihood that the Project would decrease level of satisfaction within living/working in the Township of Warwick, 62% of residents said it was likely or somewhat likely. Residents who answered likely or somewhat likely expressed concern about landfill size and odour emissions.

Odour and Visual Impact are addressed above. The nuisance level of odour from Alternative Method 1 is not likely to reach the population centre of Watford but rather will be experienced to the north and west of the landfill, mostly at the beginning of operations when the equipment will be working at the landfill perimeter. Views of the landfill from Watford (Viewpoint 4) are predicted to be moderate, and trees planted on the screening berms will continue to grow. Consequently, changes in the level of satisfaction with living and working in the community are predicted to be minor.

Confidence in TCEC Operations

In the Community Survey, 31% of respondents indicated that they are aware that the results of operations and compliance monitoring are reviewed by the Township, and 33% responded that they are aware of the weekly MECP landfill inspections. Almost half (47%) of respondents said that knowing about these activities increases their confidence in TCEC landfill operations. Thirty percent (30%) of respondents said their level of confidence in TCEC operations would not change as a result of the Project, while 27% said it was likely that their opinion of TCEC operations would decrease while 23% said it was somewhat likely.

Operations at the TCEC will continue with no changes to operating hours, haul routes, or equipment. Reviews of monitoring results, and weekly MECP inspections will continue as noted above. WM will continue to provide prompt attention to nuisance complaints to mitigate any adverse effects to the surrounding community. Consequently, no changes to confidence in TCEC operations are anticipated.

Table 6-30. Social Environment Net Effects Assessment – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Social Environment					
Effects on Local Community	Number of residents and residences (e.g., receptors)	• Development of landfill optimization will occur within the currently approved Expansion Landfill footprint. • No changes to number of employment positions at the TCEC.	• No changes to number of residents and residences.	• None required	• No net effects
	Number and type of local businesses	• Development of landfill optimization will occur within the currently approved Expansion Landfill footprint. • Procurement and provision of products and services will continue as per current operations.	• No changes to number and type of local businesses. • No displacement of business activities.	• None required	• No net effects
	Nuisance effects (odour, litter, dust, noise, birds, traffic, visual)	• Development of landfill optimization will occur within the currently approved Expansion Landfill footprint. • No changes to haul routes. • No changes to operating hours. • No changes to catchment area, vehicle origin-destination patterns, and hourly/daily trips. • No increase in the average daily tonnage. • Existing nuisance effect control and management measures will continue.	• Potential increase in predicted concentrations of odour at discrete receptors, frequency of exceedance at discrete receptors, and number of affected discrete receptors. • The proposed height increase could lead to higher wind speeds at the landfill's working face, potentially raising the frequency of litter events. • Potential increase in predicted concentrations of dust at discrete receptors, frequency of exceedance at discrete receptors, and number of affected discrete receptors. • Potential increase in off-site sound levels at receptors due to decreased separation distance from the working face.	• WM will continue to implement the odour BMPP to address odour emissions. • The litter BMPP are anticipated to effectively control blowing litter. • WM will continue to implement the dust BMPP to address dust emissions. • Construction of temporary operational berms when working along the landfill perimeter, and reduction in the number of equipment operating near the landfill perimeter. • Avifaunal (bird) scavengers will continue to be	• Predicted odour concentrations may exceed criteria at discrete receptor locations, and the frequency of odour levels above defined odour benchmarks may increase. • Visual CEV of 78, with three high CEV viewpoints, two moderate CEV viewpoints, and one low CEV viewpoint.

Table 6-30. Social Environment Net Effects Assessment – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
			• The continued use of the landfill beyond the approved design will prolong the attractiveness of the area for gulls and other avifaunal (bird) scavengers. • No changes to the overall volume of vehicles entering and exiting the TCEC. • Visual CEV of 78, with three high CEV viewpoints, two moderate CEV viewpoints, and one low CEV viewpoint.	managed following current protocols using deterrents. • Existing vegetated screening berms will continue to grow and increase in height.	• No net effects from litter, dust, noise, birds, and traffic.
	Predicted changes to use and enjoyment of property	• Existing nuisance effect control and management measures will continue.	• Potential changes to use and enjoyment of property resulting from increases in odour at recreational areas located south of the landfill.	• WM will continue to implement the odour BMPP to address odour emissions.	• Minor changes to use and enjoyment of property are anticipated due to increased odour at recreational areas located south of the landfill.
	Level of satisfaction with living/working in the community	• Development of landfill optimization will occur within the currently approved Expansion Landfill footprint. • No changes to haul routes. • No changes to operating hours. • No changes to catchment area, vehicle origin-destination patterns, and hourly/daily trips. • No increase in the average daily tonnage. • Existing nuisance effect control and management measures will continue.	• Potential changes to the level of satisfaction with living and working in the community resulting from increases in odour and changes to the visual landscape.	• WM will continue to implement the odour BMPP to address odour emissions. • Existing vegetated screening berms will continue to grow and increase in height.	• Minor changes in the level of satisfaction with living and working in the community due to increased odour and changes to the visual landscape.

Table 6-30. Social Environment Net Effects Assessment – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
	Confidence in TCEC operations	• Operations at the TCEC will continue with no changes to operating hours, haul routes, or equipment. • The WPLC (Warwick Public Liaison Committee), Technical Review Team (TRT), and MECP will continue their activities regarding the site (review, inspections).	• Potential changes to confidence in TCEC operations.	• WM will continue to provide prompt attention to nuisance complaints to mitigate any adverse effects to the surrounding community.	• No net effects.

Alternative Method 2

The net effects assessment for Alternative Method 2 is presented in **Table 6-31**.

Number of Residents and Residences

Alternative Method 2 is not anticipated to result in any changes to the number of employment positions at the TCEC, and the development will occur within the approved Expansion Landfill footprint, so no residential land acquisition is required; consequently, no changes to population (number of residents and residences) are anticipated within the Social Off-site Study Area as a result of the Project.

Number and Type of Local Businesses

Alternative Method 2 is not expected to change the number and type of local businesses. Procurement and provision of products and services are expected to continue as per current operations, and no business activities will be displaced by Project activities.

Nuisance Effects

Nuisance effects from the Project can include disturbance from odour, litter, dust, noise, traffic, and changes to the visual landscape. The assessment of nuisance effects for Alternative Method 2 is provided below by type of effect.

ODOUR

According to the responses to the Community Survey, 72% of respondents are very concerned about odour resulting from the Project, and 69% of respondents are very concerned that an increase in landfill-related odour may impact them personally.

Alternative Method 2 has the potential to increase predicted concentrations of odour at discrete receptors; therefore, it is expected that the frequency of exceedance at discrete receptors may increase, and the number of affected discrete receptors may increase compared to Future Baseline Conditions. No additional mitigation measures to address changes in odour as a result of the Project were identified. WM will continue to implement the Odour BMPP to address odour issues.

LITTER

Based on the responses to the Community Survey, 52% of respondents are concerned that an increase in litter resulting from the Project may impact them directly. The proposed height increase in Alternative Method 2 could lead to higher wind speeds at the landfill's working face, potentially raising the frequency of litter events; however, the Litter BMPP is anticipated to effectively control blowing litter in Alternative Method 2. As a result, the number of affected receptors is expected to remain unchanged compared to Future Baseline Conditions.

DUST

According to the results of the Community Survey, 35% of respondents are concerned about dust from the Project, while 54% are concerned that an increase in Project-related air emissions, including dust, may impact them directly.

Alternative Method 2 has the potential to increase predicted concentrations of dust at discrete receptors at some points during site operation; therefore, it is expected that the frequency of exceedance at discrete receptors may increase, and the number of affected discrete receptors may increase compared to Future Baseline Conditions. The Dust BMPP will continue to be implemented to address dust emissions from landfill operations.

NOISE

Based on the results of the Community Survey, 26% of respondents are very concerned about noise from the Project, and 31% are very concerned that Project-related noise may impact them directly.

The most significant potential change in off-site noise levels arise from the reintroduction of landfilling equipment along the perimeter of the approved landfill extents. This could lead to noise levels at receptors exceeding daytime landfilling guidelines, particularly along the west and north portions of the landfill when equipment is closest. Alternative Method 2 has the potential for increased offsite noise due to modifications extending to the landfill limits.

To mitigate these effects, two primary strategies have been proposed. The first strategy is to construct temporary operational berms. Another mitigation strategy is to limit equipment near the perimeter; reducing the number of equipment, such as compactors and dozers operating near the landfill perimeter, which would help meet daytime landfilling noise guidelines. With these mitigations, Alternative Method 2 will result in no net effects to noise.

TRAFFIC

According to the Community Survey, 47% of respondents were very concerned about Project-related traffic. Alternative Method 2 is not expected to have an effect on traffic. There will be no changes from current operations. Background traffic growth being the primary factor influencing future traffic volumes.

VISUAL IMPACT

According to the results of the Community Survey, 39% of respondents were very concerned about the visual effects of the Project, and 44% are very concerned about changes to their rural views.

The Visual Landscape Effects Assessment (**Section 6.2.7**) determined the magnitude of visual effects for each of the six identified receptors. Simulated views of Alternative Method 2 were developed, and CEVs were determined based on visible landfill area, distance to the site, horizontal angle of view, and visual absorption capacity. The total CEV for Alternative Method 2 is 77. Viewpoints 1, 3, and 5 are considered high CEV.

Viewpoints 2 and 4 are considered moderate CEV, and viewpoint 6 is considered low CEV.

Since the existing vegetated screening berms are not proposed to be altered, they will continue to grow and increase in height from the present day to the completion of Phase 5. The increase in the size and density of the trees will enhance the visual screening function of the vegetated berms.

Use and Enjoyment of Property

Since Alternative Method 2 involves a vertical expansion, it is not anticipated to significantly impact existing land uses. The separation distance from Watford, along with the existing buffer zones, is expected to mitigate potential impacts such as noise and air quality issues to residents, off-site recreational resources, and sensitive land uses, provided that appropriate mitigation measures and nuisance controls are maintained or enhanced. Agricultural operations, which dominate the area surrounding the TCEC, are expected to experience minimal impact from the Project. The existing waste disposal footprint will not change.

For planned land uses, the existing approved waste disposal footprint will remain unchanged, ensuring that setback distances between the landfill and any planned developments are maintained. Future land uses near the landfill, particularly industrial uses, are expected to be compatible.

In the Community Survey, residents were asked how likely it would be that they would decrease their use of outdoor recreational facilities as a result of the Project. Forty-nine percent (49%) of residents said it was likely or somewhat likely. Based on the results of the Odour effects assessment (**Section 6.2.1.4**), recreational resources to the south of the TCEC site, such as the adjacent trail, may experience an increase in odour at the start of landfilling; however, the extent of the odour exceedance decreases as the landfill is developed since the working face will move from west to east. The Odour BMPP will continue to be implemented.

Although Alternative Method 2 could result in a minor increase in odour concentrations at off-site recreational resources to the south of the landfill footprint (e.g., the trail), the increased concentrations are unlikely to result in an overall change in use of property.

Consequently, changes to use and enjoyment of property from Alternative Method 2 are anticipated to be minor.

Level of Satisfaction with Living/Working in the Community

In the Community Survey, residents were asked how satisfied they are with the Township of Warwick as a place to live; 84% of respondents indicated that they were satisfied or somewhat satisfied with the Township as a place to live. When residents were asked about the likelihood that the Project would decrease level of satisfaction within living/working in the Township of Warwick, 62% of residents said it was likely or somewhat likely. Residents who answered likely or somewhat likely expressed concern about landfill size and odour emissions.

Odour and Visual Impact are addressed above. The nuisance level of odour from Alternative Method 2 is not likely to reach the population centre of Watford but rather will be experienced to the north and west of the landfill, mostly at the beginning of operations when the equipment will be working at the landfill perimeter. Views of the landfill from Watford (Viewpoint 4) are predicted to be moderate, and trees planted on the screening berms will continue to grow. Consequently, changes in the level of satisfaction with living and working in the community are predicted to be minor.

Confidence in TCEC Operations

In the Community Survey, 31% of respondents indicated that they are aware that the results of operations and compliance monitoring are reviewed by the Township, and 33% responded that they are aware of the weekly MECP landfill inspections. Almost half (47%) of respondents said that knowing about these activities increases their confidence in TCEC landfill operations. Thirty percent (30%) of respondents said their level of confidence in TCEC operations would not change as a result of the Project, while 27% said it was likely that their opinion of TCEC operations would decrease while 23% said it was somewhat likely.

Operations at the TCEC will continue with no changes to operating hours, haul routes, or equipment. Reviews of monitoring results, and weekly MECP inspections will continue as noted above. WM will continue to provide prompt attention to nuisance complaints to mitigate any adverse effects to the surrounding community. Consequently, no changes to confidence in TCEC operations are anticipated.

Table 6-31. Social Environment Net Effects Assessment – Alternative Method 2

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Social Environment					
Effects on Local Community	Number of residents and residences (e.g., receptors)	• Development of landfill optimization will occur within the currently approved Expansion Landfill footprint. • No changes to number of employment positions at the TCEC.	• No changes to number of residents and residences.	• None required	• No net effects
	Number and type of local businesses	• Development of landfill optimization will occur within the currently approved Expansion Landfill footprint. • Procurement and provision of products and services will continue as per current operations.	• No changes to number and type of local businesses. • No displacement of business activities.	• None required	• No net effects
	Nuisance effects (litter, dust, noise, odour, traffic, visual)	• Development of landfill optimization will occur within the currently approved Expansion Landfill footprint. • No changes to haul routes. • No changes to operating hours. • No changes to catchment area, vehicle origin-destination patterns, and hourly/daily trips. • No increase in the average daily tonnage. • Existing nuisance effect control and management measures will continue.	• Potential increase in predicted concentrations of odour at discrete receptors, frequency of exceedance at discrete receptors, and number of affected discrete receptors. • The proposed height increase could lead to higher wind speeds at the landfill's working face, potentially raising the frequency of litter events. • Potential increase in predicted concentrations of dust at discrete receptors, frequency of exceedance at discrete receptors, and number of affected discrete receptors. • Potential increase in off-site sound levels at receptors due to decreased	• WM will continue to implement the odour BMPP to address odour emissions. • The litter BMPP is anticipated to effectively control blowing litter. • WM will continue to implement the dust BMPP to address dust emissions. • Construction of temporary operational berms when working along the landfill perimeter, and reduction in the number of	• Predicted odour concentrations may exceed criteria at discrete receptor locations, and the frequency of odour levels above defined odour benchmarks may increase. • Visual CEV of 77, with three high CEV viewpoints, two moderate CEV viewpoints, and one low CEV viewpoint. • No net effects from litter, dust, noise, birds, and traffic.

Table 6-31. Social Environment Net Effects Assessment – Alternative Method 2

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
			separation distance from the working face. • The continued use of the landfill beyond the approved design will prolong the attractiveness of the area for gulls and other avifaunal (bird) scavengers. • No changes to the overall volume of vehicles entering and exiting the TCEC. • Visual CEV of 77, with three high CEV viewpoints, two moderate CEV viewpoints, and one low CEV viewpoint.	equipment operating near the landfill perimeter. • Avifaunal (bird) scavengers will continue to be managed following current protocols using deterrents. • Existing vegetated screening berms will continue to grow and increase in height.	
	Predicted changes to use and enjoyment of property	• Existing nuisance effect control and management measures will continue.	• Potential changes to use and enjoyment of property resulting from increases in odour at recreational areas located south of the landfill.	• WM will continue to implement the odour BMPP to address odour emissions.	• Minor changes to use and enjoyment of property are anticipated due to increased odour at recreational areas located south of the landfill.

Table 6-31. Social Environment Net Effects Assessment – Alternative Method 2

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
	Level of satisfaction with living/working in the community	• Development of landfill optimization will occur within the currently approved Expansion Landfill footprint. • No changes to haul routes. • No changes to operating hours. • No changes to catchment area, vehicle origin-destination patterns, and hourly/daily trips. • No increase in the average daily tonnage. • Existing nuisance effect control and management measures will continue.	• Potential changes to the level of satisfaction with living and working in the community resulting from increases in odour and changes to the visual landscape.	• WM will continue to implement the odour BMPP to address odour emissions. • Existing vegetated screening berms will continue to grow and increase in height.	• Minor changes in the level of satisfaction with living and working in the community due to increased odour and changes to the visual landscape.
	Confidence in TCEC operations	• Operations at the TCEC will continue with no changes to operating hours, haul routes, or equipment. • The WPLC, TRT, and MECP will continue their activities regarding the site (review, inspections).	• Potential changes to confidence in TCEC operations.	• WM will continue to provide prompt attention to nuisance complaints to mitigate any adverse effects to the surrounding community.	• No net effects.

Alternative Method 3

The net effects assessment for Alternative Method 3 is presented in **Table 6-32**.

Number of Residents and Residences

Alternative Method 3 is not anticipated to result in any changes to the number of employment positions at the TCEC, and the development will occur within the approved Expansion Landfill footprint, so no residential land acquisition is required; consequently, no changes to population (number of residents and residences) are anticipated within the Social Off-site Study Area as a result of the Project.

Number and Type of Local Businesses

Alternative Method 3 is not expected to change the number and type of local businesses. Procurement and provision of products and services are expected to continue as per current operations, and no business activities will be displaced by Project activities.

Nuisance Effects

Nuisance effects from the Project can include disturbance from odour, litter, dust, noise, traffic, and changes to the visual landscape. The assessment of nuisance effects for Alternative Method 3 is provided below by type of effect.

ODOUR

According to the responses to the Community Survey, 72% of respondents are very concerned about odour resulting from the Project, and 69% of respondents are very concerned that an increase in landfill-related odour may impact them personally.

Alternative Method 3 has the potential to increase predicted concentrations of odour at discrete receptors; therefore, it is expected that the frequency of exceedance at discrete receptors may increase, and the number of affected discrete receptors may increase compared to Future Baseline Conditions. No additional mitigation measures to address changes in odour as a result of the Project were identified. WM will continue to implement the Odour BMPP to address odour issues.

LITTER

Based on the responses to the Community Survey, 52% of respondents are concerned that an increase in litter resulting from the Project may impact them directly. The proposed height increase in Alternative Method 3 could lead to higher wind speeds at the landfill's working face, potentially raising the frequency of litter events; however, the Litter BMPP is anticipated to effectively control blowing litter in Alternative Method 3. As a result, the number of affected receptors is expected to remain unchanged compared to Future Baseline Conditions.

DUST

According to the results of the Community Survey, 35% of respondents are concerned about dust from the Project, while 54% are concerned that an increase in Project-related air emissions, including dust, may impact them directly.

Alternative Method 3 has the potential to increase predicted concentrations of dust at discrete receptors at some points during site operation; therefore, it is expected that the frequency of exceedance at discrete receptors may increase, and the number of affected discrete receptors may increase compared to Future Baseline Conditions. The Dust BMPP will continue to be implemented to address dust emissions from landfill operations.

NOISE

Based on the results of the Community Survey, 26% of respondents are very concerned about noise from the Project, and 31% are very concerned that Project-related noise may impact them directly.

The most significant potential change in off-site noise levels arise from the reintroduction of landfilling equipment along the perimeter of the approved landfill extents. This could lead to noise levels at receptors exceeding daytime landfilling guidelines, particularly along the west and north portions of the landfill when equipment is closest. Alternative Method 3 has the potential for increased offsite noise due to modifications extending to the landfill limits.

To mitigate these effects, two primary strategies have been proposed. The first strategy is to construct temporary operational berms. Another mitigation strategy is to limit equipment near the perimeter; reducing the number of equipment, such as compactors and dozers operating near the landfill perimeter, which would help meet daytime landfilling noise guidelines. With these mitigations, Alternative Method 3 will result in no net effects to noise.

TRAFFIC

According to the Community Survey, 47% of respondents were very concerned about Project-related traffic. Alternative Method 3 is not expected to have an effect on traffic. There will be no changes from current operations. Background traffic growth being the primary factor influencing future traffic volumes.

VISUAL IMPACT

According to the results of the Community Survey, 39% of respondents were very concerned about the visual effects of the Project, and 44% are very concerned about changes to their rural views.

The Visual Landscape Effects Assessment (**Section 6.2.7**) determined the magnitude of visual effects for each of the six identified receptors. Simulated views of Alternative Method 3 were developed, and CEVs were determined based on visible landfill area, distance to the site, horizontal angle of view, and visual absorption capacity. The total

CEV for Alternative Method 3 is 81. Viewpoints 1, 3, 4 and 5 were considered high CEV. Viewpoints 2 and 6 were considered moderate CEV.

Since the existing vegetated screening berms are not proposed to be altered, they will continue to grow and increase in height from the present day to the completion of Phase 5. The increase in the size and density of the trees will enhance the visual screening function of the vegetated berms.

Use and Enjoyment of Property

Since Alternative Method 3 involves a vertical expansion, it is not anticipated to significantly impact existing land uses. The separation distance from Watford, along with the existing buffer zones, is expected to mitigate potential impacts such as noise and air quality issues to residents, off-site recreational resources, and sensitive land uses, provided that appropriate mitigation measures and nuisance controls are maintained or enhanced. Agricultural operations, which dominate the area surrounding the TCEC, are expected to experience minimal impact from the Project. The existing waste disposal footprint will not change.

For planned land uses, the existing approved waste disposal footprint will remain unchanged, ensuring that setback distances between the landfill and any planned developments are maintained. Future land uses near the landfill, particularly industrial uses, are expected to be compatible.

In the Community Survey, residents were asked how likely it would be that they would decrease their use of outdoor recreational facilities as a result of the Project. Forty-nine percent (49%) of residents said it was likely or somewhat likely. Based on the results of the Odour effects assessment (**Section 6.2.1.4**), recreational resources to the south of the TCEC site, such as the adjacent trail, may experience an increase in odour at the start of landfilling; however, the extent of the odour exceedance decreases as the landfill is developed since the working face will move from west to east. The Odour BMPP will continue to be implemented.

Although Alternative Method 3 could result in a minor increase in odour concentrations at off-site recreational resources to the south of the landfill footprint (e.g., the trail), the increased concentrations are unlikely to result in an overall change in use of property.

Consequently, changes to use and enjoyment of property from Alternative Method 3 are anticipated to be minor.

Level of Satisfaction with Living/Working in the Community

In the Community Survey, residents were asked how satisfied they are with the Township of Warwick as a place to live; 84% of respondents indicated that they were satisfied or somewhat satisfied with the Township as a place to live. When residents were asked about the likelihood that the Project would decrease level of satisfaction within living/working in the Township of Warwick, 62% of residents said it was likely or somewhat likely. Residents who answered likely or somewhat likely expressed concern about landfill size and odour emissions.

Odour and Visual Impact are addressed above. The nuisance level of odour from Alternative Method 3 is not likely to reach the population centre of Watford but rather will be experienced to the north and west of the landfill, mostly at the beginning of operations when the equipment will be working at the landfill perimeter. Views of the landfill from Watford (Viewpoint 4) are predicted to be high, and trees planted on the screening berms will continue to grow. Consequently, changes in the level of satisfaction with living and working in the community are predicted to be minor.

Confidence in TCEC Operations

In the Community Survey, 31% of respondents indicated that they are aware that the results of operations and compliance monitoring are reviewed by the Township, and 33% responded that they are aware of the weekly MECP landfill inspections. Almost half (47%) of respondents said that knowing about these activities increases their confidence in TCEC landfill operations. Thirty percent (30%) of respondents said their level of confidence in TCEC operations would not change as a result of the Project, while 27% said it was likely that their opinion of TCEC operations would decrease while 23% said it was somewhat likely.

Operations at the TCEC will continue with no changes to operating hours, haul routes, or equipment. Reviews of monitoring results, and weekly MECP inspections will continue as noted above. WM will continue to provide prompt attention to nuisance complaints to mitigate any adverse effects to the surrounding community. Consequently, no changes to confidence in TCEC operations are anticipated.

Table 6-32. Social Environment Net Effects Assessment – Alternative Method 3

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Social Environment					
Effects on Local Community	Number of residents and residences (e.g., receptors)	• Development of landfill optimization will occur within the currently approved Expansion Landfill footprint. • No changes to number of employment positions at the TCEC.	• No changes to number of residents and residences.	• None required	• No net effects
	Number and type of local businesses	• Development of landfill optimization will occur within the currently approved Expansion Landfill footprint. • Procurement and provision of products and services will continue as per current operations.	• No changes to number and type of local businesses. • No displacement of business activities.	• None required	• No net effects
	Nuisance effects (litter, dust, noise, odour, birds, traffic, visual)	• Development of landfill optimization will occur within the currently approved Expansion Landfill footprint. • No changes to haul routes. • No changes to operating hours. • No changes to catchment area, vehicle origin-destination patterns, and hourly/daily trips.	• Potential increase in predicted concentrations of odour at discrete receptors, frequency of exceedance at discrete receptors, and number of affected discrete receptors. • The proposed height increase could lead to higher wind speeds at the landfill's working face, potentially raising the frequency of litter events.	• WM will continue to implement the odour BMPP to address odour emissions. • The litter BMPP is anticipated to effectively control blowing litter. • WM will continue to implement the dust BMPP to address dust emissions. • Construction of temporary operational berms when working	• Predicted odour concentrations may exceed criteria at discrete receptor locations, and the frequency of odour levels above defined odour benchmarks may increase. • Visual CEV of 81, with four high CEV viewpoints and two moderate CEV viewpoints.

Table 6-32. Social Environment Net Effects Assessment – Alternative Method 3

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
		• No increase in the average daily tonnage. • Existing nuisance effect control and management measures will continue.	• Potential increase in predicted concentrations of dust at discrete receptors, frequency of exceedance at discrete receptors, and number of affected discrete receptors. • Potential increase in off-site sound levels at receptors due to decreased separation distance from the working face. • The continued use of the landfill beyond the approved design will prolong the attractiveness of the area for gulls and other avifaunal (bird) scavengers. • No changes to the overall volume of vehicles entering and exiting the TCEC. • Visual CEV of 81, with four high CEV viewpoints and two moderate CEV viewpoints.	along the landfill perimeter, and reduction in the number of equipment operating near the landfill perimeter. • Avifaunal (bird) scavengers will continue to be managed following current protocols using deterrents. • Existing vegetated screening berms will continue to grow and increase in height.	• No net effects from litter, dust, noise, birds, and traffic.
	Predicted changes to use and enjoyment of property	• Existing nuisance effect control and management measures will continue.	• Potential changes to use and enjoyment of property resulting from increases in odour at recreational areas	• WM will continue to implement the odour BMPP to address odour emissions.	• Minor changes to use and enjoyment of property are anticipated due to increased odour at recreational areas

Table 6-32. Social Environment Net Effects Assessment – Alternative Method 3

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
			located south of the landfill.		located south of the landfill.
	Level of satisfaction with living/working in the community	• Development of landfill optimization will occur within the currently approved Expansion Landfill footprint. • No changes to haul routes. • No changes to operating hours. • No changes to catchment area, vehicle origin-destination patterns, and hourly/daily trips. • No increase in the average daily tonnage. • Existing nuisance effect control and management measures will continue.	• Potential changes to the level of satisfaction with living and working in the community resulting from increases in odour and changes to the visual landscape.	• WM will continue to implement the odour BMPP to address odour emissions. • Existing vegetated screening berms will continue to grow and increase in height.	• Moderate changes in the level of satisfaction with living and working in the community due to increased odour and changes to the visual landscape.
	Confidence in TCEC operations	• Operations at the TCEC will continue with no changes to operating hours, haul routes, or equipment. • The WPLC, TRT, and MECP will continue their activities regarding the site (review, inspections).	• Potential changes to confidence in TCEC operations.	• WM will continue to provide prompt attention to nuisance complaints to mitigate any adverse effects to the surrounding community.	• No net effects.

6.2.6 Economic Environment

The Economic Environment considers Economic Effects on the Local Community.

6.2.6.1 Economic Effects on the Local Community

Economic Effects on the Local Community are part of the Economic Environment component of the Socio-Economic Environment. The Socio-Economic Environment net effects assessment incorporates information from the Socio-Economic Environment Existing Conditions Report (**Supporting Document 1-8**) and details of the Project design provided in the CDR (**Supporting Document 2**) in order to assess the net environmental effects of the three Alternative Methods. The detailed net effects assessment is provided in the Socio-Economic Environment Effects Assessment Report (**Supporting Document 3-8**).

For the Economic Environment, the general Off-site Study Area was expanded to include the Township of Warwick (**Section 4, Figure 4-17**). To identify the potential effects of the Project on the Economic Environment, the conceptual design of each of the three Alternative Methods for the landfill optimization was examined to determine if it will have an effect on local community economics through changes in employment at site (number, type, and duration), contributions to the host community, and opportunities for the provision and procurement of products and/or services.

Future Baseline Conditions

The Future Baseline Conditions for the social environment are summarized below.

Employment at Site

The TCEC is not a significant source of employment in the Economic Off-site Study Area due to the scale of its operations and the proximity of the Township of Warwick to other major urban centres. The TCEC provides stable employment for 35 staff, the majority of which are equipment operators.

Employment at the TCEC is not expected to increase significantly from existing conditions; rather, it is assumed that the same number of employment positions will continue to 2031 under future baseline conditions.

Contributions to the Host Community

WM has a Host Community Agreement with the Township of Warwick and has contributed over $41.3 million in host community fees to the Township from 2009 through 2024. Through annual host community payments, WM has contributed, on average, approximately 24% of the Township's total gross annual operating budget and approximately 36% of the Township's total municipal revenue. Based on the

annual tax rates published by the Township of Warwick[16], WM has contributed between 1.7% and 3.5% of the Township's property tax revenue over the past 5 years. Since 2009, WM has also provided additional support for community projects, contributing over $800,000 to important projects across the County of Lambton.

It is expected that WM will continue its host community contributions and community support under Future Baseline Conditions. Based on an average annual contribution of approximately $4.1 million under the current host community agreement, WM's host community payments are estimated to total $66.3 million by 2031. Considering the trend of increasing tax rates over the past 5 years, it is conservatively assumed that WM's property tax contribution will continue to form at least 3.5% of the Township's property tax revenue under Future Baseline Conditions. Community support contributions depend upon the availability of community projects, so the dollar amount of future contributions cannot be estimated.

Provision and Procurement of Products and/or Services

WM relies on a variety of local vendors to maintain its operations at the TCEC, contributing approximately $2.5 million annually to the local economy (Watford and Township of Warwick) through the procurement of local goods and services. These contributions are expected to continue under Future Baseline Conditions, and it is estimated that an additional $15 million will be contributed to the local economy by 2031.

Alternative Method 1

The net effects assessment for Alternative Method 1 is presented in **Table 6-33**.

Employment at Site

Alternative Method 1 will not result in any changes to the number of employment positions; however, the existing 35 stable employment positions will continue for an additional 12 years.

Contributions to the Host Community

In the Community Survey, 48% of respondents said that continued host community fees would increase their support for the Project, while 52% said it would not; the latter respondents stated that the current level of payments by WM to the Township should be increased, were concerned about the long-term effects of the landfill, and wished for WM to continue paying host fees even after closure of the landfill.

It is expected that WM will continue its host community contributions, municipal tax payments, and community support under Alternative Method 1. Based on the average annual contributions, estimated at approximately $4.1 million under the current host community agreement, host community payments for the duration of Alternative

[16] Township of Warwick Property Tax Rates available at https://www.warwicktownship.ca/en/living-in-warwick/taxes.aspx.

Method 1 are estimated to amount to approximately $50 million. Based on the trend of increasing tax rates over the past 5 years, it is conservatively assumed that WM's property tax contribution will continue to form at least 3.5% of the Township's property tax revenue for the duration of Alternative Method 1. WM will also continue to contribute to community projects.

Provision and Procurement of Products and/or Services

WM relies on a variety of local vendors to maintain its operations at the TCEC. Local community contributions are expected to continue under Alternative Method 1. Based on an annual average of $2.5 million in local expenditures, an estimated $30 million will be contributed to the local economy over the duration of Alternative Method 1.

In the Economic Survey, 60% of businesses identified that continued operation would be important for their businesses, indicating that continued landfill operation would be positive and potentially result in future business. The same percentage of businesses indicated that they would be negatively affected by the landfill closure, which would result in lost income, sales, and work, effects to their employees.

Table 6-33. Economic Environment Net Effects Assessment – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Economic Environment					
Economic Effects on Local Community	Employment at site (number, type, and duration)	• No additional employment positions will be created as a result of the future development beyond the current number of positions.	• Existing 35 stable employment positions will continue for an additional 12 years during operation of Alternative Method 1.	• None required.	• Existing 35 stable employment positions will continue for an additional 12 years during operation of Alternative Method 1.
	Contributions to the host community	• Municipal contributions will continue as per current operations.	• Based on the average annual contributions, estimated at approximately $4.1 million, host community payments for the duration of Alternative Method 1 are estimated to amount to approximately $50 million. • Based on the trend of increasing tax rates over the past 5 years, it is conservatively assumed that WM's property tax contribution will continue to form at least 3.5% of the Township's property tax revenue for the duration of Alternative Method 1. • WM will continue to contribute to community projects during operation of Alternative Method 1.	• None required.	• Based on the average annual contributions, estimated at approximately $4.1 million, host community payments for the duration of Alternative Method 1 are estimated to amount to approximately $50 million. • Based on the trend of increasing tax rates over the past 5 years, it is conservatively assumed that WM's property tax contribution will continue to form at least 3.5% of the Township's property tax revenue for the duration of Alternative Method 1. • WM will continue to contribute to community projects during operation of Alternative Method 1.
	Opportunities for the provision and procurement of products and/or services	• The TCEC will continue to require goods and services from local businesses and provide services at the same rates as required for current operations.	• Based on an annual average of $2.5 million in local expenditures, an estimated $30 million will be contributed to the local economy over the duration of Alternative Method 1.	• None required.	• Based on an annual average of $2.5 million in local expenditures, an estimated $30 million will be contributed to the local economy over the duration of Alternative Method 1.

Alternative Method 2

The net effects assessment for Alternative Method 2 is presented in **Table 6-34**.

Employment at Site

Alternative Method 2 will not result in any changes to the number of employment positions; however, the existing 35 stable employment positions will continue for an additional 12 years.

Contributions to the Host Community

In the Community Survey, 48% of respondents said that continued host community fees would increase their support for the Project, while 52% said it would not; the latter respondents stated that the current level of payments by WM to the Township should be increased, were concerned about the long-term effects of the landfill, and wished for WM to continue paying host fees even after closure of the landfill.

It is expected that WM will continue its host community contributions, municipal tax payments, and community support under Alternative Method 2. Based on the average annual contributions, estimated at approximately $4.1 million under the current host community agreement, host community payments for the duration of Alternative Method 2 are estimated to amount to approximately $50 million. Based on the trend of increasing tax rates over the past 5 years, it is conservatively assumed that WM's property tax contribution will continue to form at least 3.5% of the Township's property tax revenue for the duration of Alternative Method 2. WM will also continue to contribute to community projects.

Provision and Procurement of Products and/or Services

WM relies on a variety of local vendors to maintain its operations at the TCEC. Local community contributions are expected to continue under Alternative Method 2. Based on an annual average of $2.5 million in local expenditures, an estimated $30 million will be contributed to the local economy over the duration of Alternative Method 2.

In the Economic Survey, 60% of businesses identified that continued operation would be important for their businesses, indicating that continued landfill operation would be positive and potentially result in future business. The same percentage of businesses indicated that they would be negatively affected by the landfill closure, which would result in lost income, sales, and work, effects to their employees.

Table 6-34. Economic Environment Net Effects Assessment – Alternative Method 2

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Economic Environment					
Economic Effects on Local Community	Employment at site (number, type, and duration)	• No additional employment positions will be created as a result of the future development beyond the current number of positions.	• Existing 35 stable employment positions will continue for an additional 12 years during operation of Alternative Method 2.	• None required.	• Existing 35 stable employment positions will continue for an additional 12 years during operation of Alternative Method 2.
	Contributions to the host community	• Municipal contributions will continue as per current operations.	• Based on the average annual contributions, estimated at approximately $4.1 million, host community payments for the duration of Alternative Method 2 are estimated to amount to approximately $50 million. • Based on the trend of increasing tax rates over the past 5 years, it is conservatively assumed that WM's property tax contribution will continue to form at least 3.5% of the Township's property tax revenue for the duration of Alternative Method 2. • WM will continue to contribute to community projects during operation of Alternative Method 2.	• None required.	• Based on the average annual contributions, estimated at approximately $4.1 million, host community payments for the duration of Alternative Method 2 are estimated to amount to approximately $50 million. • Based on the trend of increasing tax rates over the past 5 years, it is conservatively assumed that WM's property tax contribution will continue to form at least 3.5% of the Township's property tax revenue for the duration of Alternative Method 2. • WM will continue to contribute to community projects during operation of Alternative Method 2.
	Opportunities for the provision and procurement of products and/or services	• The TCEC will continue to require goods and services from local businesses and provide services at the same rates as required for current operations.	• Based on an annual average of $2.5 million in local expenditures, an estimated $30 million will be contributed to the local economy over the duration of Alternative Method 2.	• None required.	• Based on an annual average of $2.5 million in local expenditures, an estimated $30 million will be contributed to the local economy over the duration of Alternative Method 2.

Alternative Method 3

The net effects assessment for Alternative Method 3 is presented in **Table 6-35**.

Employment at Site

Alternative Method 3 will not result in any changes to the number of employment positions; however, the existing 35 stable employment positions will continue for an additional 12 years.

Contributions to the Host Community

In the Community Survey, 48% of respondents said that continued host community fees would increase their support for the Project, while 52% said it would not; the latter respondents stated that the current level of payments by WM to the Township should be increased, were concerned about the long-term effects of the landfill, and wished for WM to continue paying host fees even after closure of the landfill.

It is expected that WM will continue its host community contributions, municipal tax payments, and community support under Alternative Method 3. Based on the average annual contributions, estimated at approximately $4.1 million under the current host community agreement, host community payments for the duration of Alternative Method 3 are estimated to amount to approximately $50 million. Based on the trend of increasing tax rates over the past 5 years, it is conservatively assumed that WM's property tax contribution will continue to form at least 3.5% of the Township's property tax revenue for the duration of Alternative Method 3. WM will also continue to contribute to community projects.

Provision and Procurement of Products and/or Services

WM relies on a variety of local vendors to maintain its operations at the TCEC. Local community contributions are expected to continue under Alternative Method 3. Based on an annual average of $2.5 million in local expenditures, an estimated $30 million will be contributed to the local economy over the duration of Alternative Method 3.

In the Economic Survey, 60% of businesses identified that continued operation would be important for their businesses, indicating that continued landfill operation would be positive and potentially result in future business. The same percentage of businesses indicated that they would be negatively affected by the landfill closure, which would result in lost income, sales, and work, effects to their employees.

Table 6-35. Economic Environment Net Effects Assessment – Alternative Method 3

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Economic Environment					
Economic Effects on Local Community	Employment at site (number, type, and duration)	• No additional employment positions will be created as a result of the future development beyond the current number of positions.	• Existing 35 stable employment positions will continue for an additional 12 years during operation of Alternative Method 3.	• None required.	• Existing 35 stable employment positions will continue for an additional 12 years during operation of Alternative Method 3.
	Contributions to the host community	• Municipal contributions will continue as per current operations.	• Based on the average annual contributions, estimated at approximately $4.1 million, host community payments for the duration of Alternative Method 3 are estimated to amount to approximately $50 million. • Based on the trend of increasing tax rates over the past 5 years, it is conservatively assumed that WM's property tax contribution will continue to form at least 3.5% of the Township's property tax revenue for the duration of Alternative Method 3. • WM will continue to contribute to community projects during operation of Alternative Method 3.	• None required.	• Based on the average annual contributions, estimated at approximately $4.1 million, host community payments for the duration of Alternative Method 3 are estimated to amount to approximately $50 million. • Based on the trend of increasing tax rates over the past 5 years, it is conservatively assumed that WM's property tax contribution will continue to form at least 3.5% of the Township's property tax revenue for the duration of Alternative Method 3. • WM will continue to contribute to community projects during operation of Alternative Method 3.
	Opportunities for the provision and procurement of products and/or services	• The TCEC will continue to require goods and services from local businesses and provide services at the same rates as required for current operations.	• Based on an annual average of $2.5 million in local expenditures, an estimated $30 million will be contributed to the local economy over the duration of Alternative Method 3.	• None required.	• Based on an annual average of $2.5 million in local expenditures, an estimated $30 million will be contributed to the local economy over the duration of Alternative Method 3.

6.2.7 Visual Landscape

Visual Landscape considers the Visual Impact of the Facility including the perception of the landscape and views.

6.2.7.1 Visual Impact of Facility

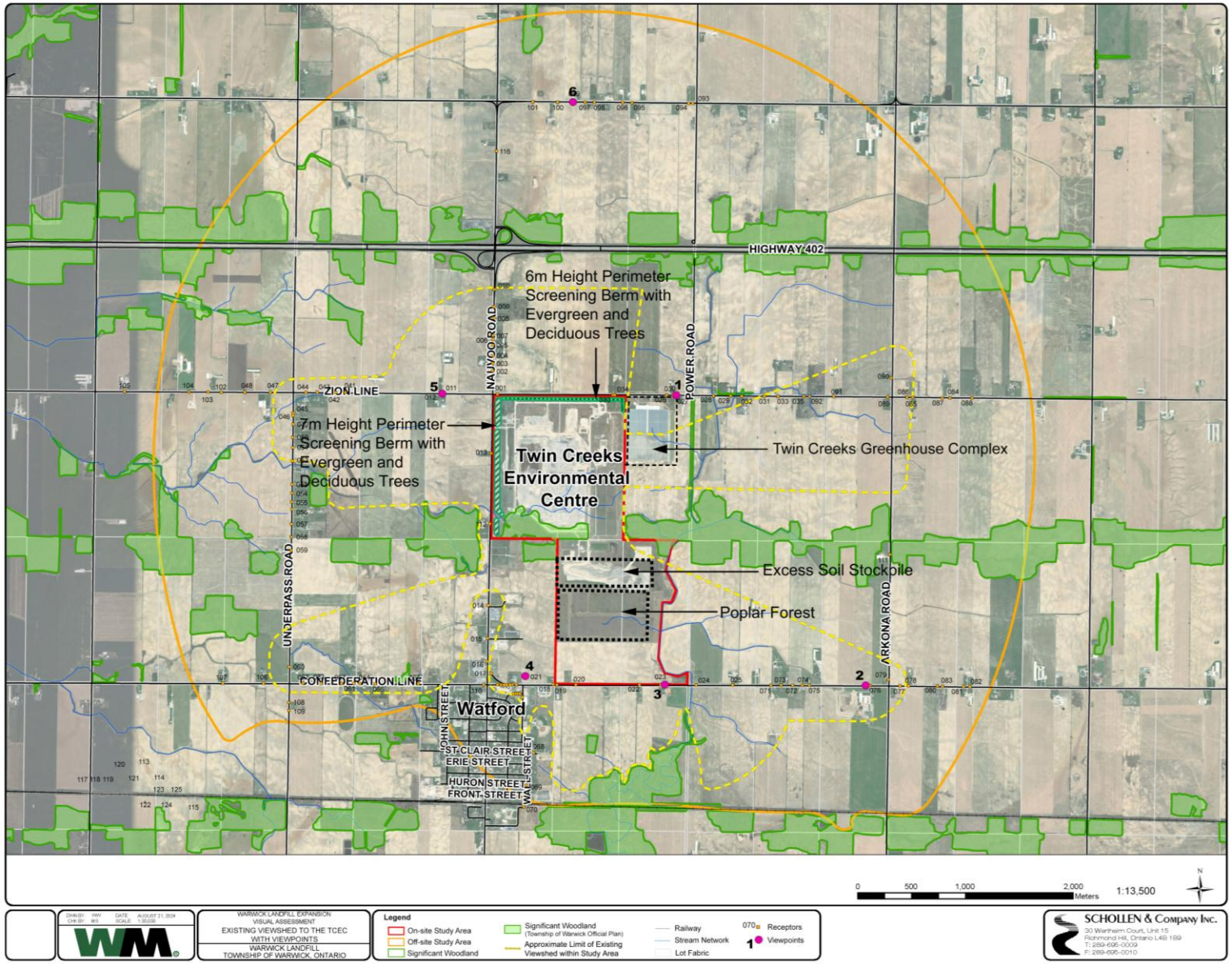
The Visual Landscape net effects assessment incorporates information from the Visual Landscape Existing Conditions Report (**Supporting Document 1-9**) and details of the Project design provided in the CDR (**Supporting Document 2**) in order to assess the net environmental effects of the three Alternative Methods. The detailed net effects assessment is provided in the Visual Landscape Effects Assessment Report (**Supporting Document 3-9**).

The On-site Study Area for Visual Landscape corresponds to the general On-site Study Area, while the Off-site Study Area was expanded by approximately 2.5 km in three directions: westward to include receptors near Underpass Road and Confederation Line; eastward to include those along Arkona Road; and northward to capture receptors north of Highway 402 (**Section 4, Figure 4-18**).

Receptors are locations where views to the TCEC are available where there is a potential for a change in the visual landscape as a result of the implementation and/or operation of the Project. Candidate receptors include residences, businesses, public amenities (such as parks and recreational facilities, cemeteries and other land uses that may be sensitive to changes in the visual environment). Viewpoints are the locations from which the visual simulations were generated to enable the comparative evaluation of the Alternative Methods and represent the typical view from each receptor zone. The viewpoints and receptors for Visual Landscape effects assessment are shown on **Figure 6-3**.

The contours of the waste disposal facility may affect the visual appeal of the landscape. The implementation of the Project may result in changes in the perception of the visual landscape for certain receptors and viewpoints. The magnitude of change was determined considering the visible landfill area, distance to the Landfill Optimization site, horizontal angle of view, and Visual Absorption Capacity Factor (VACF). The visible landfill area is determined by measuring the height and width of the landfill when viewed from each receptor and viewpoint. These measurements were multiplied to calculate the potential landfill area that would be visible from each receptor and viewpoint. The distance to the Landfill Optimization site from each receptor and viewpoint was measured in metres. As distance from the landfill increases, the potential visual effect decreases due to the effect of diminishing scale. The horizontal angle of view is the measure of the unobstructed view angle from each receptor and viewpoint to the proposed Landfill Optimization site. As the horizontal angle of view increases, potential effects increase.

Figure 6-3. Viewpoints and Receptors for the Visual Landscape Effects Assessment



The VACF is defined as the relative capacity of a landscape to absorb visual alterations and still maintain its visual integrity. VACF parameters include slope and vegetation cover. The values from the above are combined to determine an overall Combined Effect Value (CEV) for each viewpoint and receptor, which determines the magnitude of the visual effect. **Table 6-36** sets out scale of the relative magnitude of visual effect based on the range of CEVs.

Table 6-36. Combined Effect Values and Relative Visual Effect Levels

Combined Effect Value Scale	Visual Effect	Description of Effect
13 – 20	High Effect	Viewers at these locations will find the landfill optimization Project visually prominent and attention-grabbing.
9 – 12	Moderate Effect	The Project will be visible but less dominant due to factors like: • distance from the site; and • natural or built screening (e.g., woodlands, terrain, buildings).
4 - 8	Low Effect	The Project will blend into the existing environment and likely be unnoticeable from these viewpoints.
0 - 4	No effect	No effect.

Assumptions used in the Visual Landscape effects assessment include:

- Closed and capped areas will be vegetated with turf;
- Areas of unvegetated cover would be exposed to views;
- The woodlot immediately south of the Expansion Landfill would remain;
- The large spruce trees along the east side of the Expansion Landfill would remain;
- Existing hedgerows, buildings, significant woodlands, and the excess soil stockpile were taken into consideration; and
- There will be up to six approved LFG flares which will be fully enclosed, and the vapour plumes will not be visible.

Future Baseline Conditions

The future existing condition corresponds with the completion of Year 26 of the approved Expansion Landfill, which are the conditions that will exist when construction of the Project commences. The height of the approved top of landfill cover is 282 masl (approximately 40 m above existing ground level). Seven-metre-high (7 m) screening berms exist along Nauvoo Road and six-metre-high (6 m) berms exist along Zion Line and along the north end of the east property line (**Figure 6-3**). The existing screening berms will remain in their present configuration. The existing trees that are located on the screening berm will have grown to a height of approximately 22 m. Consequently,

the total height of the berm and trees will be 29 m along Nauvoo Road and 28 m along Zion Line.

Vehicle access to the landfill will continue to be provided at the site entrance location on Nauvoo Road. The Expansion Landfill side slopes would be approximately four horizontal to one vertical (4H:1V) from the existing grade to approximately 271.5 masl at which point slopes will transition to five percent (5%) for the remaining slope to the highest point.

One-hundred-metre-wide (100 m) buffer strips have been provided along the north, east and south edges of the existing Expansion Landfill.

A poplar forest that exists in the middle section of the south property and all stockpiles will continue to be located within the site boundaries.

Alternative Method 1

Changes in Perception of Landscape and Views

Table 6-37 provides a summary of the assessment data for Alternative Method 1 and indicates that the CEV for the six viewpoints is three with a high effect, two with a medium effect and one with a low effect. The total CEV for Alternative Method 1 for all six viewpoints is 78. The visual simulations of Alternative Method 1 from each of the viewpoints are provided in the Visual Landscape Effects Assessment Report (**Supporting Document 3-9**).

Table 6-37. Combined Effect Value – Alternative Method 1

Viewpoint No.	Combined Effect Value 13-20 High 9-12 Moderate ≤8 Low
1	17
2	10
3	14
4	12
5	17
6	8
TOTAL	**78**

The net effects assessment for Alternative Method 1 is presented in **Table 6-38**.

Table 6-38. Visual Landscape Net Effects Assessment – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects

Visual Impact of Facility	Predicted changes in perception of landscape and views	• Elevation of the top of the Alternative Method: 324.5 masl
		• Increase in height above approved top of waste elevation: 44.5 m
		• Topographic form: Peak with plateau
		• Area of landform profile:
		  • North = 21,818.77 m²
		  • East = 36,906.45 m²
		  • South = 21,549.38 m²
		  • West = 36,906.47 m²
		• Future existing condition corresponds with Year 26 of approved Expansion Landfill
			Total CEV values for six viewpoints:
			• High = 48
			• Moderate = 22
			• Low = 8
			
			Total CEV = 78
			
			• Three high, two moderate, and one low CEV viewpoints.
				None proposed - Existing screen planting with increase in height and density.	Total CEV values for six viewpoints:
					• High = 48
					• Moderate = 22
					• Low = 8
					
					Total CEV = 78
					
					• Three high, two moderate, and one low CEV viewpoints.

Alternative Method 2

Changes in Perception of Landscape and Views

Table 6-39 provides a summary of the assessment data for Alternative Method 2 and indicates that the CEV for the six viewpoints is three with a high effect, two with a medium effect and one with a low effect. The total CEV for all six viewpoints for Alternative Method 2 is 77. The visual simulations of Alternative Method 2 from each of the viewpoints are provided in the Visual Landscape Effects Assessment Report (**Supporting Document 3-9**).

Table 6-39. Combined Effect Value – Alternative Method 2

Viewpoint No.	Combined Effect Value 13-20 High 9-12 Moderate ≤8 Low
1	17
2	9
3	14
4	12
5	17
6	8
TOTAL	**77**

The net effects assessment for Alternative Method 2 is presented in **Table 6-40**.

Table 6-40. Visual Landscape Net Effects Assessment – Alternative Method 2

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects

Visual Impact of Facility	Predicted changes in perception of landscape and views	• Elevation of the top of the Alternative Method: 319.0 masl
		• Increase in height above approved top of waste elevation: 39.0 m
		• Topographic form: Plateau
		• Area of landform profile:
		  • North = 21,403.33 m²
		  • East = 34,977.21 m²
		  • South = 21,042.97 m²
		  • West = 34,977.17 m²
		• Future existing condition corresponds with Year 26 of approved Expansion Landfill
			• Total CEV values for six viewpoints:
			  • High = 48
			  • Moderate = 21
			  • Low = 8
			
			Total CEV = 77
			
			• Three high, two moderate, and one low CEV viewpoints.
				None proposed – Existing screen planting with increase in height and density	• Total CEV values for six viewpoints:
					  • High = 48
					  • Moderate = 21
					  • Low = 8
					
					Total CEV = 77
					
					• Three high, two moderate, and one low CEV viewpoints.

Alternative Method 3

Changes in Perception of Landscape and Views

Table 6-41 provides a summary of the assessment data for Alternative Method 3 and indicates that the CEV for the six viewpoints is four with a high effect, two with a medium effect and none with a low effect. The total CEV for all six viewpoints for Alternative Method 3 is 81. The visual simulations of Alternative Method 3 from each of the viewpoints are provided in the Visual Landscape Effects Assessment Report (**Supporting Document 3-9**).

Table 6-41. Combined Effect Value – Alternative Method 3

Viewpoint No.	Combined Effect Value 13-20 High 9-12 Moderate ≤8 Low
1	17
2	11
3	14
4	13
5	17
6	9
TOTAL	**81**

The net effects assessment for Alternative Method 3 is presented in **Table 6-42**.

Table 6-42. Visual Landscape Net Effects Assessment – Alternative Method 3

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects

Visual Impact of Facility	Predicted changes in perception of landscape and views	• Elevation of the top of the Alternative Method: 324.5 masl
		• Increase in height above approved top of waste elevation: 44.5 m
		• Topographic form: Peak with plateau
		• Area of landform profile:
		  • North = 29,337.17 m²
		  • East = 59,040.93 m²
		  • South = 29,283.05 m²
		  • West = 59,043.98 m²
		• Future existing condition corresponds with Year 26 of approved Expansion Landfill
			• Total CEV values for six viewpoints:
			  • High = 61
			  • Moderate = 20
			  • Low = 0
			Total CEV = 81
			• Four high and two moderate CEV viewpoints.
				None proposed – Existing screen planting with increase in height and density	• Total CEV values for six viewpoints:
					  • High = 61
					  • Moderate = 20
					  • Low = 0
					Total CEV = 81
					• Four high and two moderate CEV viewpoints.

6.2.8 Cultural Environment

The Cultural Environment considers Cultural Heritage Resources and Archaeological Resources.

6.2.8.1 Cultural Heritage Resources

The Cultural Heritage Resources net effects assessment incorporates information from the Cultural Heritage Resources Existing Conditions Report (**Supporting Document 1-10**) and details of the Project design provided in the CDR (**Supporting Document 2**) in order to assess the net environmental effects of the three Alternative Methods. The detailed net effects assessment is provided in the Cultural Heritage Resources Effects Assessment Report (**Supporting Document 3-10**). The Cultural Heritage Resources Effects Assessment considers only above-ground cultural heritage resources; below-ground resources/sites relating to Indigenous and Euro-Canadian settlement are considered in the associated Archaeological Resources Effects Assessment (**Section 6.2.8.2** and **Supporting Document 3-11**).

The study areas for Cultural Heritage Resources correspond with the general study areas defined for the EA (**Section 4, Figure 4-1**).

Activities related to construction and operation of the landfill may result in direct or indirect effects on identified BHRs and CHLs. BHRs and CHLs are non-renewable cultural resources. To identify the potential effects of the Project on known and potential BHRs and CHLs, the conceptual design of each of the three Alternative Methods was examined to determine if it will have an effect on:

- known and potential BHRs in the On-Site and Off-Site Study Areas and predicted direct and indirect impacts; and
- known and potential CHLs in the On-Site and Off-Site Study Areas and predicted direct and indirect impacts.

Direct impacts may include the destruction of any, or part of any, significant heritage attributes or features, and alteration that is not sympathetic, or is incompatible, with the historic fabric and appearance.

Indirect impacts may include shadows created that alter the appearance of a heritage attribute or change the viability of a natural feature or plantings, and isolation of a heritage attribute from its surrounding environment, context or a significant relationship, direct or indirect obstruction of significant views or vistas within, from, or of built and natural features, a change in land use such as rezoning a battlefield from open space to residential use, allowing new development or site alteration to fill in the formerly open spaces, and land disturbances such as a change in grade that alters soils, and drainage patterns that adversely affect an archaeological resource.

It is assumed that the construction and operation of Alternative Methods 1, 2, and 3 will take place within the existing On-site Study Area and that the landfill expansion will occur within the existing approved Expansion Landfill footprint.

Future Baseline Conditions

Proximity of Known or Potential Cultural Heritage Resources

A review of historical maps and background documents revealed a study area with a history of Indigenous land use dating back millennia and a rural land-use history dating to the early to mid-nineteenth century. Three potential BHRs and 16 potential CHLs were identified within the study areas. Of the identified BHRs and CHLs, one resource (CHL 1) is located within the On-Site Study Area. The remaining 18 identified BHRs and CHLs are located within the Off-Site Study Area. Known and potential BHRs and CHLs include 10 farmscapes (CHLs 1, 3, 4, 7-9, 11, 13, 15, and 17), three cemeteries (CHLs 2, 6, and 18), two farmhouses (BHRs 1 and 2), one church (BHR 3), one roadscape (CHL 5), one race track (CHL 12), and one historical settlement centre (CHL 19).

Alternative Method 1

The net effects assessment for Alternative Method 1 is presented in **Table 6-43**.

Proximity of Known or Potential Cultural Heritage Resources

DIRECT IMPACTS

Alternative Method 1 is not anticipated to result in direct impacts to BHRs 1 through 3 or CHLs 1 through 19. While a large portion of CHL 1 (Lot 20-21, Concession 4) is within the On-Site Study Area, none of the proposed work associated with Alternative Method 1 is anticipated to be within the limits of the CHL. CHL 1 is therefore no longer representative of its historical agricultural use due to undergoing considerable alterations.

No mitigation is required and no net effects to the identified heritage attributes of the BHRs and CHLs through direct impacts are anticipated as a result of the work associated with Alternative Method 1.

INDIRECT IMPACTS

Indirect impacts to CHL 5 (Zion Line) are anticipated as a result of the proposed work associated with Alternative Method 1, including changes to the viewscapes over agricultural fields from the roadway. These changes are not expected to result in adverse effects to CHL 5 as the views toward the TCEC site have already been significantly impacted, and the relationship between Zion Line and the surrounding area is no longer representative of the historical agricultural context of the roadway.

Alternative Method 1 is not anticipated to result in indirect impacts to BHRs 1 through 3 or CHLs 1 through 4 and 6 through 19. No mitigation is required and no net effects to the identified heritage attributes of the BHRs and CHLs through indirect impacts are anticipated as a result of the work associated with Alternative Method 1.

Table 6-43. Cultural Heritage Resources Net Effects Assessment – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Cultural Heritage Resources	Direct Impacts	• The construction and operation of Alternative Method 1 will take place within the existing On-site Study Area. • The landfill expansion will occur within the existing approved Expansion Landfill footprint. • The buildout of the landfill in the northeast corner will move the bordering swales to the east and new culvert will be constructed south of SWM pond 4.	• No direct impacts are anticipated to the identified BHRs and CHLs.	• None required	• No net effects to the heritage attributes of identified BHRs and CHLs.
	Indirect Impacts	• Vibration related to any and all construction activities. • The construction and operation of Alternative Method 2 will take place within the existing On-site Study Area. • The landfill expansion will occur within the existing approved Expansion Landfill footprint. • The buildout of the landfill in the northeast corner will move the bordering swales to the east and new culvert will be constructed south of SWM pond 4. • Shadows and obstructed views created by the vertical expansion of the landfill.	• Indirect impacts to CHL 5 through changes to historical agricultural viewscapes. Impacts have been determined to not adversely impact the CHL's heritage attributes.	• None required	• No net effects to the heritage attributes of identified BHRs and CHLs.

Alternative Method 2

The net effects assessment for Alternative Method 2 is presented in **Table 6-44**.

Proximity of Known or Potential Cultural Heritage Resources

DIRECT IMPACTS

Alternative Method 2 is not anticipated to result in direct impacts to BHRs 1 through 3 or CHLs 1 through 19. While a large portion of CHL 1 (Lot 20-21, Concession 4) is within the On-Site Study Area, none of the proposed work associated with Alternative Method 2 is anticipated to be within the limits of the CHL. CHL 1 is therefore no longer representative of its historical agricultural use due to undergoing considerable alterations.

No mitigation is required and no net effects to the identified heritage attributes of the BHRs and CHLs through direct impacts are anticipated as a result of the work associated with Alternative Method 2.

INDIRECT IMPACTS

Indirect impacts to CHL 5 (Zion Line) are anticipated as a result of the proposed work associated with Alternative Method 2, including changes to the viewscapes over agricultural fields from the roadway. These changes are not expected to result in adverse effects to CHL 5 as the views toward the TCEC site have already been significantly impacted, and the relationship between Zion Line and the surrounding area is no longer representative of the historical agricultural context of the roadway.

Alternative Method 2 is not anticipated to result in indirect impacts to BHRs 1 through 3 or CHLs 1 through 4 and 6 through 19. No mitigation is required and no net effects to the identified heritage attributes of the BHRs and CHLs through indirect impacts are anticipated as a result of the work associated with Alternative Method 2.

Table 6-44. Cultural Heritage Resources Net Effects Assessment – Alternative Method 2

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Cultural Heritage Resources	Direct Impacts	• The construction and operation of Alternative Method 1 will take place within the existing On-site Study Area. • The landfill expansion will occur within the existing approved Expansion Landfill footprint. • The buildout of the landfill in the northeast corner will move the bordering swales to the east and new culvert will be constructed south of SWM pond 4.	• No direct impacts are anticipated to the identified BHRs and CHLs.	• None required	• No net effects to the heritage attributes of identified BHRs and CHLs.
	Indirect Impacts	• Vibration related to any and all construction activities. • The construction and operation of Alternative Method 2 will take place within the existing On-site Study Area. • The landfill expansion will occur within the existing approved Expansion Landfill footprint. • The buildout of the landfill in the northeast corner will move the bordering swales to the east and new culvert will be constructed south of SWM pond 4. • Shadows and obstructed views created by the vertical expansion of the landfill.	• Indirect impacts to CHL 5 through changes to historical agricultural viewscapes. Impacts have been determined to not adversely impact the CHL's heritage attributes.	• None required	• No net effects to the heritage attributes of identified BHRs and CHLs.

Alternative Method 3

The net effects assessment for Alternative Method 3 is presented in **Table 6-45**.

Proximity of Known or Potential Cultural Heritage Resources

DIRECT IMPACTS

Alternative Method 3 is not anticipated to result in direct impacts to BHRs 1 through 3 or CHLs 1 through 19. While a large portion of CHL 1 (Lot 20-21, Concession 4) is within the On-Site Study Area, none of the proposed work associated with Alternative Method 3 is anticipated to be within the limits of the CHL. CHL 1 is therefore no longer representative of its historical agricultural use due to undergoing considerable alterations.

No mitigation is required and no net effects to the identified heritage attributes of the BHRs and CHLs through direct impacts are anticipated as a result of the work associated with Alternative Method 3.

INDIRECT IMPACTS

Indirect impacts to CHL 5 (Zion Line) are anticipated as a result of the proposed work associated with Alternative Method 3, including changes to the viewscapes over agricultural fields from the roadway. These changes are not expected to result in adverse effects to CHL 5 as the views toward the TCEC site have already been significantly impacted, and the relationship between Zion Line and the surrounding area is no longer representative of the historical agricultural context of the roadway.

Alternative Method 3 is not anticipated to result in indirect impacts to BHRs 1 through 3 or CHLs 1 through 4 and 6 through 19. No mitigation is required and no net effects to the identified heritage attributes of the BHRs and CHLs through indirect impacts are anticipated as a result of the work associated with Alternative Method 3.

Table 6-45. Cultural Heritage Resources Net Effects Assessment – Alternative Method 3

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Cultural Heritage Resources	Direct Impacts	• The construction and operation of Alternative Method 1 will take place within the existing On-site Study Area. • The landfill expansion will occur within the existing approved Expansion Landfill footprint. • The buildout of the landfill in the northeast corner will move the bordering swales to the east and new culvert will be constructed south of SWM pond 4.	• No direct impacts are anticipated to the identified BHRs and CHLs.	• None required	• No net effects to the heritage attributes of identified BHRs and CHLs.
	Indirect Impacts	• Vibration related to any and all construction activities. • The construction and operation of Alternative Method 2 will take place within the existing On-site Study Area. • The landfill expansion will occur within the existing approved Expansion Landfill footprint. • The buildout of the landfill in the northeast corner will move the bordering swales to the east and new culvert will be constructed south of SWM pond 4. • Shadows and obstructed views created by the vertical expansion of the landfill.	• Indirect impacts to CHL 5 through changes to historical agricultural viewscapes. Impacts have been determined to not adversely impact the CHL's heritage attributes.	• None required	• No net effects to the heritage attributes of identified BHRs and CHLs.

6.2.8.2 Archaeological Resources

The Archaeological Resources net effects assessment incorporates information from the Archaeological Resources Existing Conditions Report (**Supporting Document 1-11**) and details of the Project design provided in the CDR (**Supporting Document 2**) in order to assess the net environmental effects of the three Alternative Methods. The detailed net effects assessment is provided in the Archaeological Resources Effects Assessment Report (**Supporting Document 3-11**).

Because archaeological assessments are concerned with direct impacts or impacts within 50 m of an archaeological resource, only the general On-site Study Area was included as the Study Area for Archaeological Resources (**Section 4, Figure 4-1**).

Archaeological resources are non-renewable cultural resources that can be destroyed by the construction and operation of a waste disposal facility. Activities related to construction and operation of the landfill may cause negative effects on archaeological sites or areas with archaeological potential. To identify the potential effects of the Project on Archaeological Resources, the conceptual design of each of the three Alternative Methods was examined to determine if it will have an effect on:

- Archaeological Resources and areas of archaeological potential on-site; and
- Cemetery property within approximately 10 metres.

It is assumed that the construction and operation of Alternative Methods 1, 2, and 3 will take place within the existing On-site Study Area and that the landfill expansion will occur within the existing approved Expansion Landfill footprint.

Future Baseline Conditions

The Future Baseline Conditions are assumed to be the same as the existing conditions described below. The existing approved waste disposal footprint area of the TCEC will not change when the Project begins, or in any Alternative Method in the proposed landfill optimization. Similarly, existing Archaeological Resources will not change before the start of construction.

Archaeological Resources and Areas of Archaeological Potential On-Site

Archaeological site AfHl-14 is located within the southeast corner of the On-site Study Area and is the only archaeological site relevant to the Project. This site is considered to have further cultural heritage value or interest and has been protected in perpetuity with the establishment of a protective 10 m buffer and surrounding conservation area following the completion of a Stage 3 site-specific assessment in 2007. No activities that may alter the archaeological site may occur, and continued avoidance and protection is required.

The Stage 1 Archaeological Assessment (AA) determined that the remainder of the On-site Study Area beyond the protected area of Site AfHl-14 was previously assessed and has no further archaeological concern.

Cemetery Property Within Approximately 10 metres

The northern portion of Watford Cemetery is immediately adjacent to the On-site Study Area on the east side of Nauvoo Road within the Off-site Area. It is over 200 m from the approved Expansion Landfill footprint. This cemetery is well defined and has low potential for unmarked burials outside of the cemetery boundary and into the On-site Study Area.

Alternative Method 1

The net effects assessment for Alternative Method 1 is presented in **Table 6-46**.

Archaeological Resources and Areas of Archaeological Potential On-Site

Archaeological site AfHl-14 is located within the southeast corner of the On-site Study Area and is the only archaeological site relevant to the Project. The remainder of the On-site Study Area beyond the protected limits of AfHl-14 was previously assessed and has no further archaeological concern.

The landfill optimization will be located within the approved Expansion Landfill footprint and archaeological site AfHl-14 will not be impacted by the construction and operation of Alternative Method 1. There is no potential for the disturbance of unassessed or documented archaeological resources and there are no net effects for Alternative Method 1.

Cemetery Property Within Approximately 10 metres

A historic cemetery, Watford Cemetery, is located over 200 m from the approved Expansion Landfill footprint. The Stage 1 AA determined that no cemetery investigation is required for the Project. The entire area of Alternative Method 1 is within the On-site Study Area and therefore there will be no impacts on the cemetery property. There is no potential for the disturbance of the cemetery and there are no net effects for Alternative Method 1.

Table 6-46. Archaeological Resources Net Effects Assessment – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Archaeological Resources	Archaeological resources and areas of archaeological potential on-site and predicted impacts on them	• The construction and operation of Alternative Method 1 will take place within the existing On-site Study Area. Landfill expansion will only be occurring within the approved Expansion Landfill footprint • There will be no change to any Off-site activities associated with the Project • Archaeological site AfHl-14 is located in the southeastern corner of the TCEC site and will not be impacted by the construction and operation of Alternative Method 1 • The Stage 1 AA determined that the remainder of the On-site Study Area beyond the protected area of site AfHl-14 has been previously assessed and has no further archaeological concern	• No potential for the disturbance of unassessed or documented archaeological resources • Site AfHl-14 has further cultural heritage value or interest and has been protected in perpetuity with the establishment of a protective 10 metre buffer and surrounding conservation area following the completion of a Stage 3 site-specific assessment in 2007 (P057-307-2006 and P057-374-2007). The avoidance and protection measures recommended for the area around the archaeological site will not be required for the Project as no construction and operation activities are planned.	• None required	• No net effects on on-site Archaeological Resources and areas of archaeological potential
	Cemetery property within approximately 10 metres of the proposed impacts	• The construction and operation of Alternative Method 1 will take place within the existing On-site Study Area. Landfill expansion will only be occurring within the approved Expansion Landfill footprint. • There will be no change to any Off-site activities associated with the Project • A historic cemetery, Watford Cemetery, is located adjacent to the western portion of the TCEC site. • The Stage 1 AA determined that no cemetery investigation is required for this project.	• No potential for the disturbance of the cemetery	• None required	• No net effects on the cemetery property

Alternative Method 2

The net effects assessment for Alternative Method 2 is presented in **Table 6-47**.

Archaeological Resources and Areas of Archaeological Potential On-Site

Archaeological site AfHl-14 is located within the southeast corner of the On-site Study Area and is the only archaeological site relevant to the Project. The remainder of the On-site Study Area beyond the protected limits of AfHl-14 was previously assessed and has no further archaeological concern.

The landfill optimization will be located within the approved Expansion Landfill footprint and archaeological site AfHl-14 will not be impacted by the construction and operation of Alternative Method 2. There is no potential for the disturbance of unassessed or documented archaeological resources and there are no net effects for Alternative Method 2.

Cemetery Property Within Approximately 10 metres

A historic cemetery, Watford Cemetery, is located over 200 m from the approved Expansion Landfill footprint. The Stage 1 AA determined that no cemetery investigation is required for the Project. The entire area of Alternative Method 2 is within the On-site Study Area and therefore there will be no impacts on the cemetery property. There is no potential for the disturbance of the cemetery and there are no net effects for Alternative Method 2.

Table 6-47. Archaeological Resources Net Effects Assessment – Alternative Method 2

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Archaeological Resources	Archaeological resources and areas of archaeological potential on-site and predicted impacts on them	• The construction and operation of Alternative Method 2 will take place within the existing On-site Study Area. Landfill expansion will only be occurring within the approved Expansion Landfill footprint • There will be no change to any Off-site activities associated with the Project • Archaeological site AfHl-14 is located in the southeastern corner of the TCEC site and will not be impacted by the construction and operation of Alternative Method 1 • The Stage 1 AA determined that the remainder of the On-site Study Area beyond the protected area of site AfHl-14 has been previously assessed and has no further archaeological concern	• No potential for the disturbance of unassessed or documented archaeological resources • Site AfHl-14 has further cultural heritage value or interest and has been protected in perpetuity with the establishment of a protective 10 metre buffer and surrounding conservation area upon the completion of a Stage 3 site-specific assessment in 2007 (P057-307-2006 and P057-374-2007). Continued avoidance and protection is required for the site should the area be impacted by any construction and operation activities.	• None required	• No net effects on on-site Archaeological Resources and areas of archaeological potential
	Cemetery property within approximately 10 metres of the proposed impacts	• The construction and operation of Alternative Method 2 will take place within the existing On-site Study Area Landfill design and geometry. landfill expansion will only be occurring within the approved Expansion Landfill footprint • There will be no change to any Off-site activities associated with the Project • A historic cemetery, Watford Cemetery, is located adjacent to the western portion of the TCEC site. • The Stage 1 AA determined that no cemetery investigation is required for this project.	• No potential for the disturbance of the cemetery	• None required	• No net effects on Archaeological Resources

Alternative Method 3

The net effects assessment for Alternative Method 3 is presented in **Table 6-48**.

Archaeological Resources and Areas of Archaeological Potential On-Site

Archaeological site AfHl-14 is located within the southeast corner of the On-site Study Area and is the only archaeological site relevant to the Project. The remainder of the On-site Study Area beyond the protected limits of AfHl-14 was previously assessed and has no further archaeological concern.

The landfill optimization will be located within the approved Expansion Landfill footprint and archaeological site AfHl-14 will not be impacted by the construction and operation of Alternative Method 3. There is no potential for the disturbance of unassessed or documented archaeological resources and there are no net effects for Alternative Method 3.

Cemetery Property Within Approximately 10 metres

A historic cemetery, Watford Cemetery, is located over 200 m from the approved Expansion Landfill footprint. The Stage 1 AA determined that no cemetery investigation is required for the Project. The entire area of Alternative Method 3 is within the On-site Study Area and therefore there will be no impacts on the cemetery property. There is no potential for the disturbance of the cemetery and there are no net effects for Alternative Method 3.

Table 6-48. Archaeological Resources Net Effects Assessment – Alternative Method 3

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Archaeological Resources	Archaeological resources and areas of archaeological potential on-site and predicted impacts on them	• The construction and operation of Alternative Method 3 will take place within the existing On-site Study Area Landfill design and geometry. Landfill expansion will only be occurring within the approved Expansion Landfill footprint • There will be no change to any Off-site activities associated with the Project • Archaeological site AfHl-14 is located in the southeastern corner of the TCEC site and will not be impacted by the construction and operation of Alternative Method 1 • The Stage 1 AA determined that the remainder of the On-site Study Area beyond the protected area of site AfHl-14 has been previously assessed and has no further archaeological concern	• No potential for the disturbance of unassessed or documented archaeological resources • Site AfHl-14 has further cultural heritage value or interest and has been protected in perpetuity with the establishment of a protective 10 metre buffer and surrounding conservation area upon the completion of a Stage 3 site-specific assessment in 2007 (P057-307-2006 and P057-374-2007). Continued avoidance and protection is required for the site should the area be impacted by any construction and operation activities.	• None required	• No net effects on on-site Archaeological Resources and areas of archaeological potential
	Cemetery property within approximately 10 metres of the proposed impacts	• The construction and operation of Alternative Method 3 will take place within the existing On-site Study Area Landfill design and geometry. landfill expansion will only be occurring within the approved Expansion Landfill footprint • There will be no change to any Off-site activities associated with the Project • A historic cemetery, Watford Cemetery, is located adjacent to the western portion of the TCEC site. • The Stage 1 AA determined that no cemetery investigation is required for this project.	• No potential for the disturbance of the cemetery	• None required	• No net effects on Archaeological Resources

6.2.9 Transportation

The Transportation net effects assessment incorporates information from the Transportation Existing Conditions Report (**Supporting Document 1-12**) and details of the Project design provided in the CDR (**Supporting Document 2**) in order to assess the net environmental effects of the three Alternative Methods. The detailed net effects assessment is provided in the Transportation Effects Assessment Report (**Supporting Document 3-12**).

For Transportation, the general Off-site Study Area was extended to include the intersections that are used by facility vehicles to serve the local and broader areas based on known haul routes and typical origin-destinations for site traffic (**Section 4, Figure 4-23**).

Truck traffic associated with continued operations of the landfill may adversely affect residents, businesses, institutions and movement of farm vehicles in the site vicinity. To identify the potential effects of the Project on Transportation, the conceptual design of each Alternative Method for the landfill optimization was examined to determine if it will have an effect on:

- traffic operations through changes in peak traffic volumes and Average Annual Daily Traffic (AADT);
- intersection performance (capacity, delay, queues);
- road safety (collisions); and
- sight distance at the primary site entrance.

The effects assessment focuses on the transportation intersection performance since the other indicators are expected to remain the same as existing conditions due to the site traffic remaining unchanged. Background traffic growth is expected and was incorporated into the traffic forecasts for the purposes of the intersection performance analysis and this would be the only factor which could affect the collision rates and traffic volumes within the Off-site Study Area.

The intersections included in the Transportation effects assessment include the following five (5) locations:

1. Highway 402 and Nauvoo Road Eastbound Off-ramp Terminal;
2. Highway 402 and Nauvoo Road Westbound Off-ramp Terminal;
3. Nauvoo Road and Confederation Line;
4. Nauvoo Road and Zion Line; and
5. Primary facility entrance on Nauvoo Road.

An additional site access for the RNG Facility on the TCEC site was developed along Confederation Line and is included in the Transportation Off-site Study Area.

It was assumed that the TCEC will continue to operate as it does today with no changes to traffic generated or the origins and destinations of site traffic, and the daily,

seasonal, and hourly vehicle arrival patterns will remain unchanged. The primary haul routes are to and from Highway 402, with approximately 80% of site truck traffic going to the north to Highway 402 and the remainder of site traffic heading to the south towards Watford. No changes to the approved service area, annual fill rate, haul routes, employee traffic volumes, or operational hours are anticipated from the Project.

The Transportation Effects Assessment considered the following scenarios for traffic analysis:

- 2032 horizon year without the TCEC in operation ('Do Nothing');
- 2032 horizon year with the TCEC in operation (optimization proceeds);
- 2043 horizon year without the TCEC in operation ('Do Nothing'); and
- 2043 horizon year with the TCEC in operation (optimization proceeds).

The 2032 horizon represents the 10-year horizon from existing conditions and the 2043 horizon year represents the extension of the TCEC operating life to 2043.

Under existing conditions, the surrounding Off-site Study Area study intersections are operating within acceptable thresholds. The intersection characteristics (lane configuration, travel speeds, and traffic volumes) and the existing traffic volumes were used as the basis to forecast and assess future traffic operations.

On a peak operating day there are typically 47 inbound and 77 outbound trips during the weekday AM peak hour, 44 inbound and 52 outbound trips during the midday peak hour, and 26 inbound and 30 outbound trips during the weekday PM peak hour. These volumes represent the existing condition peak day as well as future conditions.

Future Baseline Conditions

Conservative growth rates were selected and used in the traffic volume forecasting. The inbound weigh scale processing time is assumed to be the same under future conditions.

Peak Hour and Daily Truck Traffic Volumes and Average Annual Daily Traffic

Future background traffic volumes (i.e., without site traffic) for the 2032 and 2043 horizon years were developed by applying a compound annual growth rate (CAGR) to the existing traffic volumes. The volumes are presented in the Transportation Effects Assessment Report (**Supporting Document 3-12**).

Intersection Performance

The intersection analysis considers three separate measures of performance:

- The capacity of all intersection movements, represented by the volume to capacity (v/c) ratio. The v/c ratio is a measure of the degree of capacity utilized at an intersection.
- The level of service (LOS) for all intersection turning movements as well as for the overall intersection. LOS is an indicator of how long a vehicle must wait to complete

a movement and is represented by a letter between 'A' and 'F', with 'F' being the longest delay.

- The forecasted queue lengths (50th and 95th percentile queue lengths).

Critical operations for the effects assessment were defined as:

- Shared traffic movements with v/c ratios exceeding 0.85;
- Exclusive turning movements with v/c ratios exceeding 1.00;
- Exclusive turning movements where queues exceed available storage or shared movements where queue spillback impacts upstream intersections; and
- Exclusive turn lanes that are inaccessible due to the adjacent queues.

Under 2032 Future Baseline Conditions, all movements operate at LOS C or better except for the eastbound and westbound movements at Confederation Line and Nauvoo Road. Eastbound and westbound left are anticipated to operate at LOS D during the PM peak hour. All movements at all intersections and for all periods have sufficient residual capacity. 95th percentile queues for eastbound and westbound movements at Confederation Line and Nauvoo Road are not expected to exceed 12 m. 95th percentile queues for all other movements are not expected to exceed 5 m for all periods.

Under 2043 Future Baseline Conditions, two critical movements were identified. The eastbound left-turn at Confederation Line and Nauvoo Road is expected to operate at LOS F during the PM peak hour. During the PM peak hour, westbound left is expected to operate at LOS E. Despite the delays, all other movements will operate with residual capacity during all periods. 95th percentile queues on the eastbound and westbound approaches at Confederation Line and Nauvoo Road are expected to be less than 20 m. 95th percentile queues for all other movements are expected to be 5 m or less for all periods. The Township of Warwick and County of Lambton are currently coordinating upgrades to this intersection by converting it from two-way stop-control to a full traffic signal. These planned improvements are expected to address existing operational constraints and are independent of the Project.

Road Safety

The Transportation Existing Conditions Report (**Supporting Document 1-12**) did not identify any relation between truck traffic generated by the TCEC and collisions occurring within the Off-site Study Area. Background traffic volumes are expected to increase, which may affect collision rates, but this is not expected to be related to the TCEC.

Sight Distance at the Primary Site Entrance

The TCEC site entrance on Nauvoo Road is expected to remain unchanged from existing conditions. The sight distances at the driveway are adequate and there are no apparent concerns with the driveway function, and this will remain the same under Future Baseline Conditions.

Alternative Methods

The net effects assessment for Transportation under all three Alternative Methods is presented in **Table 6-49**.

Peak Hour and Daily Truck Traffic Volumes and Average Annual Daily Traffic

Site traffic volumes in and out of the site were assumed to be the same as existing volumes for both 2032 and 2043 future conditions under all Alternative Methods. Traffic volumes are presented in the Transportation Effects Assessment Report (**Supporting Document 3-12**). No effects are predicted and no mitigation measures are required.

Intersection Performance

Under 2032 conditions with the Project, when compared with background conditions, all intersection approach or movement LOS values will remain the same. There are nominal increases in the v/c ratios, however, these increases are small, and all movements are expected to continue operating within acceptable thresholds. 95th percentile queues under total future conditions are nearly identical to 2032 Future Baseline Conditions. TCEC site traffic is anticipated to have negligible impact on queues at all Off-site Study Area intersections except at the TCEC site entrance.

Under 2043 conditions with the Project, most turning movements will operate with similar LOS compared to background conditions; however, there are two movements: the westbound left-turn at Nauvoo Road and Confederation Line which would increase to LOS F from E, as well as the eastbound left-turn which would increase to LOS E from D. There are nominal increases in the v/c ratios, but the increases are small, and all movements are expected to operate within acceptable thresholds. 95th percentile queues under total future conditions are nearly identical to 2043 Future Baseline Conditions.

No effects are predicted and no mitigation measures are required.

Road Safety

Cycling volumes are very low within the study area, and there were no collisions with cyclists identified. Furthermore, there were no indications that cycling safety is a concern nor indications that traffic associated with the TCEC would generate safety concerns for cyclists.

Pedestrian volumes are also low, particularly across Nauvoo Road, and no pedestrians were observed north of Confederation Line. Similar to cycling, no pedestrian collisions were identified, and there are no indications of safety concerns related to pedestrians, nor indications that traffic associated with the TCEC would generate safety concerns for pedestrians.

Collision rates are not expected to change as a result of the Project. The effects assessment found no relationship between truck traffic generated by the TCEC and collisions within the Off-site Study Area. While background traffic volumes may

increase over time, any potential rise in collision rates is not expected to be linked to the Project.

No effects are predicted and no mitigation measures are required.

Sight Distance at the Primary Site Entrance

The TCEC site entrance will remain unchanged compared to existing conditions; therefore, no effects are predicted.

Table 6-49. Transportation Net Effects Assessment – Alternative Methods 1, 2, and 3

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Traffic Operations	Change in peak hour and daily truck traffic volume and AADT along the Off-site Study Area road segments	• Changes in traffic volumes within Off-site Study Area is the result of background growth and background developments. • TCEC site traffic will not change under 2032 and 2043 future conditions	• No changes as a result of TCEC optimization under future conditions. As a result, TCEC will not have any effects on Off-site Study Area in 2032 and 2043 future conditions	• No mitigation measures required in 2032 and 2043 future conditions	• No effects predicted
	Intersection performance – capacity, delay, queues (based on HCM 2000 and generated by Synchro Traffic Signal Coordination Software Version 11) – for the Off-site Study Area intersections	• Exclusive left turn lanes with shared through-right lanes at Confederation Line and Nauvoo Road are assumed to be in place by the 2032 horizon year	• No changes as a result of TCEC optimization under future conditions. As a result, TCEC will not have any effects on Off-site Study Area in 2032 and 2043 future conditions	• No mitigation measures required in 2032 and 2043 future conditions	• No effects predicted
	Road safety • Collisions per million vehicles at all Off-site Study Area intersections (severity, involving pedestrians, cyclists, autos, trucks, school buses, and agricultural vehicles) • Collisions per million vehicle-km along all Off-site Study Area road segments (severity, involving pedestrians, cyclists, autos, trucks, school buses, and agricultural vehicles) • Collisions by environmental conditions for segments and intersections	• TCEC site traffic will not change under 2032 and 2043 future conditions	• No changes as a result of TCEC optimization under future conditions. As a result, TCEC will not have any effects on Off-site Study Area in 2032 and 2043 future conditions	• No mitigation measures required in 2032 and 2043 future conditions	• No effects predicted
	Sight distance at the primary site entrance	• TCEC site driveway will remain unchanged compared to existing conditions.	• No changes from TCEC site under future conditions. As a result, there are no impacts to consider.	• No mitigation measures required in 2032 and 2043 future conditions	• No effects predicted

6.2.10 Current and Planned Future Land Use

Current and Planned Future Land Use considers Effects on Current and Future Land Uses.

The Land Use net effects assessment incorporates information from the Land Use Existing Conditions Report (**Supporting Document 1-13**) and details of the Project design provided in the CDR (**Supporting Document 2**) in order to assess the net environmental effects of the three Alternative Methods. The detailed net effects assessment is provided in the Land Use Effects Assessment Report (**Supporting Document 3-13**).

The On-site and Off-site Study Areas for Land Use correspond to those for the Social Environment (**Section 4, Figure 4-16**). The On-site Study Area corresponds to the general On-site Study Area, while the Off-site Study Area was expanded to encompass the village of Watford.

The continued operation of the landfill may not be fully compatible with certain current and/or planned future land uses in the Off-site Study Area. Waste disposal facilities can potentially have a negative impact on sensitive land uses in the vicinity of the site. To identify the potential effects of the Project on Land Use, the conceptual design of each Alternative Method for the landfill optimization was examined to determine if it will have an effect on:

- Current land use;
- Planned land use;
- Type(s) and proximity of off-site recreational resources within 1 km of a landfill footprint;
- Type(s) and proximity of off-site sensitive land uses as defined by the Provincial Policy Statement (now Provincial Planning Statement) and the MECP D-1 Guidelines (e.g., dwellings, churches, parks) within 1 km of a landfill footprint; and
- Type(s) and proximity of agricultural land use/operations (e.g., organic, cash crop, livestock).

Key assumptions used in the Land Use effects assessment include:

- The existing approved waste disposal footprint will not change; only the maximum permitted height of waste will increase.
- All alternative methods are considered stable in terms of final landfill slopes and peak profile height.
- Property boundaries and buffer widths will remain unchanged, as the landfill footprint is not expanding.
- No operational changes are anticipated for the landfill optimization and the landfill will operate consistent with current conditions with the same annual tonnage limits,

truck trips, operating hours, site equipment, annual capacity, and nuisance controls for odour, litter, dust, noise, and birds.

- The Visual Landscape Effects Assessment (**Section 6.2.7** and **Supporting Document 3-9**) identifies that the Combined Effect Value (CEV) scores for all three Alternatives Methods are similar (ranging from 77 to 81), indicating minimal differences in visual impacts and no significant influence on land use. Existing visual mitigation measures (e.g., berms, plantings, poplar forest, soil stockpile) are effective in screening views. Trees on the screening berm are expected to grow taller over time, enhancing visual screening.

Future Baseline Conditions

Under Future Baseline Conditions, current land uses within the Off-site Study Area, specifically sensitive land uses, will continue to exist and operate. It is assumed that the Settlement Area limits of the Township of Watford will continue to remain as currently approved unless a review of the County or Local OPs expand the area, which would allow for additional sensitive land use designations (i.e., Residential, Open Space). These land uses, if within 500 m of the landfill fill area, will be subject to consultation with the Province to mitigate land use incompatibility issues as outlined in the MECP Guideline D-4: Land Use On or Near Landfills and Dumps.

It is anticipated that the landfill will continue to be consistent with the Provincial Planning Statement, provincial land use and resource management plans, and municipal land use policies, plans, and zoning by-laws (including municipal setbacks).

Some planned residential development within the Township of Warwick, specifically those draft plans approved, or site plans approved by Council and/or the County, may start construction or be completed prior to the Project being started. These land uses have been evaluated through the planning approvals process and are anticipated to proceed regardless of the Project.

Alternative Method 1

The net effects assessment for Alternative Method 1 is presented in **Table 6-50**.

Current Land Use

The Off-site Study Area includes the community of Watford and the surrounding agricultural area within 1 km of the landfill footprint. There are approximately 33 residences within the agricultural land use designation in the Off-site Study Area, excluding the Watford Settlement Area. The existing separation distance between the Village from the landfill, as well as the pre-existing permanent buffer areas, are anticipated to mitigate against potential impacts and land use compatibility issues, including from noise and air quality. Existing mitigation measures in use at the TCEC will continue or be enhanced, as detailed in other effects assessments in **Supporting Document 3**.

Current land uses within 500 m of the landfill fill area will be subject to consultation with the Province prior to a *Planning Act* approval being adopted or granted, in the

case that new development (i.e., expansion of current use) or a proposed change of land use; however, current land uses within 500 m are permitted to exist and function pursuant to Section 34(9) of the *Planning Act*.

Under Alternative Method 1, no changes to the landfill footprint are proposed, and therefore, existing setback distances between the TCEC operation and any residences within the agricultural land use designation outside the Watford Settlement Area, will be maintained. Proactive nuisance controls will continue to be employed by WM to minimize nuisance effects related to odour, litter, dust, noise, and birds on the surrounding environment.

Any industrial land uses within the Off-site Study Area are not considered sensitive; as such, industrial and manufacturing uses are compatible uses with the landfill and will not be as susceptible to potential impacts.

In summary, there are no significant effects on the current residential, commercial, parks and open space, institutional, and commercial industrial land uses within the settlement area of Watford anticipated as a result of the proposed vertical expansion in Alternative Method 1.

Planned Land Use

Planned land use development will be subject to Provincial, County, and/or Municipal policies and/or regulations to ensure compatibility between sensitive land uses and the TCEC. As such, it is anticipated that planned land uses in proximity to the landfill site will be compatible with the landfill use (i.e., industrial uses) and, if a planned sensitive land use is proposed, appropriate measures may be implemented in accordance with Provincial, County, and/or Municipal policies and/or regulations (i.e., appropriate setbacks). The existing buffer area surrounding the landfill site will not change under Alternative Method 1.

Existing mitigation measures in use at the TCEC will continue or be enhanced as detailed in other effects assessments in **Supporting Document 3**. In summary, there are no significant effects on planned land uses anticipated as a result of Alternative Method 1.

Type(s) and Proximity of Off-Site Recreational Resources within 1 km

The definition of “sensitive land use” in the D-1-3 Land Use Compatibility Guidelines includes “*certain outdoor recreational uses deemed by a municipality or other level of government to be sensitive,*” as well as permanent structures such as community centres. There are four public parks and one community complex located within the Off-site Study Area. Under Alternative Method 1, the approved landfill footprint will not change and thus the setback distance between the TCEC operation and any off-site recreational resources will be maintained. If changes in land use are proposed at the off-site recreational areas within 500 m of the landfill, the changes would be subject to consultation with the Province before a *Planning Act* approval is adopted or granted. Existing off-site recreational land uses within 500 metres of the landfill site are permitted to exist pursuant to Section 34(9) of the *Planning Act*.

In summary, there are no significant effects on off-site recreational resources anticipated as a result of Alternative Method 1.

Type(s) and Proximity of Off-Site Sensitive Land Uses

The Province considers a number of non-agricultural, non-residential, and non-recreational land uses to be "*sensitive*", including daycare centres, educational and health facilities (PPS); institutions such as schools, churches, community centres, and daycares (D-1-3); permanent structures where a person is present on a full-time basis (but not including food or motor vehicle service facilities adjacent to a highway, utility operations, scrap yards, heavy industrial uses, gravel pits, quarries, mining or forestry activities) and cemeteries (D-4). In Watford, there are two elementary schools, two daycares, two healthcare facilities, two retirement/long-term care facilities, two active cemeteries, one inactive cemetery, and four churches. Under Alternative Method 1, the approved landfill footprint will not change and thus the setback distance between the TCEC operation and existing off-site sensitive land uses will be maintained.

The existing separation distance between Watford and the landfill, and the pre-existing permanent buffer areas, are anticipated to mitigate against potential impacts and land use compatibility issues, including noise and air quality. Existing mitigation measures in use at the TCEC will continue or be enhanced, as detailed in other effects assessments in **Supporting Document 3**. In summary, there are no significant effects on existing off-site sensitive land uses anticipated as a result of Alternative Method 1.

Type(s) and Proximity of Agricultural Land Use/Operations

The D-1-3 Land Use Compatibility Guidelines identify that "*certain agricultural operations (e.g. cattle raising, mink farming, cash crops and orchards)"* may be considered sensitive land uses, and the D-4 Guidelines identify that livestock pastures and *"permanent structures used in animal husbandry*" are considered sensitive land uses for landfills currently in operation. Agricultural uses (both cash crops and livestock operations) are the predominant land uses within the Off-site Study Area (apart from the Watford Settlement Area). Most "undeveloped" land within the Off-site Study Area is used for agricultural cash crop farming, and 13 livestock operations have been identified within this area, along with one greenhouse operation.

Under Alternative Method 1, no significant effects on existing agricultural land use and associated operations are anticipated; the existing landfill footprint will not change. Expansion of existing agricultural operations will be subject to Provincial, County, and/or Municipal policies and/or regulations to ensure compatibility between the agricultural operation and the TCEC; however, current agricultural land uses and their associated operations within 500 m of the landfill site are considered permitted to exist pursuant to Section 34(9) of the *Planning Act*.

Table 6-50. Current and Future Land Use Net Effects Assessment – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Effects on Current and Future Land Uses	Current land use	• Current land uses and their locations in proximity to the TCEC will remain as they exist at the time of project commencement. • Under the proposed vertical expansion, the existing approved waste disposal footprint area of the TCEC would not change; the maximum permitted height of waste would be increased. • Alternative Method 1 proposes the second highest maximum elevation increase for vertical expansion, compared between the three alternative methods. • The existing visual impact mitigation measures are anticipated to effectively screen views. • Permanent minimum buffer areas prescribed in the Local OP and Township ZBL will remain. • The establishment of an expanded landfill triggers municipal and provincial policies that restrict sensitive land uses in the Off-site Study Area. • It is anticipated that existing nuisance controls performed by WM at the TCEC will be continued and/or enhanced pending the results of the Effects Assessment reporting completed by other technical consultants (i.e., Air Quality, Archaeology, Cultural Heritage, Ecological Environment, Hydrogeological,	• No significant impacts to the residential, commercial, parks and open space, institutional, and commercial industrial land uses within the settlement area of Watford are anticipated. The existing separation distance between the Village from the landfill site is anticipated to mitigate against potential impacts and land use compatibility issues. • Current land uses within 500 m of the landfill fill area will be subject to consultation with the Province before a *Planning Act* approval is adopted or granted, in the case that new development or change of land use is proposed. • The existing approved waste disposal footprint area of the TCEC would not change and, as such, existing setback distances between the TCEC operation and any current land uses will be maintained. No significant effects anticipated.	• Maintain previously approved setback and buffer distances, and existing berming. • Continued employment or enhancement of nuisance controls by WM, related to odour, litter, dust, noise and birds on the surrounding environment.	• No significant net effects anticipated between the TCEC operation and any current land uses; setback distances are maintained. Legally established existing land uses (considered sensitive) within 500 m of the landfill site are permitted to continue to exist (pursuant to Section 34(9) of the *Planning Act*) • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls.

Table 6-50. Current and Future Land Use Net Effects Assessment – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
		Surface Water, Transportation, Noise, and Human Health).			
	Planned land use	• Planning land uses will be in keeping with the general land use schedule as it exists in the County OP and Local OP. • Under the proposed vertical expansion, the existing approved waste disposal footprint area of the TCEC would not change, but rather, the maximum permitted height of the waste would be increased. • Alternative Method 1 proposes the second highest maximum elevation increase for vertical expansion, compared between the three alternative methods. • Permanent minimum buffer areas prescribed in the Local OP and Township ZBL will remain. • The establishment of an expanded landfill, as well as any proposed future development potential in proximity to the landfill site, triggers municipal and provincial policies that restrict sensitive land uses in the Off-site Study Area. • It is anticipated that existing nuisance controls performed by WM at the TCEC will be continued and/or enhanced pending the results of the Effects Assessment reporting completed by other technical consultants (i.e., Air Quality, Archaeology,	• The existing approved waste disposal footprint area of the TCEC would not change and, as such, existing setback distances between the TCEC operation and any planned land uses will be maintained. No significant effects anticipated. • Planned land use development (i.e., expansion of current use or new uses) will be subject to Provincial, County, and/or Municipal polices and/or regulations to ensure compatibility between planned sensitive uses and the existing and/or newly expanded TCEC operation.	• Maintain previously approved setback and buffer distances, and existing berming. • Continued employment or enhancement of nuisance controls by WM, related to odour, litter, dust, noise and birds on the surrounding environment.	• No significant net effects anticipated between the TCEC operation and any planned land uses; setback distances are maintained. • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls.

Table 6-50. Current and Future Land Use Net Effects Assessment – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
		Cultural Heritage, Ecological Environment, Hydrogeological, Surface Water, Transportation, Noise, and Human Health).			
	Type(s) and proximity of off-site recreational resources within 1 km of a landfill footprint potentially affected	• Under the proposed vertical expansion, the existing approved waste disposal footprint area of the TCEC would not change, but rather, the maximum permitted height of the waste would be increased. • Alternative Method 1 proposes the second highest maximum elevation increase for vertical expansion, compared between the three alternative methods. • Permanent minimum buffer areas prescribed in the Local OP and Township ZBL will remain. • The establishment of an expanded landfill, as well as any proposed future development potential in proximity to the landfill site, triggers municipal and provincial policies that restrict sensitive land uses in the Off-site Study Area. • It is anticipated that existing nuisance controls performed by WM at the TCEC will be continued and/or enhanced pending the results of the Effects Assessment reporting completed by other technical consultants (i.e., Air Quality, Archaeology, Cultural Heritage, Ecological Environment, Hydrogeological,	• The existing approved waste disposal footprint area of the TCEC would not change and, as such, existing setback distances between the TCEC operation and off-site recreational resources will be maintained. No significant effects anticipated.	• Maintain previously approved setback and buffer distances, and existing berming. • Continued employment or enhancement of nuisance controls by WM, related to odour, litter, dust, noise and birds on the surrounding environment.	• No significant net effects anticipated between the TCEC operation and any off-site recreational resources; setback distances are maintained. Legally established existing off-site recreational resources (considered sensitive) within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*) • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls.

Table 6-50. Current and Future Land Use Net Effects Assessment – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
		Surface Water, Transportation, Noise, and Human Health).			
	Type(s) and proximity of off-site sensitive land uses as defined by the Provincial Policy Statement and the MECP D-1 Guidelines (e.g., dwellings, churches, parks) within 1 km of a landfill footprint potentially affected	• Under the proposed vertical expansion, the existing approved waste disposal footprint area of the TCEC would not change, but rather, the maximum permitted height of the waste would be increased. • Alternative Method 1 proposes the second highest maximum elevation increase for vertical expansion, compared between the three alternative methods. • Permanent minimum buffer areas prescribed in the Local OP and Township ZBL will remain. • The establishment of an expanded landfill, as well as any proposed future development potential in proximity to the landfill site, triggers municipal and provincial policies that restrict sensitive land uses in the Off-site Study Area. • It is anticipated that existing nuisance controls performed by WM at the TCEC will be continued and/or enhanced pending the results of the Effects Assessment reporting completed by other technical consultants (i.e., Air Quality, Archaeology, Cultural Heritage, Ecological Environment, Hydrogeological, Surface Water, Transportation, Noise, and Human Health).	• The existing approved waste disposal footprint area of the TCEC would not change and, as such, existing setback distances between the TCEC operation and any existing off-site sensitive land uses will be maintained. No significant effects anticipated. • Off-site sensitive land uses within 500 m of the landfill fill area will be subject to consultation with the Province before a *Planning Act* approval is adopted or granted, in the case that new development or change of land use is proposed.	• Maintain previously approved setback and buffer distances, and existing berming. • Continued employment or enhancement of nuisance controls by WM, related to odour, litter, dust, noise and birds on the surrounding environment.	• No significant net effects anticipated between the TCEC operation and any sensitive land use; setback distances are maintained. Legally established existing sensitive land use (considered sensitive) within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*) • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls.

Table 6-50. Current and Future Land Use Net Effects Assessment – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
	Type(s) and proximity of agricultural land use/operations (e.g., organic, cash crop, livestock)	• Under the proposed vertical expansion, the existing approved waste disposal footprint area of the TCEC would not change, but rather, the maximum permitted height of the waste would be increased. • Alternative Method 1 proposes the second highest maximum elevation increase for vertical expansion, compared between the three alternative methods. • Permanent minimum buffer areas prescribed in the Local OP and Township ZBL will remain. • The establishment of an expanded landfill, as well as any proposed future development potential in proximity to the landfill site, triggers municipal and provincial policies that restrict sensitive land uses in the Off-site Study Area. • It is anticipated that existing nuisance controls performed by WM at the TCEC will be continued and/or enhanced pending the results of the Effects Assessment reporting completed by other technical consultants (i.e., Air Quality, Archaeology, Cultural Heritage, Ecological Environment, Hydrogeological, Surface Water, Transportation, Noise, and Human Health).	• Under the proposed vertical expansion, no potential effects are anticipated on existing agricultural land uses and associated operations; the existing approved waste disposal footprint area of the TCEC would not change. • Expansion of existing agricultural operations will be subject to Provincial, County, and/or Municipal polices and/or regulations to ensure compatibility between the agricultural operation and the existing and/or newly expanded TCEC operation.	• Maintain previously approved setback and buffer distances, and existing berming. • Continued employment or enhancement of nuisance controls by WM, related to odour, litter, dust, noise and birds on the surrounding environment.	• No significant net effects anticipated between the TCEC operation and any existing and operating agricultural land use; setback distances are maintained. Legally established existing operating agricultural land uses within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*) • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls.

Alternative Method 2

The net effects assessment for Alternative Method 2 is presented in **Table 6-51**.

Current Land Use

Similar to Alternative Method 1, the existing separation distance between the Village from the landfill, as well as the pre-existing permanent buffer areas, are anticipated to mitigate against potential impacts and land use compatibility issues, including from noise and air quality. Existing mitigation measures in use at the TCEC will continue or be enhanced, as detailed in other effects assessments in **Supporting Document 3**.

Current land uses within 500 m of the landfill fill area will be subject to consultation with the Province prior to a *Planning Act* approval being adopted or granted, in the case that new development (i.e., expansion of current use) or a proposed change of land use; however, current land uses within 500 m are permitted to exist and function pursuant to Section 34(9) of the *Planning Act*.

Under Alternative Method 2, no changes to the landfill footprint are proposed, and therefore, existing setback distances between the TCEC operation and any residences within the agricultural land use designation outside the Watford Settlement Area, will be maintained. Proactive nuisance controls will continue to be employed by WM to minimize nuisance effects related to odour, litter, dust, noise, and birds on the surrounding environment.

Any industrial land uses within the Off-site Study Area are not considered sensitive; as such, industrial and manufacturing uses are compatible uses with the landfill and will not be as susceptible to potential impacts.

In summary, there are no significant effects on the current residential, commercial, parks and open space, institutional, and commercial industrial land uses within the settlement area of Watford anticipated as a result of the proposed vertical expansion in Alternative Method 2.

Planned Land Use

Planned land use development will be subject to Provincial, County, and/or Municipal policies and/or regulations to ensure compatibility between sensitive land uses and the TCEC. As such, it is anticipated that planned land uses in proximity to the landfill site will be compatible with the landfill use (i.e., industrial uses) and, if a planned sensitive land use is proposed, appropriate measures may be implemented in accordance with Provincial, County, and/or Municipal policies and/or regulations (i.e., appropriate setbacks). The existing buffer area surrounding the landfill site will not change under Alternative Method 2.

Existing mitigation measures in use at the TCEC will continue or be enhanced as detailed in other effects assessments in **Supporting Document 3**. In summary, there are no significant effects on planned land uses anticipated as a result of Alternative Method 2.

Type(s) and Proximity of Off-Site Recreational Resources within 1 km

Under Alternative Method 2, the approved landfill footprint will not change and thus the setback distance between the TCEC operation and any off-site recreational resources will be maintained. If changes in land use are proposed at the off-site recreational areas within 500 m of the landfill, the changes would be subject to consultation with the Province before a *Planning Act* approval is adopted or granted. Existing off-site recreational land uses within 500 metres of the landfill site are permitted to exist pursuant to Section 34(9) of the *Planning Act*.

In summary, there are no significant effects on off-site recreational resources anticipated as a result of Alternative Method 2.

Type(s) and Proximity of Off-Site Sensitive Land Uses

Under Alternative Method 2, the approved landfill footprint will not change and thus the setback distance between the TCEC operation and existing off-site sensitive land uses will be maintained.

The existing separation distance between Watford and the landfill, and the pre-existing permanent buffer areas, are anticipated to mitigate against potential impacts and land use compatibility issues, including noise and air quality. Existing mitigation measures in use at the TCEC will continue or be enhanced, as detailed in other effects assessments in **Supporting Document 3**. In summary, there are no significant effects on existing off-site sensitive land uses anticipated as a result of Alternative Method 2.

Type(s) and Proximity of Agricultural Land Use/Operations

Under Alternative Method 2, no significant effects on existing agricultural land use and associated operations are anticipated; the existing landfill footprint will not change. Expansion of existing agricultural operations will be subject to Provincial, County, and/or Municipal policies and/or regulations to ensure compatibility between the agricultural operation and the TCEC; however, current agricultural land uses and their associated operations within 500 m of the landfill site are considered permitted to exist pursuant to Section 34(9) of the *Planning Act*.

Table 6-51. Current and Future Land Uses Net Effects Assessment – Alternative Method 2

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Effects on Current and Future Land Uses	Current land use	• Current land uses and their locations in proximity to the TCEC will remain as they exist at the time of project commencement. • Under the proposed vertical expansion, the existing approved waste disposal footprint area of the TCEC would not change; the maximum permitted height of waste would be increased. • Alternative Method 2 proposes the smallest elevation maximum for vertical expansion, compared between the three alternative methods. • The existing visual impact mitigation measures are anticipated to effectively screen views. • Permanent minimum buffer areas prescribed in the Local OP and Township ZBL will remain. • The establishment of an expanded landfill triggers municipal and provincial policies that restrict sensitive land uses in the Off-site Study Area. • It is anticipated that existing nuisance controls performed by WM at the TCEC will be continued and/or enhanced pending the results of the Effects Assessment reporting completed by other technical consultants (i.e., Air Quality, Archaeology, Cultural Heritage, Ecological Environment, Hydrogeological, Surface Water, Transportation, Noise, and Human Health).	• No significant impacts to the residential, commercial, parks and open space, institutional, and commercial industrial land uses within the settlement area of Watford are anticipated. The existing separation distance between the Village from the landfill site is anticipated to mitigate against potential impacts and land use compatibility issues. • Current land uses within 500 m of the landfill fill area will be subject to consultation with the Province before a *Planning Act* approval is adopted or granted, in the case that new development or change of land use is proposed. • The existing approved waste disposal footprint area of the TCEC would not change and, as such, existing setback distances between the TCEC operation and any current land uses will be maintained. No significant effects anticipated.	• Maintain previously approved setback and buffer distances, and existing berming. • Continued employment or enhancement of nuisance controls by WM, related to odour, litter, dust, noise and birds on the surrounding environment.	• No significant net effects anticipated between the TCEC operation and any current land uses; setback distances are maintained. Legally established existing land uses (considered sensitive) within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*) • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls.

Table 6-51. Current and Future Land Uses Net Effects Assessment – Alternative Method 2

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
	Planned land use	• Planning land uses will be in keeping with the general land use schedule as it exists in the County OP and Local OP. • Under the proposed vertical expansion, the existing approved waste disposal footprint area of the TCEC would not change, but rather, the maximum permitted height of the waste would be increased. • Alternative Method 2 proposes the smallest elevation maximum for vertical expansion, compared between the three alternative methods. • Permanent minimum buffer areas prescribed in the Local OP and Township ZBL will remain. • The establishment of an expanded landfill, as well as any proposed future development potential in proximity to the landfill site, triggers municipal and provincial policies that restrict sensitive land uses in the Off-site Study Area. • It is anticipated that existing nuisance controls performed by WM at the TCEC will be continued and/or enhanced pending the results of the Effects Assessment reporting completed by other technical consultants (i.e., Air Quality, Archaeology, Cultural Heritage, Ecological Environment, Hydrogeological, Surface Water, Transportation, Noise, and Human Health).	• The existing approved waste disposal footprint area of the TCEC would not change and, as such, existing setback distances between the TCEC operation and any planned land uses will be maintained. No significant effects anticipated. • Planned land use development (i.e., expansion of current use or new uses) will be subject to Provincial, County, and/or Municipal polices and/or regulations to ensure compatibility between planned sensitive uses and the existing and/or newly expanded TCEC operation.	• Maintain previously approved setback and buffer distances, and existing berming. • Continued employment or enhancement of nuisance controls by WM, related to odour, litter, dust, noise and birds on the surrounding environment.	• No significant net effects anticipated between the TCEC operation and any planned land uses; setback distances are maintained. • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls.

Table 6-51. Current and Future Land Uses Net Effects Assessment – Alternative Method 2

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
	Type(s) and proximity of off-site recreational resources within 1 km of a landfill footprint potentially affected	• Under the proposed vertical expansion, the existing approved waste disposal footprint area of the TCEC would not change, but rather, the maximum permitted height of the waste would be increased. • Alternative Method 2 proposes the smallest elevation maximum for vertical expansion, compared between the three alternative methods. • Permanent minimum buffer areas prescribed in the Local OP and Township ZBL will remain. • The establishment of an expanded landfill, as well as any proposed future development potential in proximity to the landfill site, triggers municipal and provincial policies that restrict sensitive land uses in the Off-site Study Area. • It is anticipated that existing nuisance controls performed by WM at the TCEC will be continued and/or enhanced pending the results of the Effects Assessment reporting completed by other technical consultants (i.e., Air Quality, Archaeology, Cultural Heritage, Ecological Environment, Hydrogeological, Surface Water, Transportation, Noise, and Human Health).	• The existing approved waste disposal footprint area of the TCEC would not change and, as such, existing setback distances between the TCEC operation and off-site recreational resources will be maintained. No significant effects anticipated.	• Maintain previously approved setback and buffer distances, and existing berming. • Continued employment or enhancement of nuisance controls by WM, related to odour, litter, dust, noise and birds on the surrounding environment.	• No significant net effects anticipated between the TCEC operation and any off-site recreational resources; setback distances are maintained. Existing off-site recreational resources (considered sensitive) within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*) • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls.

Table 6-51. Current and Future Land Uses Net Effects Assessment – Alternative Method 2

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
	Type(s) and proximity of off-site sensitive land uses as defined by the Provincial Policy Statement and the MECP D-1 Guidelines (e.g., dwellings, churches, parks) within 1 km of a landfill footprint potentially affected	• Under the proposed vertical expansion, the existing approved waste disposal footprint area of the TCEC would not change, but rather, the maximum permitted height of the waste would be increased. • Alternative Method 2 proposes the smallest elevation maximum for vertical expansion, compared between the three alternative methods. • Permanent minimum buffer areas prescribed in the Local OP and Township ZBL will remain. • The establishment of an expanded landfill, as well as any proposed future development potential in proximity to the landfill site, triggers municipal and provincial policies that restrict sensitive land uses in the Off-site Study Area. • It is anticipated that existing nuisance controls performed by WM at the TCEC will be continued and/or enhanced pending the results of the Effects Assessment reporting completed by other technical consultants (i.e., Air Quality, Archaeology, Cultural Heritage, Ecological Environment, Hydrogeological, Surface Water, Transportation, Noise, and Human Health).	• The existing approved waste disposal footprint area of the TCEC would not change and, as such, existing setback distances between the TCEC operation and any existing off-site sensitive land uses will be maintained. No significant effects anticipated. • Off-site sensitive land uses within 500 m of the landfill fill area will be subject to consultation with the Province before a *Planning Act* approval is adopted or granted, in the case that new development or change of land use is proposed.	• Maintain previously approved setback and buffer distances, and existing berming. • Continued employment or enhancement of nuisance controls by WM, related to odour, litter, dust, noise and birds on the surrounding environment.	• No significant net effects anticipated between the TCEC operation and any sensitive land use; setback distances are maintained. Legally established existing sensitive land use (considered sensitive) within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*) • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls.

Table 6-51. Current and Future Land Uses Net Effects Assessment – Alternative Method 2

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
	Type(s) and proximity of agricultural land use/operations (e.g., organic, cash crop, livestock)	• Under the proposed vertical expansion, the existing approved waste disposal footprint area of the TCEC would not change, but rather, the maximum permitted height of the waste would be increased. • Alternative Method 2 proposes the smallest elevation maximum for vertical expansion, compared between the three alternative methods. • Permanent minimum buffer areas prescribed in the Local OP and Township ZBL will remain. • The establishment of an expanded landfill, as well as any proposed future development potential in proximity to the landfill site, triggers municipal and provincial policies that restrict sensitive land uses in the Off-site Study Area. • It is anticipated that existing nuisance controls performed by WM at the TCEC will be continued and/or enhanced pending the results of the Effects Assessment reporting completed by other technical consultants (i.e., Air Quality, Archaeology, Cultural Heritage, Ecological Environment, Hydrogeological, Surface Water, Transportation, Noise, and Human Health).	• Under the proposed vertical expansion, no potential effects are anticipated on existing agricultural land uses and associated operations; the existing approved waste disposal footprint area of the TCEC would not change. • Expansion of existing agricultural operations will be subject to Provincial, County, and/or Municipal polices and/or regulations to ensure compatibility between the agricultural operation and the existing and/or newly expanded TCEC operation.	• Maintain previously approved setback and buffer distances, and existing berming. • Continued employment or enhancement of nuisance controls by WM, related to odour, litter, dust, noise and birds on the surrounding environment.	• No significant net effects anticipated between the TCEC operation and any existing and operating agricultural land use; setback distances are maintained. Legally established existing agricultural land uses within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*) • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls.

Alternative Method 3

The net effects assessment for Alternative Method 3 is presented in **Table 6-52**.

Current Land Use

Similar to Alternative Method 1, the existing separation distance between the Village from the landfill, as well as the pre-existing permanent buffer areas, are anticipated to mitigate against potential impacts and land use compatibility issues, including from noise and air quality. Existing mitigation measures in use at the TCEC will continue or be enhanced, as detailed in other effects assessments in **Supporting Document 3**.

Current land uses within 500 m of the landfill fill area will be subject to consultation with the Province prior to a *Planning Act* approval being adopted or granted, in the case that new development (i.e., expansion of current use) or a proposed change of land use; however, current land uses within 500 m are permitted to exist and function pursuant to Section 34(9) of the *Planning Act*.

Under Alternative Method 3, no changes to the landfill footprint are proposed, and therefore, existing setback distances between the TCEC operation and any residences within the agricultural land use designation outside the Watford Settlement Area will be maintained. Proactive nuisance controls will continue to be employed by WM to minimize nuisance effects related to odour, litter, dust, noise, and birds on the surrounding environment.

Any industrial land uses within the Off-site Study Area are not considered sensitive; as such, industrial and manufacturing uses are compatible uses with the landfill and will not be as susceptible to potential impacts.

In summary, there are no significant effects on the current residential, commercial, parks and open space, institutional, and commercial industrial land uses within the settlement area of Watford anticipated as a result of the proposed vertical expansion in Alternative Method 3.

Planned Land Use

Planned land use development will be subject to Provincial, County, and/or Municipal policies and/or regulations to ensure compatibility between sensitive land uses and the TCEC. As such, it is anticipated that planned land uses in proximity to the landfill site will be compatible with the landfill use (i.e., industrial uses) and, if a planned sensitive land use is proposed, appropriate measures may be implemented in accordance with Provincial, County, and/or Municipal policies and/or regulations (i.e., appropriate setbacks). The existing buffer area surrounding the landfill site will not change under Alternative Method 3.

Existing mitigation measures in use at the TCEC will continue or be enhanced as detailed in other effects assessments in **Supporting Document 3**. In summary, there are no significant effects on planned land uses anticipated as a result of Alternative Method 3.

Type(s) and Proximity of Off-Site Recreational Resources within 1 km

Under Alternative Method 3, the approved landfill footprint will not change and thus the setback distance between the TCEC operation and any off-site recreational resources will be maintained. If changes in land use are proposed at the off-site recreational areas within 500 m of the landfill, the changes would be subject to consultation with the Province before a *Planning Act* approval is adopted or granted. Existing off-site recreational land uses within 500 metres of the landfill site are permitted to exist pursuant to Section 34(9) of the *Planning Act*.

In summary, there are no significant effects on off-site recreational resources anticipated as a result of Alternative Method 3.

Type(s) and Proximity of Off-Site Sensitive Land Uses

Under Alternative Method 3, the approved landfill footprint will not change and thus the setback distance between the TCEC operation and existing off-site sensitive land uses will be maintained.

The existing separation distance between Watford and the landfill, and the pre-existing permanent buffer areas, are anticipated to mitigate against potential impacts and land use compatibility issues, including noise and air quality. Existing mitigation measures in use at the TCEC will continue or be enhanced, as detailed in other effects assessments in **Supporting Document 3**. In summary, there are no significant effects on existing off-site sensitive land uses anticipated as a result of Alternative Method 3.

Type(s) and Proximity of Agricultural Land Use/Operations

Under Alternative Method 3, no significant effects on existing agricultural land use and associated operations are anticipated; the existing landfill footprint will not change. Expansion of existing agricultural operations will be subject to Provincial, County, and/or Municipal policies and/or regulations to ensure compatibility between the agricultural operation and the TCEC; however, current agricultural land uses and their associated operations within 500 m of the landfill site are considered permitted to exist pursuant to Section 34(9) of the *Planning Act*.

Table 6-52. Current and Future Land Uses Net Effects Assessment – Alternative Method 3

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Effects on Current and Future Land Uses	Current land use	• Current land uses and their locations in proximity to the TCEC will remain as they exist at the time of project commencement. • Under the proposed vertical expansion, the existing approved waste disposal footprint area of the TCEC would not change; the maximum permitted height of waste would be increased. • Alternative Method 3 proposes the highest maximum elevation increase for vertical expansion, compared between the three alternative methods. • The existing visual impact mitigation measures are anticipated to effectively screen views. • Permanent minimum buffer areas prescribed in the Local OP and Township ZBL will remain. • The establishment of an expanded landfill triggers municipal and provincial policies that restrict sensitive land uses in the Off-site Study Area. • It is anticipated that existing nuisance controls performed by WM at the TCEC will be continued and/or enhanced pending the results of the Effects Assessment reporting completed by other technical consultants (i.e., Air Quality, Archaeology, Cultural Heritage, Ecological Environment, Hydrogeological, Surface Water, Transportation, Noise, and Human Health).	• No significant impacts to the residential, commercial, parks and open space, institutional, and commercial industrial land uses within the settlement area of Watford are anticipated. The existing separation distance between the Village from the landfill site is anticipated to mitigate against potential impacts and land use compatibility issues. • Current land uses within 500 m of the landfill fill area will be subject to consultation with the Province before a *Planning Act* approval is adopted or granted, in the case that new development or change of land use is proposed. • The existing approved waste disposal footprint area of the TCEC would not change and, as such, existing setback distances between the TCEC operation and any current land uses will be maintained. No significant effects anticipated.	• Maintain previously approved setback and buffer distances, and existing berming. • Continued employment or enhancement of nuisance controls by WM, related to odour, litter, dust, noise and birds on the surrounding environment.	• No significant net effects anticipated between the TCEC operation and any current land uses; setback distances are maintained. Legally established existing land uses (considered sensitive) within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*) • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls.

Table 6-52. Current and Future Land Uses Net Effects Assessment – Alternative Method 3

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
	Planned land use	• Planning land uses will be in keeping with the general land use schedule as it exists in the County OP and Local OP. • Under the proposed vertical expansion, the existing approved waste disposal footprint area of the TCEC would not change, but rather, the maximum permitted height of the waste would be increased. • Alternative Method 3 proposes the highest maximum elevation increase for vertical expansion, compared between the three alternative methods. • Permanent minimum buffer areas prescribed in the Local OP and Township ZBL will remain. • The establishment of an expanded landfill, as well as any proposed future development potential in proximity to the landfill site, triggers municipal and provincial policies that restrict sensitive land uses in the Off-site Study Area. • It is anticipated that existing nuisance controls performed by WM at the TCEC will be continued and/or enhanced pending the results of the Effects Assessment reporting completed by other technical consultants (i.e., Air Quality, Archaeology, Cultural Heritage, Ecological Environment, Hydrogeological, Surface Water, Transportation, Noise, and Human Health).	• The existing approved waste disposal footprint area of the TCEC would not change and, as such, existing setback distances between the TCEC operation and any planned land uses will be maintained. No significant effects anticipated. • Planned land use development (i.e., expansion of current use or new uses) will be subject to Provincial, County, and/or Municipal polices and/or regulations to ensure compatibility between planned sensitive uses and the existing and/or newly expanded TCEC operation.	• Maintain previously approved setback and buffer distances, and existing berming. • Continued employment or enhancement of nuisance controls by WM, related to odour, litter, dust, noise and birds on the surrounding environment.	• No significant net effects anticipated between the TCEC operation and any planned land uses; setback distances are maintained. • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls.

Table 6-52. Current and Future Land Uses Net Effects Assessment – Alternative Method 3

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
	Type(s) and proximity of off-site recreational resources within 1 km of a landfill footprint potentially affected	• Under the proposed vertical expansion, the existing approved waste disposal footprint area of the TCEC would not change, but rather, the maximum permitted height of the waste would be increased. • Alternative Method 3 proposes the highest maximum elevation increase for vertical expansion, compared between the three alternative methods. • Permanent minimum buffer areas prescribed in the Local OP and Township ZBL will remain. • The establishment of an expanded landfill, as well as any proposed future development potential in proximity to the landfill site, triggers municipal and provincial policies that restrict sensitive land uses in the Off-site Study Area. • It is anticipated that existing nuisance controls performed by WM at the TCEC will be continued and/or enhanced pending the results of the Effects Assessment reporting completed by other technical consultants (i.e., Air Quality, Archaeology, Cultural Heritage, Ecological Environment, Hydrogeological, Surface Water, Transportation, Noise, and Human Health).	• The existing approved waste disposal footprint area of the TCEC would not change and, as such, existing setback distances between the TCEC operation and off-site recreational resources will be maintained. No significant effects anticipated.	• Maintain previously approved setback and buffer distances, and existing berming. • Continued employment or enhancement of nuisance controls by WM, related to odour, litter, dust, noise and birds on the surrounding environment.	• No significant net effects anticipated between the TCEC operation and any off-site recreational resources; setback distances are maintained. Legally established existing off-site recreational resources (considered sensitive) within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*) • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls.

Table 6-52. Current and Future Land Uses Net Effects Assessment – Alternative Method 3

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
	Type(s) and proximity of off-site sensitive land uses as defined by the Provincial Policy Statement and the MECP D-1 Guidelines (e.g., dwellings, churches, parks) within 1 km of a landfill footprint potentially affected	• Under the proposed vertical expansion, the existing approved waste disposal footprint area of the TCEC would not change, but rather, the maximum permitted height of the waste would be increased. • Alternative Method 3 proposes the highest maximum elevation increase for vertical expansion, compared between the three alternative methods. • Permanent minimum buffer areas prescribed in the Local OP and Township ZBL will remain. • The establishment of an expanded landfill, as well as any proposed future development potential in proximity to the landfill site, triggers municipal and provincial policies that restrict sensitive land uses in the Off-site Study Area. • It is anticipated that existing nuisance controls performed by WM at the TCEC will be continued and/or enhanced pending the results of the Effects Assessment reporting completed by other technical consultants (i.e., Air Quality, Archaeology, Cultural Heritage, Ecological Environment, Hydrogeological, Surface Water, Transportation, Noise, and Human Health).	• The existing approved waste disposal footprint area of the TCEC would not change and, as such, existing setback distances between the TCEC operation and any existing off-site sensitive land uses will be maintained. No significant effects anticipated. • Off-site sensitive land uses within 500 m of the landfill fill area will be subject to consultation with the Province before a *Planning Act* approval is adopted or granted, in the case that new development or change of land use is proposed.	• Maintain previously approved setback and buffer distances, and existing berming. • Continued employment or enhancement of nuisance controls by WM, related to odour, litter, dust, noise and birds on the surrounding environment.	• No significant net effects anticipated between the TCEC operation and any sensitive land use; setback distances are maintained. Legally established existing sensitive land use (considered sensitive) within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*) • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls.

Table 6-52. Current and Future Land Uses Net Effects Assessment – Alternative Method 3

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
	Type(s) and proximity of agricultural land use/operations (e.g., organic, cash crop, livestock)	• Under the proposed vertical expansion, the existing approved waste disposal footprint area of the TCEC would not change, but rather, the maximum permitted height of the waste would be increased. • Alternative Method 3 proposes the highest maximum elevation increase for vertical expansion, compared between the three alternative methods. • Permanent minimum buffer areas prescribed in the Local OP and Township ZBL will remain. • The establishment of an expanded landfill, as well as any proposed future development potential in proximity to the landfill site, triggers municipal and provincial policies that restrict sensitive land uses in the Off-site Study Area. • It is anticipated that existing nuisance controls performed by WM at the TCEC will be continued and/or enhanced pending the results of the Effects Assessment reporting completed by other technical consultants (i.e., Air Quality, Archaeology, Cultural Heritage, Ecological Environment, Hydrogeological, Surface Water, Transportation, Noise, and Human Health).	• Under the proposed vertical expansion, no potential effects are anticipated on existing agricultural land uses and associated operations; the existing approved waste disposal footprint area of the TCEC would not change. • Expansion of existing agricultural operations will be subject to Provincial, County, and/or Municipal polices and/or regulations to ensure compatibility between the agricultural operation and the existing and/or newly expanded TCEC operation.	• Maintain previously approved setback and buffer distances, and existing berming. • Continued employment or enhancement of nuisance controls by WM, related to odour, litter, dust, noise and birds on the surrounding environment.	• No significant net effects anticipated between the TCEC operation and any existing and operating agricultural land use; setback distances are maintained. Legally established existing operating agricultural land uses within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*) • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls.

7 Comparative Evaluation of Net Effects and Identification of the Preferred Alternative

This section of the Environmental Assessment (EA) Study Report provides a comparative evaluation of the net effects of each Alternative Method and the identification of the Preferred Alternative for the Twin Creeks Environmental Centre (TCEC) Landfill Optimization Project. The net effects of the Alternative Methods are detailed in **Section 6**.

7.1 Comparative Evaluation

The three Alternative Methods were comparatively evaluated using the net environmental effects (i.e., after mitigation measures are considered) identified in **Section 6** to compare the Alternative Methods in terms of evaluation criteria and indicators. The following method was used in the comparative evaluation in accordance with the approved Terms of Reference (ToR):

- The predicted net effects (after mitigation) of each Alternative Method for each indicator were compared against each other and a preference rating was assigned (i.e., Preferred, Not Preferred, or No Substantial Difference).
- A conclusion was drawn regarding a Preferred Alternative for each of the evaluation criteria (i.e., a Preferred Alternative was identified, or the Alternative Methods were identified as having 'No Substantial Difference'). A rationale was provided for the conclusion.
- An overall Preferred Alternative was identified for each environmental component based on the conclusions for each of the associated evaluation criteria.

The net effects for each indicator are provided in **Table 4-1** for the three Alternative Methods, and a conclusion regarding a Preferred Alternative is identified for each of the environmental criteria and environmental components.

Note that Human Health is not included in the comparative evaluation, as the Human Health Effects Assessment is conducted on the Preferred Alternative only. This effects assessment is presented in **Section 8**.

Table 7-1. Comparative Evaluation of the Alternative Methods

Evaluation Criteria	Indicators	Net Effects of Alternative Methods		
		Alternative Method 1	Alternative Method 2	Alternative Method 3
Natural Environment				
Atmospheric Environment				
Air Quality – Dust	Predicted Off-site POI Air Concentrations	• None. With the application of current and additional mitigation measures, predicted concentrations at discrete receptors are expected to decrease to levels similar to Future Baseline Conditions. **No Substantial Difference**	• None. With the application of current and additional mitigation measures, predicted concentrations at discrete receptors are expected to decrease to levels similar to Future Baseline Conditions. **No Substantial Difference**	• None. With the application of current and additional mitigation measures, predicted concentrations at discrete receptors are expected to decrease to levels similar to Future Baseline Conditions. **No Substantial Difference**
	Frequency of Exceedance of Applicable Criteria	• None. With the application of current and additional mitigation measures, the frequencies of predicted exceedance at discrete receptors are expected to decrease to levels similar to Future Baseline Conditions. **No Substantial Difference**	• None. With the application of current and additional mitigation measures, the frequencies of predicted exceedance at discrete receptors are expected to decrease to levels similar to Future Baseline Conditions. **No Substantial Difference**	• None. With the application of current and additional mitigation measures, the frequencies of predicted exceedance at discrete receptors are expected to decrease to levels similar to Future Baseline Conditions. **No Substantial Difference**
	Number of Off-site Receptors Affected	• None. With the application of current and additional mitigation measures, the number of off-site receptors potentially affected are expected to decrease to quantities similar to Future Baseline Conditions. **No Substantial Difference**	• None. With the application of current and additional mitigation measures, the number of off-site receptors potentially affected are expected to decrease to quantities similar to Future Baseline Conditions. **No Substantial Difference**	• None. With the application of current and additional mitigation measures, the number of off-site receptors potentially affected are expected to decrease to quantities similar to Future Baseline Conditions. **No Substantial Difference**
	Criteria Rating and Rationale	***There is no Preferred Alternative identified for Air Quality – Dust.*** There is no substantial difference between the net effects of the three Alternative Methods in terms of Air Quality – Dust as, with the application of additional mitigation measures, the effect of each Alternative Method is expected to be similar to Future Baseline Conditions.		

Table 7-1. Comparative Evaluation of the Alternative Methods

Evaluation Criteria	Indicators	Net Effects of Alternative Methods		
		Alternative Method 1	Alternative Method 2	Alternative Method 3
Air Quality – Landfill Gas and Combustion By-Products	Predicted Off-site POI Air Concentrations	• None. **No Substantial Difference**	• None. **No Substantial Difference**	• None. **No Substantial Difference**
	Frequency of Exceedance of Applicable Criteria	• None. **No Substantial Difference**	• None. **No Substantial Difference**	• None. **No Substantial Difference**
	Number of Off-site Receptors Affected	• None. **No Substantial Difference**	• None. **No Substantial Difference**	• None. **No Substantial Difference**
	Criteria Rating and Rationale	***There is no Preferred Alternative identified for Air Quality – LFG and Combustion By-Products.*** There is no substantial difference between the net effects of the three Alternative Methods in terms of Air Quality – Landfill Gas and Combustion By-products, as no net effects are predicted for any of the three Alternative Methods.		
Air Quality – Blowing Litter	Extent of Zones Potentially Impacted	• None with the continuation of existing mitigation measures. **No Substantial Difference**	• None with the continuation of existing mitigation measures. **No Substantial Difference**	• None with the continuation of existing mitigation measures. **No Substantial Difference**
	Number of Off-site Receptors Affected	• None with the continuation of existing mitigation measures. **No Substantial Difference**	• None with the continuation of existing mitigation measures. **No Substantial Difference**	• None with the continuation of existing mitigation measures. **No Substantial Difference**
	Criteria Rating and Rationale	***There is no Preferred Alternative identified for Air Quality – Blowing Litter.*** There is no substantial difference between the net effects of the three Alternative Methods in terms of Air Quality - Blowing Litter as, with the continuation of existing mitigation measures, no net effects are anticipated for any of the three Alternative methods.		
Odour	Off-site Odour Concentrations at Sensitive Receptors	• Predicted odour concentrations may exceed criteria at discrete receptor locations. Existing mitigation measures will continue. **No Substantial Difference**	• Predicted odour concentrations may exceed criteria at discrete receptor locations. Existing mitigation measures will continue. **No Substantial Difference**	• Predicted odour concentrations may exceed criteria at discrete receptor locations. Existing mitigation measures will continue. **No Substantial Difference**

Table 7-1. Comparative Evaluation of the Alternative Methods

Evaluation Criteria	Indicators	Net Effects of Alternative Methods		
		Alternative Method 1	Alternative Method 2	Alternative Method 3
	Frequency of Odour Levels Above Defined Odour Benchmarks	• Frequency of odour levels above defined odour benchmarks may increase. Existing mitigation measures will continue. **No Substantial Difference**	• Frequency of odour levels above defined odour benchmarks may increase. Existing mitigation measures will continue. **No Substantial Difference**	• Frequency of odour levels above defined odour benchmarks may increase. Existing mitigation measures will continue. **No Substantial Difference**
	Number of Off-site Receptors Affected	• The number of discrete receptors with predicted odour concentrations exceeding criteria may increase. Existing mitigation measures will continue. **No Substantial Difference**	• The number of discrete receptors with predicted odour concentrations exceeding criteria may increase. Existing mitigation measures will continue. **No Substantial Difference**	• The number of discrete receptors with predicted odour concentrations exceeding criteria may increase. Existing mitigation measures will continue. **No Substantial Difference**
	Criteria Rating and Rationale	***There is no Preferred Alternative identified for Odour.*** There is no substantial difference between the net effects of the three Alternative Methods in terms of Odour as, with the continuation of existing mitigation measures, the net effects for each Alternative Method are anticipated to be similar to Future Baseline Conditions.		
Noise	• Predicted site-related noise levels (measured in dBA or dBAI). • Change in sound levels (dB).	• Landfill and construction equipment will be positioned significantly closer to the site perimeter and at marginally higher ground elevations compared to other alternatives, resulting in a comparatively greater impact at the nearest point of reception (POR). Noise levels to meet applicable landfilling noise guidelines during daytime hours, with considerable additional mitigation measures. **Not Preferred**	• Noise levels to meet applicable landfilling noise guidelines during daytime hours, with additional mitigation measures. **No Substantial Difference**	• Noise levels to meet applicable landfilling noise guidelines during daytime hours, with additional mitigation measures. **No Substantial Difference**

Table 7-1. Comparative Evaluation of the Alternative Methods

Evaluation Criteria	Indicators	Net Effects of Alternative Methods		
		Alternative Method 1	**Alternative Method 2**	**Alternative Method 3**
	Criteria Rating and Rationale	***Alternative Method 1 is not preferred, and there is no substantial difference between Alternative Methods 2 and 3 for Noise.*** Alternative Method 1 has a greater potential off-site noise impacts as landfill operations will be nearer the PORs, while Alternative Methods 2 and 3 have a greater setback from the PORs. Each Alternative Method will require the same landfilling equipment and quantities at critical locations in the landfill; however, Alternative Method 1 would require considerable additional mitigation compared to Alternative Methods 2 and 3 to meet applicable landfilling noise guidelines at the PORs.		
Overall Rating and Rationale for the Atmospheric Environment		***Alternative Methods 2 and 3 are the Preferred Alternative from an Atmospheric Environment perspective.*** Alternative Method 1 would require considerable additional mitigation to meet applicable landfilling noise guidelines at the PORs.		
Hydrogeology Environment				
Groundwater Quality	Predicted effects on Groundwater Quality on-site from increased waste quantities disposed within the Expansion Landfill	• None, with the continuation of current leachate management practices, as long as the hydraulic trap design is maintained as required for the TCEC. **No Substantial Difference**	• None, with the continuation of current leachate management practices, as long as the hydraulic trap design is maintained as required for the TCEC. **No Substantial Difference**	• None, with the continuation of current leachate management practices, as long as the hydraulic trap design is maintained as required for the TCEC. **No Substantial Difference**
	Predicted Contaminating Lifespan (CLS)	• Under any of the Alternative Methods chosen, the at-Capacity CLS is calculated to be 163 years post-closure. **No Substantial Difference**	• Under any of the Alternative Methods chosen, the at-Capacity CLS is calculated to be 163 years post-closure. **No Substantial Difference**	• Under any of the Alternative Methods chosen, the at-Capacity CLS is calculated to be 163 years post-closure. **No Substantial Difference**
	Criteria Rating and Rationale	***There is no Preferred Alternative identified for Groundwater Quality.*** With the continuation of current leachate management practices, and as long as the hydraulic trap design is maintained as required for the TCEC, there are no resulting net effects under any of the three Alternative Methods aside from the increase in CLS from 102 years to 163 years assuming the Expansion Landfill is filled to its proposed additional Alternative Method capacity. This will increase the duration of the risk of potential negative effects to Groundwater Quality at the TCEC by 61 years. Therefore, there is no substantial difference between the Alternative Methods.		

Table 7-1. Comparative Evaluation of the Alternative Methods

Evaluation Criteria	Indicators	Net Effects of Alternative Methods		
		Alternative Method 1	**Alternative Method 2**	**Alternative Method 3**
Groundwater Quantity	Predicted effect of Landfill Optimization on Groundwater flow and Quantity both on-site and off-site.	• None, as long as the hydraulic trap design is maintained as required for the TCEC. **No Substantial Difference**	• None, as long as the hydraulic trap design is maintained as required for the TCEC. **No Substantial Difference**	• None, as long as the hydraulic trap design is maintained as required for the TCEC. **No Substantial Difference**
	Criteria Rating and Rationale	***There is no Preferred Alternative identified for Groundwater Quantity.*** As long as the hydraulic trap design is maintained as required for the TCEC, there are no resulting net effects for any of the three Alternative Methods. Therefore, there is no substantial difference between the Alternative Methods.		
Overall Rating and Rationale for Hydrogeology		***No Preferred Alternative is identified from a Hydrogeology perspective.*** There is no substantial difference between the three Alternative Methods for the Groundwater Quality and Groundwater Quantity evaluation criteria.		
Surface Water Environment				
Surface Water Quality	Predicted effects on Surface Water Quality on-site prior to off-site discharge (Erosional effects on total suspended solids [TSS] and heavy metal concentrations in surface water)	• With the continuation of existing sediment control mitigation measures, no net erosional effects to Surface Water Quality are anticipated. **No Substantial Difference**	• With the continuation of existing sediment control mitigation measures, no net erosional effects to Surface Water Quality are anticipated. **No Substantial Difference**	• With the continuation of existing sediment control mitigation measures, no net erosional effects to Surface Water Quality are anticipated. **No Substantial Difference**
	Predicted effects on Surface Water Quality on-site prior to off-site discharge (Leachate seep impacts to Surface Water Quality)	• With the implementation of a seepage monitoring and repair program, no net effects to Surface Water Quality from leachate seeps are anticipated . **No Substantial Difference**	• With the implementation of a seepage monitoring and repair program, no net effects to Surface Water Quality from leachate seeps are anticipated . **No Substantial Difference**	• With the implementation of a seepage monitoring and repair program, no net effects to Surface Water Quality from leachate seeps are anticipated . **No Substantial Difference**

Table 7-1. Comparative Evaluation of the Alternative Methods

Evaluation Criteria	Indicators	Net Effects of Alternative Methods		
		Alternative Method 1	Alternative Method 2	Alternative Method 3
	Predicted effects from polyaromatic hydrocarbons (PAHs) Surface Water Quality within the roadside ditch of the northbound lane of Nauvoo Road from the Site to Hwy 402 in the Off-Site Study Area	• None, with the continuation of existing mitigation measures. **No Substantial Difference**	• None, with the continuation of existing mitigation measures. **No Substantial Difference**	• None, with the continuation of existing mitigation measures. **No Substantial Difference**
	Criteria Rating and Rationale	***There is no Preferred Alternative identified for Surface Water Quality.*** Mitigation measures currently implemented as part of the existing landfill operations to control erosion, prevent or repair leachate seeps, and manage automobile shredder residue (ASR) track-out will continue to be applied under all Alternative Methods. With the continued implementation of the on-site mitigative measures to control erosion effects and/or prevent leachate seep effects to Surface Water Quality, there are no resulting net effects in any of the three Alternative Methods. Therefore, there is no substantial difference between the Alternative Methods for Surface Water Quality.		
Surface Water Quantity	Change in runoff volumes and peak flows resulting from steeper and longer side slopes	• Increase in peak flows of up to 11% from Future Baseline Conditions. **Not Preferred**	• Increase in peak flows of up to 10% from Future Baseline Conditions. **Preferred**	• Increase in peak flows of up to 11% from Future Baseline Conditions. **Not Preferred**
	Changes in drainage areas on-site and off-site	• Changes in catchment areas within the landfill optimization area are between -23% and 37% when compared to Future Baseline Conditions. • No change in off-site areas. **Not Preferred**	• Changes in catchment areas within the landfill optimization area are between -22% and 34% when compared to Future Baseline Conditions. • No change in off-site areas. **Preferred**	• Changes in catchment areas within the landfill optimization area are between -24% and 36% when compared to Future Baseline Conditions. • No change in off-site areas. **Not Preferred**
	Predicted occurrence and degree of off-site effects	• Increase in peak flows of up to 11% from Future Baseline Conditions. **Not Preferred**	• Increase in peak flows of up to 10% from Future Baseline Conditions. **Preferred**	• Increase in peak flows of up to 11% from Future Baseline Conditions. **Not Preferred**

Table 7-1. Comparative Evaluation of the Alternative Methods

Evaluation Criteria	Indicators	Net Effects of Alternative Methods		
		Alternative Method 1	**Alternative Method 2**	**Alternative Method 3**
	Criteria Rating and Rationale	***Alternative Method 2 is preferred over Alternative Methods 1 and 3 for Surface Water Quantity.*** The peak flows leaving the site under Alternative Method 2 (10%) present slightly lower increase above existing conditions than Alternative Methods 1 (11%) and 3 (11%), and Alternative Method 2 has the lowest peaking elevation when compared to other Alternative Methods; as such, reduced runoff velocity and enhanced infiltration of the stormwater are anticipated. Additionally, the maximum increase of drainage area from existing conditions for one catchment (G3A) under Alternative Method 2 is the lowest (34%) when compared to Alternative Methods 1 and 3.		
Overall Rating and Rationale for the Surface Water Environment		***Alternative Method 2 is the Preferred Alternative from a Surface Water Environment perspective.*** Alternative Method 2 has the lowest increase in peak flows above existing conditions, has the lowest peaking elevation resulting in reduced runoff velocity and enhanced stormwater infiltration, and has the lowest increase in drainage area.		
Ecological Environment				
Terrestrial Ecosystems	Predicted effects on vegetation communities and species including rare, threatened, or endangered species.	• None **No Substantial Difference**	• None **No Substantial Difference**	• None **No Substantial Difference**
	Predicted effects on wildlife and wildlife habitat including rare, threatened, or endangered species.	• With continued implementation of existing mitigation measures, there is a minimal effect of prolonged attractiveness of the area for avifaunal scavengers, although overall use of landfill by avifaunal scavengers is low. **No Substantial Difference**	• With continued implementation of existing mitigation measures, there is a minimal effect of prolonged attractiveness of the area for avifaunal scavengers, although overall use of landfill by avifaunal scavengers is low. **No Substantial Difference**	• With continued implementation of existing mitigation measures, there is a minimal effect of prolonged attractiveness of the area for avifaunal scavengers, although overall use of landfill by avifaunal scavengers is low. **No Substantial Difference**
	Criteria Rating & Rationale	***There is no Preferred Alternative identified for Terrestrial Ecosystems.*** There is no substantial difference between the net effects of the three Alternative Methods on Terrestrial Ecosystems. The continued operation of landfill will prolong the attractiveness of the area for avifaunal scavengers under each Alternative Method, which will be managed through the continuation of existing mitigation measures.		

Table 7-1. Comparative Evaluation of the Alternative Methods

Evaluation Criteria	Indicators	Net Effects of Alternative Methods		
		Alternative Method 1	**Alternative Method 2**	**Alternative Method 3**
Aquatic Ecosystems	Predicted effects on aquatic habitat, including fish habitat.	• None. **No Substantial Difference**	• None. **No Substantial Difference**	• None. **No Substantial Difference**
	Predicted effects on aquatic biota including rare, threatened, or endangered species.	• None. **No Substantial Difference**	• None. **No Substantial Difference**	• None. **No Substantial Difference**
	Criteria Rating & Rationale	***There is no Preferred Alternative identified for Aquatic Ecosystems.*** There is no substantial difference between the three Alternative Methods for Aquatic Ecosystems. No net effects on aquatic ecosystems are anticipated for any of the three Alternative Methods.		
Overall Rating and Rationale for the Ecological Environment		***No Preferred Alternative is identified from an Ecological Environment perspective.*** There is no substantial difference between the three Alternative Methods for the Terrestrial or Aquatic Ecosystems.		
Socio-Economic Environment				
Social Environment				
Effects on Local Community	Number of residents and residences (e.g., receptors)	• No net effects **No Substantial Difference**	• No net effects **No Substantial Difference**	• No net effects **No Substantial Difference**
	Number and type of local businesses	• No net effects **No Substantial Difference**	• No net effects **No Substantial Difference**	• No net effects **No Substantial Difference**
	Nuisance effects (litter, dust, noise, odour, traffic, visual)	• Predicted odour concentrations may exceed criteria at discrete receptor locations, and the frequency of odour levels above defined odour benchmarks may increase. • Visual combined effect value (CEV) of 78, with three high CEV viewpoints, two moderate CEV viewpoints, and one low CEV viewpoint.	• Predicted odour concentrations may exceed criteria at discrete receptor locations, and the frequency of odour levels above defined odour benchmarks may increase. • Visual CEV of 77, with three high CEV viewpoints, two moderate CEV viewpoints, and one low CEV viewpoint.	• Predicted odour concentrations may exceed criteria at discrete receptor locations, and the frequency of odour levels above defined odour benchmarks may increase. • Visual CEV of 81, with four high CEV viewpoints and two moderate CEV viewpoints. • No net effects from litter, dust, noise, birds, and traffic.

Table 7-1. Comparative Evaluation of the Alternative Methods

Evaluation Criteria	Indicators	Net Effects of Alternative Methods		
		Alternative Method 1	**Alternative Method 2**	**Alternative Method 3**
		• No net effects from litter, dust, noise, birds, and traffic. **Not Preferred**	• No net effects from litter, dust, noise, birds, and traffic. **Preferred**	**Not Preferred**
	Predicted changes to use and enjoyment of property	• Minor changes to use and enjoyment of property are anticipated due to increased odour at recreational areas located south of the landfill. **No Substantial Difference**	• Minor changes to use and enjoyment of property are anticipated due to increased odour at recreational areas located south of the landfill. **No Substantial Difference**	• Minor changes to use and enjoyment of property are anticipated due to increased odour at recreational areas located south of the landfill. **No Substantial Difference**
	Level of satisfaction with living/working in the community	• Minor changes in the level of satisfaction with living and working in the community due to increased odour and changes to the visual landscape. **Preferred**	• Minor changes in the level of satisfaction with living and working in the community due to increased odour and changes to the visual landscape. **Preferred**	• Moderate changes in the level of satisfaction with living and working in the community due to increased odour and changes to the visual landscape. **Not Preferred**
	Confidence in TCEC operations	• No net effects **No Substantial Difference**	• No net effects **No Substantial Difference**	• No net effects **No Substantial Difference**
	Criteria Rating and Rationale	***Alternative Method 2 is preferred over Alternative Methods 1 and 3 for the Social Environment.*** Alternative Method 2 will result in an overall lower visual combined effect value (CEV) than Alternative Methods 1 and 3, and minor changes in the level of satisfaction with living and working in the community due to changes to the visual landscape. There is no substantial difference between the three Alternative Methods with respect to the other indicators for the Social Environment.		
Overall Rating and Rationale for the Social Environment		***Alternative Method 2 is the Preferred Alternative from a Social Environment perspective.*** Alternative Method 2 will result in an overall lower visual combined effect value (CEV) than Alternative Methods 1 and 3, and minor changes in the level of satisfaction with living and working in the community due to changes to the visual landscape.		

Table 7-1. Comparative Evaluation of the Alternative Methods

Evaluation Criteria	Indicators	Net Effects of Alternative Methods		
		Alternative Method 1	Alternative Method 2	Alternative Method 3
Economic Environment				
Economic Effects on Local Community	Employment at site (number, type, and duration)	• Existing 35 stable employment positions will continue for an additional 12 years. **No Substantial Difference**	• Existing 35 stable employment positions will continue for an additional 12 years. **No Substantial Difference**	• Existing 35 stable employment positions will continue for an additional 12 years. **No Substantial Difference**
	Contributions to the host community	• Based on the average annual contributions under the current host community agreement, estimated at approximately $4.1 million, host community payments are estimated to amount to approximately $50 million. • Based on the trend of increasing tax rates over the past 5 years, it is conservatively assumed that WM's property tax contribution will continue to form at least 3.5% of the Township's property tax revenue for the duration of Alternative Method 1. • WM will continue to contribute to community projects during operations. **No Substantial Difference**	• Based on the average annual contributions under the current host community agreement, estimated at approximately $4.1 million, host community payments are estimated to amount to approximately $50 million. • Based on the trend of increasing tax rates over the past 5 years, it is conservatively assumed that WM's property tax contribution will continue to form at least 3.5% of the Township's property tax revenue for the duration of Alternative Method 2. • WM will continue to contribute to community projects during operations. **No Substantial Difference**	• Based on the average annual contributions under the current host community agreement, estimated at approximately $4.1 million, host community payments are estimated to amount to approximately $50 million. • Based on the trend of increasing tax rates over the past 5 years, it is conservatively assumed that WM's property tax contribution will continue to form at least 3.5% of the Township's property tax revenue for the duration of Alternative Method 3. • WM will continue to contribute to community projects during operations. **No Substantial Difference**
	Opportunities for the provision and procurement of products and/or services	• Based on an annual average of $2.5 million in local expenditures, an estimated $30 million will be contributed to the local economy during operations. **No Substantial Difference**	• Based on an annual average of $2.5 million in local expenditures, an estimated $30 million will be contributed to the local economy during operations. **No Substantial Difference**	• Based on an annual average of $2.5 million in local expenditures, an estimated $30 million will be contributed to the local economy during operations. **No Substantial Difference**

Table 7-1. Comparative Evaluation of the Alternative Methods

Evaluation Criteria	Indicators	Net Effects of Alternative Methods		
		Alternative Method 1	**Alternative Method 2**	**Alternative Method 3**
	Criteria Rating and Rationale	***There is no Preferred Alternative identified for the Economic Environment.*** There is no substantial difference between the net effects of the three Alternative Methods for the Economic Environment. Each Alternative Method will result in an additional 12 years of stable employment for 35 WM employees, host community payments of approximately $50 million, property tax contribution of 3.5% of the Township's annual property tax revenue, continued contributions to community projects, and an estimated $30 million contributed to the local economy during operations.		
Overall Rating and Rationale for the Economic Environment		***No Preferred Alternative is identified from an Economic Environment perspective.*** There is no substantial difference between the three Alternative Methods for employment at site, contributions to the host community, or opportunities for the provision and procurement of products and/or services .		
Visual Landscape				
Visual Impact of Facility	Predicted changes in perceptions of landscapes and views	• CEV of 78 for six viewpoints. • Three viewpoints with high CEV. • Two viewpoints with moderate CEV. • One viewpoint with low CEV. **Not Preferred**	• CEV of 77 for six viewpoints. • Three viewpoints with high CEV. • Two viewpoints with moderate CEV. • One viewpoint with low CEV. **Preferred**	• CEV of 81 for six viewpoints. • Four viewpoints with high CEV. • Two viewpoints with moderate CEV. **Not Preferred**
	Criteria Rating and Rationale	***Alternative Method 2 is preferred over Alternative Methods 1 and 3 for Visual Landscape.*** Alternative Method 2 is preferred over Alternative Methods 1 and 3 since the CEV for the six viewpoints simulated and assessed is lower than the CEV for Alternative Methods 1 and 3.		
Overall Rating and Rationale for Visual Landscape		***Alternative Method 2 is the Preferred Alternative from a Visual Landscape perspective.*** Alternative Method 2 will result in an overall lower visual combined effect value (CEV) than Alternative Methods 1 and 3.		

Table 7-1. Comparative Evaluation of the Alternative Methods

Evaluation Criteria	Indicators	Net Effects of Alternative Methods		
		Alternative Method 1	Alternative Method 2	Alternative Method 3
Cultural Environment				
Cultural Environment				
Cultural Heritage Resources	Direct Impacts	• No net effects to the heritage attributes of the identified built heritage resources (BHRs) and CHLs resulting from Alternative Method 1. **No Substantial Difference**	• No net effects to the heritage attributes of the identified BHRs and CHLs resulting from Alternative Method 2. **No Substantial Difference**	• No net effects to the heritage attributes of the identified BHRs and CHLs resulting from Alternative Method 3. **No Substantial Difference**
	Indirect Impacts	• No net effects to the heritage attributes of the identified BHRs and CHLs resulting from Alternative Method 1. **No Substantial Difference**	• No net effects to the heritage attributes of the identified BHRs and CHLs resulting from Alternative Method 2. **No Substantial Difference**	• No net effects to the heritage attributes of the identified BHRs and CHLs resulting from Alternative Method 3. **No Substantial Difference**
	Criteria Rating and Rationale	***There is no Preferred Alternative identified for Cultural Heritage Resources.*** There is no substantial difference between the three Alternative Methods regarding direct or indirect impacts to identified BHRs and CHLs. No net effects are anticipated to the identified BHRs and CHLs from any of the three Alternative Methods.		
Archaeological Resources	Archaeological resources on-site and areas of archaeological potential and predicted impacts on them	• No net effects on on-site Archaeological Resources and areas of archaeological potential. **No Substantial Difference**	• No net effects on on-site Archaeological Resources and areas of archaeological potential. **No Substantial Difference**	• No net effects on on-site Archaeological Resources and areas of archaeological potential. **No Substantial Difference**
	Cemetery property within approximately 10 metres of the proposed impacts	• No net effects on the cemetery property. **No Substantial Difference**	• No net effects on the cemetery property. **No Substantial Difference**	• No net effects on the cemetery property. **No Substantial Difference**

Table 7-1. Comparative Evaluation of the Alternative Methods

Evaluation Criteria	Indicators	Net Effects of Alternative Methods		
		Alternative Method 1	**Alternative Method 2**	**Alternative Method 3**
	Criteria Rating and Rationale	***There is no Preferred Alternative identified for Archaeological Resources.*** There is no substantial difference between the three Alternative Methods, as there is no potential for the disturbance of unassessed or documented archaeological resources and areas of archaeological potential or the cemetery property. No net effects are anticipated to Archaeological Resources from any of the three Alternative Methods.		
Overall Rating and Rationale for the Cultural Environment		***No Preferred Alternative is identified from a Cultural Environment perspective.*** There is no substantial difference between the three Alternative Methods for Cultural Heritage Resources or Archaeological Resources.		
Built Environment				
Transportation				
Traffic Operations	Change in peak hour and daily truck traffic volume and Average Annual Daily Traffic (AADT) along the Off-site Study Area road segments	• No net effect on traffic volumes. **No Substantial Difference**	• No net effect on traffic volumes. **No Substantial Difference**	• No net effect on traffic volumes. **No Substantial Difference**
	Intersection performance for the Off-site Study Area intersections	• No net effect on intersection performance. **No Substantial Difference**	• No net effect on intersection performance. **No Substantial Difference**	• No net effect on intersection performance. **No Substantial Difference**
	Road safety • Collisions per million vehicles at all Off-site Study Area intersections • Collisions per million vehicle-km along all Off-site Study Area Road segments • Collisions by environmental conditions for	• No net effects on road safety. **No Substantial Difference**	• No net effects on road safety. **No Substantial Difference**	• No net effects on road safety. **No Substantial Difference**

Table 7-1. Comparative Evaluation of the Alternative Methods

Evaluation Criteria	Indicators	Net Effects of Alternative Methods		
		Alternative Method 1	Alternative Method 2	Alternative Method 3
	segments and intersections			
	Sight distance at the primary site entrance	• No net effect on sight distance. **No Substantial Difference**	• No net effect on sight distance. **No Substantial Difference**	• No net effect on sight distance. **No Substantial Difference**
	Criteria Rating and Rationale	***There is no Preferred Alternative identified for Transportation.*** There is no substantial difference between the three Alternative Methods for Traffic Operations. No net effects on Traffic Operations are anticipated from any of the three Alternative Methods.		
Overall Rating and Rationale for Transportation		***No Preferred Alternative is identified from a Transportation perspective.*** There is no substantial difference between the three Alternative Methods for Traffic Operations.		
Current and Planned Future Land Use				
Effects on Current and Future Land Uses	Current land use	• No significant net effects anticipated between the TCEC operation and any current land uses; setback distances are maintained. Legally established existing land uses (considered sensitive) within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*) • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls. **No Substantial Difference**	• No significant net effects anticipated between the TCEC operation and any current land uses; setback distances are maintained. Legally established existing land uses (considered sensitive) within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*) • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls. **No Substantial Difference**	• No significant net effects anticipated between the TCEC operation and any current land uses; setback distances are maintained. Legally established existing land uses (considered sensitive) within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*) • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls. **No Substantial Difference**

Table 7-1. Comparative Evaluation of the Alternative Methods

Evaluation Criteria	Indicators	Net Effects of Alternative Methods		
		Alternative Method 1	Alternative Method 2	Alternative Method 3
	Planned land use	• No significant net effects anticipated between the TCEC operation and any planned land uses; setback distances are maintained. • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls. **No Substantial Difference**	• No significant net effects anticipated between the TCEC operation and any planned land uses; setback distances are maintained. • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls. **No Substantial Difference**	• No significant net effects anticipated between the TCEC operation and any planned land uses; setback distances are maintained. • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls. **No Substantial Difference**
	Type(s) and proximity of off-site recreational resources within 1 km of a landfill footprint potentially affected	• No significant net effects anticipated between the TCEC operation and any off-site recreational resources; setback distances are maintained. Legally established existing off-site recreational resources (considered sensitive) within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*) • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls. **No Substantial Difference**	• No significant net effects anticipated between the TCEC operation and any off-site recreational resources; setback distances are maintained. Legally established existing off-site recreational resources (considered sensitive) within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*) • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls. **No Substantial Difference**	• No significant net effects anticipated between the TCEC operation and any off-site recreational resources; setback distances are maintained. Legally established existing off-site recreational resources (considered sensitive) within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*) • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls. **No Substantial Difference**

Table 7-1. Comparative Evaluation of the Alternative Methods

Evaluation Criteria	Indicators	Net Effects of Alternative Methods		
		Alternative Method 1	Alternative Method 2	Alternative Method 3
	Type(s) and proximity of off-site sensitive land uses as defined by the Provincial Policy Statement (now Provincial Planning Statement) and the Ontario Ministry of Environment, Conservation, and Parks (MECP) D-1 Guidelines (e.g., dwellings, churches, parks) within 1 km of a landfill footprint potentially affected	• No significant net effects anticipated between the TCEC operation and any sensitive land use; setback distances are maintained. Existing sensitive land use (considered sensitive) within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*) • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls. **No Substantial Difference**	• No significant net effects anticipated between the TCEC operation and any sensitive land use; setback distances are maintained. Existing sensitive land use (considered sensitive) within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*) • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls. **No Substantial Difference**	• No significant net effects anticipated between the TCEC operation and any sensitive land use; setback distances are maintained. Existing sensitive land use (considered sensitive) within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*) • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls. **No Substantial Difference**
	Type(s) and proximity of agricultural land use/operations (e.g., organic, cash crop, livestock)	• No significant net effects anticipated between the TCEC operation and any existing and operating agricultural land use; setback distances are maintained. Legally established existing operating agricultural land uses within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*) • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls. **No Substantial Difference**	• No significant net effects anticipated between the TCEC operation and any existing and operating agricultural land use; setback distances are maintained. Legally established existing operating agricultural land uses within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*) • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls. **No Substantial Difference**	• No significant net effects anticipated between the TCEC operation and any existing and operating agricultural land use; setback distances are maintained. Legally established existing operating agricultural land uses within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*) • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls. **No Substantial Difference**

Table 7-1. Comparative Evaluation of the Alternative Methods

Evaluation Criteria	Indicators	Net Effects of Alternative Methods		
		Alternative Method 1	Alternative Method 2	Alternative Method 3
	Criteria Rating and Rationale	***There is no Preferred Alternative identified for Current and Future Land Uses.*** There is no substantial difference between the three Alternative Methods for Land Use. All three Alternative Methods will result in no significant net effects on current land use, planned land use, type(s) and proximity of off-site recreational resources within 1 km, type(s) and proximity of off-site sensitive land uses as defined by the Provincial Planning Statement and the MECP D-1 Guidelines (e.g., dwellings, churches, parks) within 1 km, and type(s) and proximity of agricultural land use/operations (e.g., organic, cash crop, livestock).		
Overall Rating and Rationale for Current and Planned Future Land Use		***No Preferred Alternative is identified from a Land Use perspective.*** There is no substantial difference between the three Alternative Methods for Current and Future Land Uses.		

7.2 Identification of the Preferred Alternative

As shown in **Table 4-1**, Alternative Method 2 is identified as the Preferred Alternative for three of the environmental components (Surface Water Environment, Social Environment, and Visual Landscape), while the remaining effects assessments determined that there is no substantial difference between the three Alternative Methods. The results of the comparative evaluation and identification of the Preferred Alternative are summarized in **Table 7-2**.

Table 7-2. Summary of Comparative Evaluation Results and Identification of the Preferred Alternative

Environmental Component	Evaluation Criteria	Preferred Alternative		
		Alternative Method 1	Alternative Method 2	Alternative Method 3
Natural Environment				
Atmospheric Environment	Air Quality – Dust	**No Substantial Difference**	**No Substantial Difference**	**No Substantial Difference**
	Air Quality – Landfill Gas and Combustion By-Products	**No Substantial Difference**	**No Substantial Difference**	**No Substantial Difference**
	Air Quality – Blowing Litter	**No Substantial Difference**	**No Substantial Difference**	**No Substantial Difference**
	Odour	**No Substantial Difference**	**No Substantial Difference**	**No Substantial Difference**
	Noise	**Not Preferred**	**No Substantial Difference**	**No Substantial Difference**
Preferred Alternative for the Atmospheric Environment		**Not Preferred**	**No Substantial Difference**	
Hydrogeology	Groundwater Quality	**No Substantial Difference**	**No Substantial Difference**	**No Substantial Difference**
	Groundwater Quantity	**No Substantial Difference**	**No Substantial Difference**	**No Substantial Difference**
Preferred Alternative for Hydrogeology		**No Substantial Difference**		
Surface Water Environment	Surface Water Quality	**No Substantial Difference**	**No Substantial Difference**	**No Substantial Difference**
	Surface Water Quantity	**Not Preferred**	**Preferred**	**Not Preferred**
Preferred Alternative for the Surface Water Environment		**Not Preferred**	**Preferred**	**Not Preferred**
Ecological Environment	Terrestrial Ecosystems	**No Substantial Difference**	**No Substantial Difference**	**No Substantial Difference**
	Aquatic Ecosystems	**No Substantial Difference**	**No Substantial Difference**	**No Substantial Difference**

Table 7-2. Summary of Comparative Evaluation Results and Identification of the Preferred Alternative

Environmental Component	Evaluation Criteria	Preferred Alternative		
		Alternative Method 1	Alternative Method 2	Alternative Method 3
Preferred Alternative for the Ecological Environment		**No Substantial Difference**		
Socio-Economic Environment				
Social Environment	Effects on Local Community	**Not Preferred**	**Preferred**	**Not Preferred**
Preferred Alternative for the Social Environment		**Not Preferred**	**Preferred**	**Not Preferred**
Economic Environment	Economic Effects on Local Community	**No Substantial Difference**	**No Substantial Difference**	**No Substantial Difference**
Preferred Alternative for the Economic Environment		**No Substantial Difference**		
Visual Landscape	Visual Impact of Facility	**Not Preferred**	**Preferred**	**Not Preferred**
Preferred Alternative for Visual Landscape		**Not Preferred**	**Preferred**	**Not Preferred**
Cultural Environment				
Cultural Environment	Cultural Heritage Resources	**No Substantial Difference**	**No Substantial Difference**	**No Substantial Difference**
	Archaeological Resources	**No Substantial Difference**	**No Substantial Difference**	**No Substantial Difference**
Preferred Alternative for the Cultural Environment		**No Substantial Difference**		
Built Environment				
Transportation	Traffic Operations	**No Substantial Difference**	**No Substantial Difference**	**No Substantial Difference**
Preferred Alternative for Transportation		**No Substantial Difference**		
Current and Planned Future Land Use	Effects on Current and Future Land Uses	**No Substantial Difference**	**No Substantial Difference**	**No Substantial Difference**
Preferred Alternative for Current and Planned Future Land Use		**No Substantial Difference**		
Overall Preferred Alternative		**Not Preferred**	**Preferred**	**Not Preferred**

Alternative Method 2 is preferred over Alternative Methods 1 and 3 based on the comparative evaluation of the net effects of the Surface Water Environment (Surface Water Quantity), Social Environment (Effects on the Local Community), and Visual

Landscape (Visual Impact of the Facility). A description of the Preferred Alternative is provided in **Section 7.3**, below. The net effects assessment, cumulative effects, climate change considerations, and advantages and disadvantages of the Preferred Alternative over the 'Do Nothing' Alternative are provided in **Section 8**.

7.3 Description of the Preferred Alternative

The Preferred Alternative is Alternative Method 2, which is described in detail in **Section 5.7** of the EA Study Report and in the Conceptual Design Report (CDR) (**Supporting Document 2**). The Preferred Alternative, which will provide an additional 14.3 million m³ of landfill capacity, includes the increase of the final landfill side slopes from 4H:1V to 2.5H:1V between elevation 250 metres above sea level (masl) and elevation 313 masl, about 60 m in grade change, transitioning to a grade of 20H:1V upper slope and peaking at elevation 319 masl over the Expansion Landfill footprint. This is an increase of 39 m in the maximum height of waste above the currently approved elevation for the top of the waste of 280 masl. The proposed landfill expansion will consist of four (4) stages; each operating for 2 to 3 years.

The TCEC is bounded to the north by Zion Line, to the east by the Twin Creeks Greenhouse and agricultural lands, to the south by lands owned by WM used for agricultural production and by Confederation Line, and to the west by Nauvoo Road. The setbacks from the Expansion Landfill footprint to the property boundaries are 101 m to the north, approximately 206 m to the east, 100 m to 256 m to the south, and 235 m to the west. Since the Preferred Alternative will not change the existing approved landfill limit of waste, the existing property boundaries and buffer width will remain the same after the vertical expansion.

Additional details about the design of the Preferred Alternative including site development, leachate generation and management, LFG management, stormwater management, ancillary facilities, site traffic, and operations are provided in **Section 5.7** and the CDR (**Supporting Document 2**).

8 Net Effects of the Preferred Alternative

This section of the Draft Environmental Assessment (EA) Study Report presents the net effects assessment for the Preferred Alternative (Alternative Method 2), an assessment of cumulative effects, climate change considerations, and advantages and disadvantages of the Preferred Alternative over the 'Do Nothing' alternative.

8.1 Net Effects Assessment for the Preferred Alternative

The results of the net effects assessment of the Preferred Alternative (Alternative Method 2) are presented below based on the assessment in **Section 6.2** and the corresponding Effects Assessment Reports (**Supporting Document 3**).

8.1.1 Atmospheric Environment

The Atmospheric Environment considers Air Quality (dust, landfill gas and combustion by-products, and blowing litter), Odour, and Noise.

8.1.1.1 Air Quality – Dust

The Preferred Alternative (Alternative Method 2) consists of four operational stages as shown on **Figure 5-5** (**Section 5**), and operations will move around the landfill site over the life of the landfill. The effects assessment of the Preferred Alternative considers three future operational scenarios representing significant milestones in the landfill lifecycle:

- Scenario 1: End of Stage 1 (Year 2034), with the working face and extension of the southern access haul route in the northwest corner of the existing landfill footprint. This scenario was selected due to the close proximity to discrete receptors located northwest and west of the landfill.
- Scenario 2: End of Stage 2 (Year 2037), with the working face and extension of the southern access haul route in the northeast corner of the existing landfill footprint. This scenario was selected due to the close proximity to discrete receptors located northeast of the landfill.
- Scenario 3: End of Stage 4 (Year 2042), with the working face and extension of the southern access haul route toward the northeast corner but not as close to the extent of the existing landfill footprint. This scenario was selected because it represents the final year before closure where the maximum amount of waste is in place, and due to the close proximity to discrete receptors located northeast of the landfill.

Site plans presenting the point sources, volume sources, and roadways for each scenario are provided in the Air Quality Effects Assessment Report (**Supporting Document 3-1**).

Evaluation of the Preferred Alternative for dust was completed using dispersion modelling for Total Suspended Particulate (TSP), PM_{10}, and $PM_{2.5}$. The Twin Creeks Environmental Centre (TCEC) has a Best Management Practices Plan (BMPP) for dust which outlines control measures taken to minimize dust emissions from the site. Operation of the Preferred Alternative intends to maintain current dust control practices outlined in the Dust BMPP. The same regulatory criteria and assumptions presented in **Section 6.2.1.1** apply.

A total of 25 discrete receptors were identified consisting of 24 residential receptors (denoted by prefix “R”) and a short-term receptor (STR), the cemetery located at 5606 Nauvoo Rd. These discrete receptors are closest to the landfill area in each compass direction and are expected to provide the worst-case estimate for predicted contaminant concentrations in all directions from the landfill. The receptor locations are shown in **Figure 4-3** (**Section 4**) in relation to the general study areas defined for the EA.

Overall predicted concentrations of TSP, PM_{10}, and $PM_{2.5}$ at discrete receptors are dominated by fugitive emissions from haul route traffic related to final cap construction and waste deliveries, and from bulldozing of the final cover area. For the Preferred Alternative assessment, only construction operations for landfill capping were considered, as all cell construction will have been completed in 2028 based on current schedules. Modelled concentrations for TSP, PM_{10}, and $PM_{2.5}$ at identified discrete receptors were compared against their applicable criteria presented in **Table 6-2** (**Section 6.2.1.1**).

Scenarios 1 and 2 have haul routes and the working face at the perimeter of the landfill footprint. Operations in close proximity to the property boundary are expected to be relatively short term and are primarily for the development of the landfill side slope near the perimeter of the landfill footprint. For most of the landfill life, the working face will be located more interior to the site which is expected to reduce predicted concentrations at discrete receptors and, as landfill operations progress inward, predicted concentrations are expected to decrease. This is illustrated in the evaluation of Scenario 3, which has a working face more central to the site and shows lower predicted concentrations at discrete receptors.

Off-Site Point of Impingement Air Concentrations

Under all Scenarios, predicted concentrations were below their respective criteria for annual TSP, annual $PM_{2.5}$, and 24-hour $PM_{2.5}$ at all discrete receptor locations. Predicted concentrations of 24-hour TSP and 24-hour PM_{10} exceeded applicable criteria as summarized in **Table 8-1**.

The maximum predicted 24-hour TSP concentrations under the Scenarios prior to mitigation ranged from 188 micrograms per cubic metre (µg/m³) to 299 µg/m³, and from 172 µg/m³ to 281 µg/m³ after mitigation, while the maximum predicted 24-hour PM_{10} concentrations under the Scenarios prior to mitigation ranged from 73 µg/m³ to 107 µg/m³, and from 67 µg/m³ to 100 µg/m³ after mitigation. Mitigation measures are described below.

For comparison, under Future Baseline Conditions (i.e., landfill operations of the approved Expansion Landfill in 2031), the maximum predicted 24-hour TSP concentration at a sensitive receptor location with background considered was 266 µg/m³, while the maximum predicted 24-hour PM_{10} concentration at a sensitive receptor location with background considered was 99 µg/m³.

Frequency of Exceedance of Applicable Criteria

The frequency of exceedances of 24-hour TSP and 24-hour PM_{10} are summarized in **Table 8-1**. Under all Scenarios, the maximum predicted frequency of exceedance of the 24-hour TSP criteria prior to mitigation ranged from 0.8% (approximately 3 days per year) to 2.6% (approximately 10 days per year) at R4, while after mitigation, the maximum predicted frequency of exceedance ranged from 0.5% (approximately 2 days per year) to 2.2% (approximately 8 days per year) at R4.

Under all Scenarios, the maximum predicted frequency of exceedance of the 24-hour PM_{10} criteria prior to mitigation ranged from 0.5% (approximately 2 days per year) to 1.5% (approximately 6 days per year) at R4, while after mitigation, the maximum predicted frequency of exceedance ranged from 0.4% (approximately 1.5 days per year) to 1.3% (approximately 5 days per year) at R4. Mitigation measures are described below.

For comparison, under the Future Baseline Conditions for the approved Expansion Landfill, the maximum predicted frequency of exceedance of the 24-hour TSP criteria was 1.6% (approximately 6 days per year) at R4, while the maximum predicted frequency of exceedance of the 24-hour PM_{10} criteria was 0.9% (approximately 3 days per year) at R4.

Number of Receptors Affected

The number of potentially affected sensitive receptors is summarized in **Table 8-1**. Under all Scenarios, before mitigation, a total of between 6 and 17 sensitive receptors were predicted to be affected by the exceedances of 24-hour TSP, while between 5 and 13 sensitive receptors were predicted to be affected by the exceedances of 24-hour PM_{10}. After mitigation, a total of between 3 and 9 sensitive receptors were predicted to be affected by the exceedances of 24-hour TSP, while 3 sensitive receptors were predicted to be affected by the exceedances of 24-hour PM_{10}. Mitigation measures are described below.

For comparison, under the Future Baseline Conditions for the approved Expansion Landfill, a total of seven (7) sensitive receptors were predicted to be affected by the exceedances of 24-hour TSP, while five (5) sensitive receptors were predicted to be affected by the exceedances of 24-hour PM_{10}.

Table 8-1. Maximum Concentrations, Frequencies, and Affected Receptors for Exceedances of 24-hr TSP and 24-hr PM_{10}

Contaminant and Applicable Criteria	Scenario	Without Mitigation				With Mitigation			
		# of Affected Receptors	Affected Receptors	Maximum Frequency of Exceedance at Receptors	Maximum Predicted Concentration	# of Affected Receptors	Affected Receptors	Maximum Frequency of Exceedance at Receptors	Maximum Predicted Concentration
24-hr TSP 120 µg/m³ (Ambient Air Quality Criteria [AAQC] & O.Reg. 419/05)	1	17	R1, R2, R4, R7, R8, R9, R12, R13, R14, R16, R17, R18, R19, R20, R21, R22, R23	1.1%, or 4 days per year at R7	188 µg/m³ at R7	9	R1, R4, R7, R8, R13, R16, R17, R18, R19	0.7%, or 3 days per year at R7	172 µg/m³ at R18
	2	7	R2, R4, R5, R7, R9, R12, R13	2.6%, or 10 days per year at R4	299 µg/m³ at R4	3	R2, R4, R7	2.2%, or 8 days per year at R4	281 µg/m³ at R4
	3	6	R2, R4, R7, R9, R12, R13	0.8%, or 3 days per year at R4	216 µg/m³ at R4	4	R2, R4, R7, R13	0.5%, or 2 days per year at R4	197 µg/m³ at R4
24-hr PM_{10} 50 µg/m³ (AAQC)	1	13	R1, R4, R7, R8, R9, R12, R13, R17, R18, R19, R21, R22, R23	0.9%, or 3 days per year at R7	73 µg/m³ at R7	3	R7, R17, R18	0.5%, or 2 days per year at R7	67 µg/m³ at R7
	2	6	R2, R4, R7, R9, R12, R13	1.5%, or 5.5 days per year at R4	107 µg/m³ at R4	3	R2, R4, R7	1.3%, or 5 days per year at R4	100 µg/m³ at R4
	3	5	R2, R4, R7, R9, R13	0.5%, or 2 days per year at R4	79 µg/m³ at R4	3	R2, R4, R7	0.4%, or 1.5 days per year at R4	72 µg/m³ at R4

The frequency of exceedance for the Preferred Alternative is predicted to increase from Future Baseline Conditions (**Section 6.2.1.1**) at some receptors for each of the operating Scenarios assessed. However, these Scenarios represent worst-case locations of haul routes and the working face, which change between scenarios, and consider the lowest separation distance to discrete receptors.

In efforts to further reduce predicted concentrations at discrete receptors, two mitigation measures are proposed:

- Replace the existing unpaved south access ramp of the landfill area with a hard surface equivalent to a paved road; and
- Implementation of enhanced watering practices to achieve 95% control along paved haul routes.

In order to achieve 95% control on paved surfaces, one or a combination of the two following control systems will be adopted into the existing Dust BMPP as detailed in **Supporting Document 3-1**:

- continuous watering of paved road surfaces; and/or
- an enhanced water truck protocol.

The net effects assessment of the Preferred Alternative for Air Quality – Dust is presented in **Table 8-2**.

Table 8-2. Air Quality – Dust Net Effects Assessment – Preferred Alternative

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Air Quality – Dust	Off-site Point of Impingement (POI) air concentrations of particulate matter (dust or PM) compounds at identified receptors in the immediate vicinity of the site, and community.	• Phasing and schedule of site development determines location of access roads, construction activities, and landfilling activities. • Construction activities include material handling that can generate fugitive dust. • Operating hours define the time of day during which fugitive dust may occur. • Site traffic unchanged, so traffic volumes remain consistent although the distance travelled will vary depending on access routes. • Site equipment unchanged, so nonroad vehicle activity and locations expected to remain consistent. • Compost diversion area and associated material handling activities are considered as permitted in the current Environmental Compliance Approval (ECA). • Background concentrations which can represent a significant percentage of the cumulative concentration for some contaminants are assumed to remain unchanged over the lifespan of the proposed landfill expansion. • Meteorological conditions, including wind speeds and temperatures, which form the basis for dispersion modelling are assumed to remain unchanged over the lifespan of the proposed landfill expansion.	• Concentrations of 24-hour TSP and 24-hour PM_{10} are predicted to exceed their respective criteria at discrete receptor locations. • With the application of mitigation strategies, predicted concentrations at discrete receptors are expected to decrease to levels similar to Future Baseline Conditions.	• Replace the existing unpaved south access ramp of the landfill area with a hard surface equivalent to a paved road. • Implementation of enhanced watering practices to achieve 95% control along paved haul routes. • Continued implementation of the Dust BMPP.	• Concentrations of 24-hour TSP and 24-hour PM_{10} are predicted to exceed their respective criteria at discrete receptor locations under the three development scenarios. The maximum predicted 24-hour TSP concentrations ranged from 172 µg/m³ to 281 µg/m³ (criteria is 120 µg/m³), and the maximum predicted 24-hour PM_{10} concentrations ranged from 67 µg/m³ to 100 µg/m³ (criteria is 50 µg/m³).
	Frequency of any exceedance of applicable standards, limits, or guidelines at identified receptors.		• The frequency of predicted exceedances of TSP and PM_{10} at discrete receptors may increase from Future Baseline Conditions depending on the development scenario. • With the application of mitigation strategies, the frequencies of predicted exceedances at discrete receptors are expected to decrease to levels similar to Future Baseline Conditions.		• The maximum predicted frequency of exceedance of 24-hour TSP and 24-hour PM_{10} at discrete receptor locations under the three development scenarios ranged from 0.5% (approximately 2 days per year) to 2.2% (approximately 8 days per year) at R4 for 24-hour TSP, and 0.4% (approximately 2 days per year) to 1.3% (approximately 5 days per year) at R4 for 24-hour PM_{10}.
	Number of off-site identified receptors potentially affected (e.g., residential properties, public facilities,		• The number of discrete receptors with predicted concentrations exceeding criteria may increase from Future Baseline Conditions		• Changes in the number of discrete receptors experiencing exceedances varies under the three development scenarios. A total of between 3 and 9 sensitive receptors were predicted to be

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
	businesses/farms, institutions).	• Assessment of worse case working face location. • Assessment of dry conditions. • Assessment of maximum operating condition paired with worst case meteorological conditions.	depending on the development scenario. • With the application of mitigation strategies, the numbers of off-site receptors potentially affected are expected to decrease to quantities similar to Future Baseline Conditions.		affected by the exceedances of 24-hour TSP, while 3 sensitive receptors were predicted to be affected by the exceedances of 24-hour PM_{10}.

8.1.1.2 Air Quality – Landfill Gas and Combustion By-Products

Evaluation of the Preferred Alternative for landfill gas (LFG) and combustion by-products was completed using dispersion modelling for the following Volatile Organic Compounds (VOCs) and combustion byproducts: Vinyl Chloride; Benzene; 1,2-Dichloroethane; Total Reduced Sulphurs (TRS); Hydrogen Sulphide (H_2S); Ammonia; Nitrogen Oxides (NO_x) / Nitrogen Dioxide (NO_2); Dioxins and Furans (D&F); and Sulphur Dioxide (SO_2). The same regulatory criteria and assumptions presented in **Section 6.2.1.1** apply. The same scenarios used for Dust in **Section 8.1.1.1** were used for the modelling of the VOCs and combustion by-products. Modelled concentrations of the contaminants at identified discrete receptors were compared against their applicable criteria presented in **Table 6-2** (**Section 6.2.1.1**). As with the Air Quality – Dust effects assessment above, the receptor locations are shown in **Figure 4-3** (**Section 4**) in relation to the general study areas defined for the EA.

Off-Site POI Air Concentrations

Benzene, vinyl chloride, 1,2-dichloroethane, ammonia, SO_2, NO_x, and D&F are predicted to be below their applicable criteria at all off-site locations with background included. Predicted concentrations for 24-hour H_2S are below applicable criteria at all discrete receptors with background included. Ten-minute H_2S, 10-minute TRS, and 24-hour TRS are predicted to exceed applicable criteria with background included as summarized in **Table 8-3**; however, these elevated concentrations are the result of high background concentrations generated from off-property sources unrelated to landfill operations with very little contribution coming from landfill activities.

Overall, LFG and combustion by-product concentrations at discrete receptors remain consistent throughout Scenarios 1 to 3. Slight variations do occur between Scenarios as the landfill mound haul routes and working face migrate with filling operations.

For comparison, under Future Baseline Conditions for the approved Expansion Landfill, predicted concentrations of 10-minute H_2S, 10-minute TRS, and 24-hour TRS exceed the applicable criteria. For 10-minute H_2S, the maximum landfill contribution occurs at receptor STR1 with a predicted concentration of 0.76 µg/m³ (5.9% of the criteria), which accounts for approximately 3.3% of the predicted cumulative concentration. For 10-minute TRS, the maximum landfill contribution occurs at receptor R4 with a predicted concentration of 1.17 µg/m³ (9.0% of the criteria), which accounts for approximately 2.6% of the predicted cumulative concentration. For 24-hour TRS, the maximum landfill contribution occurs at receptor R9 with a concentration of 0.15 µg/m³ (2.2% of the criteria), which accounts for approximately 1.4% of the predicted cumulative concentration.

Frequency of Exceedance of Applicable Criteria

Since background concentrations exceed criteria, the cumulative concentration (landfill plus background) always exceeds the criteria as shown in **Table 8-3**. However, the frequency of predicted exceedances are not the result of landfill operations. This is consistent with the Future Baseline Conditions for the approved Expansion Landfill.

Number of Receptors Affected

Since background concentrations exceed criteria, all receptors are affected as shown in **Table 8-3**. However, there are no receptors with predicted exceedances due to landfill operations. This is consistent with the Future Baseline Conditions for the approved Expansion Landfill.

Table 8-3. Maximum Concentrations, Frequencies, and Affected Receptors for Exceedances of 10-min H_2S, 10-min TRS, and 24-hr TRS

Contaminant and Applicable Criteria	Scenario	# of Affected Receptors	Affected Receptors	Maximum Frequency of Exceedance at Receptors	Maximum Predicted Concentration	Maximum Landfill Contribution
10-min H_2S 13 µg/m³ (AAQC & O.Reg. 419/05)	1	25	All	Note [1]	23.3 µg/m³ (179% of the criteria) at STR1	0.76 µg/m³ (5.9% of the criteria) at STR1
	2					
	3					
10-min TRS 13 µg/m³ (AAQC & O.Reg. 419/05)	1	25	All	Note [1]	45.4 µg/m³ (349% of the criteria) at R4	1.15 µg/m³ (8.8% of the criteria) at R4
	2					
	3					
24-hr TRS 7 µg/m³ (AAQC & O.Reg. 419/05)	1	24	All (Note [2])	Note [1]	11.2 µg/m³ (160% of the criteria) at R9	0.16 µg/m³ (2.3% of the criteria) at R9
	2				11.1 µg/m³ (159% of the criteria) at R9	0.12 µg/m³ (1.7% of the criteria) at R9
	3				11.1 µg/m³ (159% of the criteria) at R9	0.11 µg/m³ (1.6% of the criteria) at R9

Notes:

[1] Background concentrations for 10-minute H_2S, 10-minute TRS, and 24-hour TRS were above the applicable criteria. Modelled contributions from the landfill are relatively small compared to background.

[2] Receptor STR1 not applicable for 24-hour criteria, as it is a short-term receptor.

Consistent with Future Baseline Conditions, the predicted concentrations at discrete receptors for all LFG and combustion byproduct under the Preferred Alternative remain below applicable criteria except for H_2S and TRS. However, in both the Future Baseline Conditions and the Preferred Alternative, predicted concentrations of H_2S and TRS are dominated by elevated background concentrations. Predicted concentrations without background are consistent with Future Baseline Conditions in Scenario 1, and predicted concentrations for the Preferred Alternative under Scenarios 2 and 3 decrease slightly as final cover is applied. Therefore, the Preferred Alternative's net effect on LFG and combustion by-products is expected to be low. No additional mitigation measures are identified.

The net effects assessment of the Preferred Alternative for Air Quality – Landfill Gas and Combustion By-Products is presented in **Table 8-4**.

Table 8-4. Air Quality – Landfill Gas and Combustion By-Products Net Effects Assessment – Preferred Alternative

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Air Quality – Landfill Gas and Combustion By-Products	Off-site POI air concentrations of indicator compounds at identified receptors in the immediate vicinity of the site, and community (within 5 kilometres [km]).	• Annual waste filling rate / total additional tonnage determines the annual production of LFG. • Phasing and schedule of site development determines location of landfilling activity at the working face. • LFG generation is expected to increase during the operational life of the landfill and peak at closure. • LFG collection and treatment is expected to expand progressively as landfilling activity evolves. • LFG estimation parameters are based on the composition of municipal solid waste which is assumed to remain unchanged over the lifespan of the proposed landfill expansion. • Discrete receptors are assumed to be unchanged over the lifespan of the proposed landfill expansion. • Background concentrations which can represent a significant percentage of the cumulative concentration for some contaminants are assumed to remain unchanged over the lifespan of the proposed landfill expansion. • Meteorological conditions, including wind speeds and temperatures, which form the basis for dispersion modelling are assumed to remain unchanged over the lifespan of the proposed landfill expansion. • Landfill cover applied during different stages of landfill development. • Conservative estimate of LFG generation rate. • Conservative estimates of maximum landfill activity.	• Change in predicted concentrations of indicator contaminants at discrete receptor locations.	• None	• None. Changes in predicted concentrations will be minimal.
	Frequency of any exceedance of applicable standards, limits, or guidelines at identified receptors.		• None. No frequency of exceedance at receptors due to landfill operations.	• None	• None. No frequency of exceedance at receptors due to landfill operations.
	Number of off-site receptors potentially affected (e.g., residential properties, public facilities, businesses/farms, institutions).		• None. No receptors with predicted concentrations exceeding criteria due to landfill operations.	• None	• None. No receptors with predicted concentrations exceeding criteria due to landfill operations.

8.1.1.3 Air Quality – Blowing Litter

The Preferred Alternative shares the same footprint as the Expansion Landfill. For the assessment of the Preferred Alternative, the landfill was assessed as a whole (i.e., not looked at in terms of individual stages). This approach results in an assessment of the worst-case potential litter impacts over the life of the Preferred Alternative.

Extent of Zones Potentially Impacted

The potential zones of influence remain the same as for Future Baseline Conditions (**Section 6.2.1.3**) since the landfill footprint remains the same for the Preferred Alternative. The receptor locations and litter zones identified through the meteorological assessment are shown on **Figure 4-6** (**Section 4**). Between a distance of 500 m and 1 km there are 12 discrete receptors; however, only R3, R5, and R6 are located in the predominant wind direction. Given the separation distance, the impact in the area is expected to be low. Other residences in the area are farther than 1 km from the proposed landfill and have little or no potential for blowing litter impacts.

Number of Receptors Affected

The meteorological data used for Future Baseline Conditions to determine the number and location of off-site receptors potentially affected by blowing litter is assumed to be unchanged for the Preferred Alternative. The increase in height proposed for the Preferred Alternative may increase the potential for higher wind speeds at the landfill's working face, and this may increase the frequency of potential litter events; however, continuation of the current litter management practices would continue to manage blowing litter effectively. Therefore, it is expected that the number of receptors affected will not change compared to Future Baseline Conditions.

Receptors R2 and R4 are located to the northeast of the landfill in the predominant wind direction; despite this, the probability for winds greater than the thresholds for litter are 5% of the time, or 18 days per year. Receptors R7, R9, and STR1 are located to the west/southwest of the landfill site, not in the predominant wind direction, and the frequency of winds exceeding the litter thresholds in this area are predicted to range from <1% to 3% of the time, or less than 11 days per year. Based on a combination of the frequency of winds and the litter controls in place, the potential for blowing litter impacts at the receptors within 500 m of the landfill is low. Overall, the potential blowing litter impacts from the Preferred Alternative are low. The net effects assessment of the Preferred Alternative for Air Quality – Blowing Litter is presented in **Table 6-6**.

Table 8-5. Air Quality – Blowing Litter Net Effects Assessment – Preferred Alternative

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Air Quality – Blowing Litter	Extent of zones potentially impacted by blowing litter.	• Landfill footprint is unchanged, so the distance to receptors and the extent of each litter zone remain the same. • Existing Management using litter fencing • Positioning of mobile wind screens • Application of daily cover	• None. No change in the extent of zones potentially impacted by blowing litter.	• No additional mitigation is recommended for blowing litter. • Continued implementation of the Litter BMPP.	• None
	Number of off-site receptors potentially affected (e.g., residential properties, public facilities, businesses/farms odour sensitive area(s), institutions).	• Discrete receptors unchanged so the number of receptors and their locations in the existing litter zones remain the same. • Meteorological conditions remain unchanged with no significant increase in wind speed over the lifespan of the proposed landfill expansion.	• None. No change in the number off-site receptors potentially affected.	• No additional mitigation is recommended for blowing litter. • Continued implementation of the Litter BMPP.	• None

8.1.1.4 Odour

Evaluation of the Preferred Alternative for odour was completed using dispersion modelling to assess the potential for nuisance conditions at identified odour sensitive receptors. The receptor locations are shown in **Figure 4-3** (**Section 4**) in relation to the general study areas defined for the EA. Odour was evaluated using the following odour thresholds:

- 1 odour units per cubic metre (OU/m³) – associated with detection of odour (Ontario Ministry of Environment, Conservation and Parks [MECP] odour guideline);
- 3 OU/m³ – recognition of odour; and
- 5 OU/m³ – nuisance resulting from odour.

The emission quantification and modelling methodology is consistent with that presented in **Section 6.2.4.1**. The TCEC has an Odour BMPP which outlines control measures taken to minimize odour related emissions. Operation of the Preferred Alternative intends to maintain odour control practices outlined in the Odour BMPP.

No odour emissions are associated with the haul routes or onsite traffic and therefore changes in haul routes on the landfill mound do not impact the odour evaluation. The landfill working face location will change in the different stages of landfill operation. The same scenarios used for Dust in **Section 8.1.1.1** were used for the modelling, which consider the worst-case working face locations:

- Scenario 1: landfill operations are located in the northwestern corner of the Stage 1 landfill area, all areas except for the working face are under interim cover, and no final cap applied in anticipation of future stages of the landfill.
- Scenario 2: landfill operations are located in the northeast corner of the Stage 2 landfill area, Stage 1 area has been completed and final cap has been installed with the exception of the portion of Stage 1 that will eventually be covered by Stage 3 during future landfill development, and all other areas except for the working face are assumed to be under interim cover.
- Scenario 3: landfill operations are located in the northeast corner of the Stage 4 landfill area, all other stages have been completed and final cap has been installed, and all areas of Stage 4 except the working face are assumed to be under interim cover.

Predicted Off-site Odour Concentrations

For Scenario 1, maximum predicted odour concentrations exceed 1 OU/m³ at all receptors. Exceedances of 3 OU/m³ were predicted at 8 receptors (R1, R2, R4, and R17 through R21). No exceedances of 5 OU/m³ were predicted at any of the receptors.

For Scenario 2, maximum predicted odour concentrations exceed 1 OU/m³ at all receptors. Exceedances of 3 OU/m³ were predicted at two receptors, R2 and R4. No exceedances of 5 OU/m³ were predicted at any of the receptors.

For Scenario 3, maximum predicted odour concentrations exceed 1 OU/m³ at all receptors. An exceedance of 3 OU/m³ was predicted at one receptor, R4. No exceedances of 5 OU/m³ were predicted at any of the receptors.

In general, as the landfill progresses inwards from the property boundary predicted odour concentrations decrease as more of the landfill receives final cover and the working face separation distance to discrete receptors increases.

For comparison, under the Future Baseline Conditions for the approved Expansion Landfill, the maximum predicted concentrations at all receptors were predicted to exceed the MECP odour guideline objective of 1 OU/m³, exceedances of 3 OU/m³ were predicted at two receptors, R2 and R4, and no exceedances of 5 OU/m³ were predicted at any of the receptors.

Frequency of Odour Levels Above Defined Odour Benchmarks

Under Scenario 1, exceedances of the 1 OU/m³ guideline were predicted to occur at a frequency greater than 0.5% of the time at all receptors except R10, R11, R13, R14, R24, and STR1. The highest overall frequency of exceedance of 1 OU/m³ was 2.9% or approximately 252 hours per year predicted at R7. Exceedances of the 3 OU/m³ recognition threshold were predicted to occur less than 0.5% of the time at the 8 affected receptors (R1, R2, R4, and R17 through R21). The highest overall frequency of exceedance of 3 OU/m³ was 0.12% or approximately 10 hours per year predicted at R4.

Under Scenario 2, exceedances of the 1 OU/m³ guideline were predicted to occur at a frequency greater than 0.5% of the time at receptors R1 through R5, R7 through R9, and R16 through R19. The highest overall frequency of exceedance of 1 OU/m³ was 1.6% or approximately 141 hours per year predicted at R7. Exceedances of 3 OU/m³ were predicted to occur less than 0.5% of the time at the two affected receptors (R2 and R4). The highest overall frequency of exceedance of 3 OU/m³ was 0.01% or approximately 1 hour per year predicted at R4.

Under Scenario 3, exceedances of the 1 OU/m³ guideline were predicted to occur at a frequency less than 0.5% of the time at all receptors. The highest overall frequency of exceedance of 1 OU/m³ was 0.45% or approximately 38 hours per year predicted at R4. Exceedances of 3 OU/m³ were predicted to occur less than 0.5% of the time at the one affected receptor (R4). The highest overall frequency of exceedance of 3 OU/m³ was 0.002% or approximately 0.21 hours per year predicted at R4.

For comparison, under the Future Baseline Conditions for the approved Expansion Landfill, exceedances of 1 OU/m³ at a frequency greater than 0.5% of the time were predicted to occur at receptors R2 through R7. The highest overall frequency of exceedance of 1 OU/m³ was 1% or approximately 84 hours per year predicted at R4 and R7. Exceedances of 3 OU/m³ were predicted to occur less than 0.5% of the time at receptors R2 and R4. The highest overall frequency of exceedance of 3 OU/m³ was 0.01% or approximately 1 hour per year predicted at R4.

Number of Receptors Affected

Exceedances of the 1 OU/m³ guideline at a frequency greater than 0.5% of the time were predicted to occur at 19 receptors under Scenario 1, at 12 receptors under Scenario 2, and at no receptors under Scenario 3.

Exceedances of 3 OU/m³ at a frequency of less than 0.5% of the time were predicted to occur at 8 receptors under Scenario 1, at two receptors under Scenario 2, and at one receptor under Scenario 3.

For comparison, under the Future Baseline Conditions for the approved Expansion Landfill, exceedances of 1 OU/m³ at a frequency greater than 0.5% of the time were predicted to occur at 6 receptors, while exceedances of 3 OU/m³ at a frequency of less than 0.5% of the time were predicted to occur at two receptors.

Scenario 1 has the working face located in the worst-case location directly along the northwestern boundary of the landfill footprint, which represents the shortest separation distance to discrete receptors. Operations in this area are expected to be relatively short as landfilling operations in this location will be primarily for the development of the side slope needed for the large mound area, and waste capacity near the perimeter of the landfill footprint will be limited. For the majority of the landfill life, the working face will be located more interior to the site which is expected to reduce the frequency and magnitude of elevated concentrations at discrete receptors. In addition, Scenario 1 represents the time period where the landfill has no final cover applied which represents the maximum potential for odour emissions.

This conclusion is supported by the predicted concentration at discrete receptors for Scenarios 2 and 3 of the Preferred Alternative. Scenarios 2 and 3 predicted lower frequencies of odour units at discrete receptors relative to Future Baseline Conditions. This reflects the improved odour control as final cap is applied to the waste mound.

The net effects assessment of the Preferred Alternative for Odour is presented in **Table 8-6**.

Table 8-6. Odour Net Effects Assessment – Preferred Alternative

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Odour	Off-site odour concentrations (odour units) at identified odour sensitive receptors in the immediate vicinity of the site.	• Phasing and schedule of site development determines location of landfilling activity at the working face, and the areas that may be under interim or final cover. • LFG collection and treatment is expected to expand progressively as landfilling activity evolves. • LFG estimation parameters are based on the composition of municipal solid waste which is assumed to remain unchanged over the lifespan of the proposed landfill expansion. • Discrete receptors are assumed to be unchanged over the lifespan of the proposed landfill expansion. • Meteorological conditions, including wind speeds and temperatures, which form the basis for dispersion modelling are assumed to remain unchanged over the lifespan of the proposed landfill expansion. • Landfill cover applied during different stages of landfill development.	• Predicted odour concentrations may exceed criteria at discrete receptor locations.	• No additional mitigation is recommended for odour. • Continued implementation of the Odour BMPP.	• Changes in the predicted concentration at each receptor vary depending on the stage of landfill operations. The maximum predicted odour concentrations exceed 1 OU/m³ at all receptors under all three development scenarios. Exceedances of 3 OU/m³ were predicted at between one (1) and 8 receptors depending on the development scenario. No exceedances of 5 OU/m³ were predicted at any of the receptors under any development scenario. • Predicted concentrations at discrete receptors are expected to be similar to Future Baseline Conditions and decrease over the life of the Project as final cover is applied.
	Frequency of any odour levels above defined odour benchmarks.		• Frequency of odour levels above defined odour benchmarks may increase from Future Baseline Conditions.	• No additional mitigation is recommended for odour. • Continued implementation of the Odour BMPP.	• Changes in frequency of predicted exceedances at each receptor vary depending on the stage of landfill operations. The highest overall frequency of exceedance of 1 OU/m³ ranged between 0.45% and 2.9% of the time at receptors R4 and R7 depending on the development scenario, compared to 1% of the time at R7 under Future Baseline Conditions. The highest overall frequency of exceedance of 3 OU/m³ ranged between 0.002% and 0.12% of the time, with the receptor and frequency depending on the development scenario, compared to 0.01% of the time at R4 under Future Baseline Conditions. • The frequency of predicted exceedance at discrete receptors are expected to be similar to Future Baseline Conditions and decrease over the life of the Project as final cover is applied.

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
	Number of off-site receptors potentially affected (e.g., residential properties, public facilities, businesses/farms odour sensitive area(s), institutions).		• The number of discrete receptors with predicted odour concentrations exceeding criteria may increase from Future Baseline Conditions.	• No additional mitigation is recommended for odour. • Continued implementation of the Odour BMPP.	• Changes in the number of discrete receptors with predicted concentrations the exceed criteria vary depending on the stage of landfill operations. Exceedances of 1 OU/m³ greater than 0.5% of the time were predicted to occur at between zero (0) and 19 receptors depending on the development scenario, compared to 7 under Future Baseline Conditions. Exceedances of 3 OU/m³ were predicted to occur at between one (1) and 8 receptors depending on the development scenario compared to two (2) under Future Baseline Conditions. • The number of discrete receptors that exceed criteria are expected to be similar to Future Baseline Conditions and decrease over the life of the Project as final cover is applied.

8.1.1.5 Noise

The Preferred Alternative (Alternative Method 2) consists of four operational stages as shown on **Figure 5-5** (**Section 5**), and operations will move around the landfill site over the life of the landfill. The effects assessment of the Preferred Alternative considers three future operational scenarios, shown in **Table 8-7**, for the determination of effects from landfilling sources. Landfilling at the TCEC is generally confined to a region for a given amount of time; as such, the landfilling equipment will have the greatest impact when working in a cell near a Point of Reception (POR). The PORs for Noise are shown on **Figure 6-2** (**Section 6**). Of the 14 PORs considered, two of the existing residences (R2 and R7) were found to have the greatest potential for impacts from noise, so construction and landfilling activities were modelled at the closest locations to these two PORs to maximize the predicted noise impact from the Preferred Alternative as per **Table 8-7**. Modelling scenarios are described in the Noise Effects Assessment Report (**Supporting Document 3-2**).

Table 8-7. Operational Stage POR Selection and Applicable Landfilling Noise Guideline Sound Level Limit

Operational Stage	Closest Residential POR	Applicable Sound Level Limit for Operational Stage (dBA)	Descriptive Location
1	R7	55	Western Edge in the Middle of Landfill Footprint
2	R2	55	Northeast Corner of Landfill Footprint
3	R7	55	Western Edge in the Middle of Landfill Footprint

Note: Decibel, weighted to reflect human sensitivity to sound using the A-weighting scale (dBA)

Stages 1 and 2 were modelled at the typical landfilling lower elevation, side slope redevelopment, and typical landfilling upper elevation, while Stage 3 was modelled for typical landfilling. The results are summarized below.

Predicted Site-Related Noise Levels

Under the typical landfilling lower elevation of Stage 1, the landfilling noise contribution will be less than the guideline sound level limits at all PORs. For side slope redevelopment, the landfilling noise contributions will be less than or equal to the guideline sound level limits at all PORs; however, equipment should be limited on the western slope in proximity to PORs to avoid exceeding the landfilling limit of 55 dBA at POR R7. Equipment would be limited to: a CAT 836G compactor; and a CAT D8R dozer. For the typical landfilling upper elevation, the landfilling noise contribution will again be less than the guideline limits at all PORs.

Under the typical landfilling lower elevation of Stage 2, the landfilling noise contribution will be less than the guideline limits at all PORs except for R2 and R3, which will exceed the applicable Landfilling Noise Guidelines sound level limits of 55 dBA at both 1.5 m and 4.5 m heights, and will require mitigation. The exceedances of the applicable limits are at the 4.5 m height at R2 with a predicted sound level of 56 dBA, and at the 1.5 m and 4.5 m heights at R3 with predicted sound levels of 56 dBA and

59 dBA, respectively. The recommended mitigation is the use of operational berms when landfilling occurs in this portion of the landfill. With the implementation of operational berms, landfilling noises off-site can be mitigated to be below landfilling sound level limits. With mitigation, the sound levels at the 1.5 m and 4.5 m heights at both R2 and R3 reduce to 51 dBA and 52 dBA, respectively.

Similarly, for side slope redevelopment, the landfilling noise contributions will be less than or equal to the guideline sound level limits at all PORs except for R2 and R3, which will potentially exceed the applicable Landfilling Noise Guidelines sound level limits of 55 dBA at both 1.5 m and 4.5 m heights, and will require mitigation. The exceedances of the applicable limits are at the 1.5 m and 4.5 m heights at R2 with predicted sound levels of 59 dBA and 60 dBA, respectively, and at the 1.5 m and 4.5 m heights at R3 with predicted sound levels of 58 dBA and 59 dBA, respectively. In addition, mitigation would be required to avoid exceeding the landfilling limit of 55 dBA at POR R14. As the work will be on a slope, the construction of temporary berms may not be achievable and mitigation will require limiting the equipment that can work in this area. Compliance can be achieved with the combination of a barrier and by limiting side slope operations to specific equipment (i.e., a CAT D6R dozer). With an operational 3 m berm and limiting the equipment to a single D6R operating on the side slopes, Landfilling Noise Guidelines sound level limits can be met at the critical POR receptor locations. With mitigation, the sound levels at the 1.5 m and 4.5 m heights at R2 reduce to 52 dBA and 54 dBA, respectively, and at R3 reduce to 53 dBA and 54 dBA, respectively. The sound level at R14 would be reduced from 55 dBA to 51 dBA.

For the typical landfilling upper elevation, the landfilling noise contribution will again be less than the guideline limits at all PORs.

Under typical landfilling for Stage 3, the landfilling noise contribution will be less than the guideline limits at all PORs.

Change in Sound Levels

Changes in noise levels were calculated by comparing the existing and approved environmental noise levels, including other sound sources such as existing landfilling operations, existing ancillary facilities, with the expected future noise levels due to the proposed landfill, ancillary sources, and construction activities. The change was then assessed based on the increase in sound level at the POR from the various existing conditions to the proposed conditions of the Preferred Alternative:

- A sound level increase of 1 – 3 decibels (dB) was qualitatively rated as insignificant;
- A sound level increase of 3 – 5 dB was qualitatively rated as noticeable;
- A sound level increase of 5 – 10 dB was qualitatively rated as significant; and
- A sound level increase of greater than 10 dB was qualitatively rated as very significant.

The change in sound level can be qualitatively rated as insignificant from existing and approved sound levels with the use of specific mitigations. The magnitude of the change in sound levels for the Preferred Alternative will range from 0 dB to 3 dB. The greatest change occurs during Stage 1 and 2 when equipment will be nearer to the landfill approved limits. Stage 3 and 4 will be constrained from the landfill approved limits and are predicted to result in changes of less than 3 dB.

The effects of haul route noise were assessed, and the analysis indicates that the changes in sound levels are primarily rated as insignificant, with a change in sound levels being less than or equal to 3 dB. As volumes for haul traffic from the Preferred Alternative will be the same as is currently approved, the change in haul route sound levels are attributed to the future growth in the area resulting in greater vehicle volumes.

The net effects assessment of the Preferred Alternative for Noise is presented in **Table 6-10**.

Table 8-8. Noise Net Effects Assessment – Preferred Alternative

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Noise	• Predicted site-related noise levels (measured in dBA or dBAI) • Changes in sound levels (dB)	• Landfilling equipment working within 50 m of the perimeter of the landfill potentially increasing off-site noise levels. • The quantity of haul trucks arriving at the Project will remain approximately the same. On-site hauling volumes represent the greatest number of vehicles in any given hour. • The on-site traffic to the working face will follow the same starting route, entering the landfill from Nauvoo Road, proceeding to the scale facility. • Operating hours for the receiving of waste and on-site hauling will not change.	• Exceedance of applicable landfilling noise guidelines during daytime hours at PORs R2 and R3 during Stage 2 landfilling at the lower elevation and during side slope redevelopment. • Changes in sound levels were determined to be insignificant (less than or equal to 3 dB).	• Construction of localized berms along the perimeter of the landfill. • Limit the number of active equipment near the perimeter of the landfill.	• Noise levels will meet applicable landfilling noise guidelines during daytime hours, with the implementation of the identified mitigation measures. • Changes in sound levels were qualitatively rated as insignificant (less than or equal to 3 dB).

Note: A-weighted sound pressure level of an impulsive sound measured with a sound level meter set to "impulse" response corresponding to a rising slope time of 35 ms (dBAI).

8.1.2 Hydrogeology

Hydrogeology considers Groundwater Quantity and Groundwater Quality. The effects assessment for the Preferred Alternative is summarized below from **Section 6.2.2**.

8.1.2.1 Groundwater Quality

The net effects assessment for the Preferred Alternative is presented in **Table 6-13**.

The Preferred Alternative will not result in a change to the waste footprint, and no changes are proposed to the landfill base design, the annual fill rate, leachate collection and management processes, the site boundaries, or buffer widths. There will be an increase in landfill finished cap surface area.

The peak leachate generation rate for the Preferred Alternative was predicted to be 119,000 cubic metres per year (m³/year). With respect to Groundwater Quality on-site the hydraulic trap effect is anticipated to remain in effect from Future Baseline Conditions through the Preferred Alternative as there are no proposed changes to the designed footprint or leachate management practices of the Expansion Landfill. Within the Expansion Landfill, leachate mounding is not expected to develop based on the landfill's design.

Predicted Effects on On-site Groundwater Quality

The increase in waste mass from the Preferred Alternative is not expected to cause adverse effects to off-site Groundwater Quality; however, the Preferred Alternative will result in a 3% increase in peak annual leachate generation compared to Future Baseline Conditions, due to a larger landfill cap surface area. This additional leachate volume introduces the potential for increased risk to groundwater quality at the TCEC.

With the continuation of leachate management practices, no mitigative measures are required as there are no negative effects predicted as it relates to Groundwater Quality. Groundwater Quality (e.g., analytical testing for leachate and groundwater) should continue to be monitored at the TCEC in accordance with the relevant conditions of the Waste and Sewage ECAs.

Predicted Contaminating Lifespan

The increase in waste volume under the Preferred Alternative will increase the Expansion Landfill's contaminating lifespan (CLS), thus prolonging the Groundwater Quality's exposure to potential risks from leachate impacts. The CLS of the Expansion Landfill was predicted to increase by 61 years under the Preferred Alternative relative to Future Baseline Conditions, resulting in a CLS of 163 years post-closure.

Table 8-9. Groundwater Quality Net Effects Assessment – Preferred Alternative

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Groundwater Quality	Predicted effects on Groundwater Quality on-site from increased waste quantities disposed within the Expansion Landfill	Key Design Considerations: • Increase in waste volume of 14.3 million m³ without change in waste footprint. • Increase in landfill finished cap surface area in consideration of leachate generation rates. • Peak leachate generation rate of 119,000 m³/year. • No proposed changes to the landfill base design as well as leachate collection and management for the Expansion Landfill. • The existing TCEC property boundaries and buffer width will remain the same. Key Assumptions: • With respect to Groundwater Quality on-site the hydraulic trap effect is anticipated to remain in effect from Future Baseline Conditions through into the Preferred Alternative as there are no proposed changes to the designed footprint or leachate management practices of the Expansion Landfill into Future Baseline Conditions. • Within the Expansion Landfill, leachate mounding is not expected to develop based on the landfill's design. • Landfilling operational conditions are expected to remain the same under the Preferred Alternative and be consistent with current-approved Future Baseline operational requirements. • No changes to the annual fill rate. • The approach to managing (disposing) leachate generated at the TCEC will remain the same as that presented for Future Baseline Conditions.	• With respect to Groundwater Quality off-site, the impact of the increase in mass of the Expansion Landfill waste mound is not predicted to have an adverse effect off-site to groundwater conditions. • Peak annual leachate generation rates for the Preferred Alternative are approximately 3% greater than that predicted under Future Baseline Conditions from the Conceptual Design Report (CDR) (**Supporting Document 2**). The increase in landfill cap surface area under the Preferred Alternative will generate a greater volume of leachate (3% more) compared to Future Baseline Conditions thus, having the potential for an increased risk for Groundwater Quality impacts at the TCEC.	• With the continuation of leachate management practices, no mitigative measures are required as there are no negative effects predicted as it relates to Groundwater Quality. To verify this prediction WM Canada (WM) should continue to monitor Groundwater Quality (e.g., analytical testing for leachate and groundwater) at the TCEC in accordance with the relevant conditions of the Waste and Sewage ECAs.	• None, so long as the hydraulic trap design is maintained as required under the Waste and Sewage ECAs.
	Predicted CLS	Key Design Considerations: • Increase in waste volume of 14.3 million m³ without change in waste footprint.	• The increase in waste volume under the Preferred Alternative will	• Groundwater environmental monitoring programs	• Under the Preferred Alternative, the

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
		• The existing TCEC property boundaries and buffer width will remain the same. Key Assumptions: • With respect to Groundwater Quality on-site the hydraulic trap effect is anticipated to remain in effect from Future Baseline Conditions through into the Preferred Alternative as there are no proposed changes to the designed footprint or leachate management practices of the Expansion Landfill into Future Baseline Conditions. • Within the Expansion Landfill, leachate mounding is not expected to develop based on the landfill's design. • Landfilling operational conditions are expected to remain the same under the Preferred Alternative and be consistent with current-approved Future Baseline operational requirements. • No changes to the annual fill rate. • The approach to managing (disposing) leachate generated at the TCEC will remain the same as that presented for Future Baseline Conditions.	increase the Expansion Landfill's CLS, thus prolonging the Groundwater Quality's exposure to potential risks from leachate impacts. • The CLS of the Expansion Landfill was predicted to increase by 61 years under the Preferred Alternative relative to a CLS of 102 years under Future Baseline Conditions, which increases the duration of the existing risk of potential negative effects to Groundwater Quality at the TCEC.	(EMPs) will continue into the CLS of the Expansion Landfill.	at-capacity CLS will increase 61 years to 163 years post-closure

8.1.2.2 Groundwater Quantity

The net effects assessment for the Preferred Alternative is presented in **Table 6-16**.

The Preferred Alternative will not result in a change to the waste footprint, and no changes are proposed to the landfill base design, the annual fill rate, or leachate collection and management processes. There will be an increase in landfill finished cap surface area.

The peak leachate generation rate for the Preferred Alternative was predicted to be 119,000 m³/year. With respect to Groundwater Quantity on-site the hydraulic trap effect is anticipated to remain in effect from Future Baseline Conditions through the Preferred Alternative as there are no proposed changes to the designed footprint or leachate management practices of the Expansion Landfill. Within the Expansion Landfill, leachate mounding is not expected to develop based on the landfill's design.

Predicted Effects on Groundwater Quantity and Flow

The increased mass of the Expansion Landfill under the Preferred Alternative is not expected to adversely affect off-site groundwater flow or quantity. The increase in landfill cap surface area under the Preferred Alternative will generate a greater volume of leachate (3% more) compared to Future Baseline Conditions; however, the Preferred Alternative is not predicted to result in a negative potential effect to groundwater quantity and flow relative to Future Baseline Conditions.

With the continuation of leachate management practices, no mitigative measures are required as there are no negative effects predicted as it relates to Groundwater Quantity. Groundwater Quantity (e.g., liquid levels for both leachate and groundwater) should continue to be monitored at the TCEC in accordance with the relevant conditions of the Waste and Sewage ECAs.

Table 8-10. Groundwater Quantity Net Effects Assessment – Preferred Alternative

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Groundwater Quantity	Predicted effect of Landfill Optimization on Groundwater flow and Quantity both on-site and off-site.	Key Design Considerations: • Increase in waste volume of 14.3 million m³ without change in waste footprint. • Increase in landfill finished cap surface area in consideration of leachate generation rates. • Peak leachate generation rate of 119,000 m³/year. • No proposed changes to the landfill base design as well as leachate collection and management for the Expansion Landfill. • The existing TCEC property boundaries and buffer width will remain the same. Key Assumptions: • With respect to Groundwater flow/quantity on-site the hydraulic trap effect is anticipated to remain in effect from Future Baseline Conditions through into the Preferred Alternative as there are no proposed changes to the designed footprint or leachate management practices of the Expansion Landfill into Future Baseline Conditions. • Within the Expansion Landfill, leachate mounding is not expected to develop based on the landfill's design. • Landfilling operational conditions are expected to remain the same under The Preferred Alternative and be consistent with current-approved Future Baseline operational requirements. • No changes to the annual fill rate. • The approach to managing (disposing) leachate generated at the TCEC will remain the same as that presented for Future Baseline Conditions.	• With respect to Groundwater flow and Quantity off-site, the impact of the increase in mass of the Expansion Landfill waste mound is not predicted to have an adverse effect off-site to groundwater conditions. • Under the Preferred Alternative, there is no negative potential effect to Groundwater flow and Quantity relative to Existing and Future Baseline Conditions. • Peak annual leachate generation rates for The Preferred Alternative are approximately 3% greater than that predicted under Future Baseline Conditions (from the CDR (**Supporting Document 2**)). The increase in landfill cap surface area under the Preferred Alternative will generate a greater volume of leachate (3% more) compared to Future Baseline Conditions.	• With the continuation of leachate management practices, no mitigative measures are required as there are no negative effects predicted as it relates to Groundwater Quantity. To verify this prediction WM should continue to monitor Groundwater Quantity (e.g., liquid levels for both leachate and groundwater) at the TCEC in accordance with the relevant conditions of the Waste and Sewage ECAs.	• None, so long as the hydraulic trap design is maintained as required under the Waste and Sewage ECAs.

8.1.3 Surface Water Environment

The Surface Water Environment considers Surface Water Quality and Surface Water Quantity.

8.1.3.1 Surface Water Quality

The effects assessment for the Preferred Alternative is summarized below from **Section 6.2.1.3**. The net effects assessment for the Preferred Alternative is presented in **Table 8-11**.

The evaluation of Surface Water Quality under the Preferred Alternative considers the same considerations applied to evaluation of the TCEC under the Future Baseline Conditions. The Preferred Alternative is predicted to potentially have an effect because of the following:

- Increased erosional effects in consideration of steeper sideslopes, exposed sideslopes during construction, and larger surface area of the finished landfill cap.
- Increased waste mound height increases the cap surface area and probability for leachate seeps to occur as a result of perched leachate scenarios. Also, removal of interim clayey soil cap for Landfill Optimization along the sideslopes also increases the potential for perched leachate related effects to Surface Water Quality while this area of the waste mound is not completed with interim or final cap.
- Increased waste mound height, thereby increasing landfill operational life, increases the duration of Automobile Shredder Residue (ASR) disposal and management at the TCEC, which increases the potential for ASR to be tracked off-site along the north bound lane of Nauvoo Road to Highway 402.

Predicted Effects on Surface Water Quality On-Site Prior to Off-Site Discharge

Erosional Effects on TSS and Heavy Metal Concentrations in Surface Water

The increase in landfill height and surface area of the landfill cap could lead to greater erosion. The steeper side slopes of the Preferred Alternative may increase the risk of precipitation-induced erosion, leading to elevated Total Suspended Solids (TSS) and soil-related metals (e.g., zinc, chromium, nickel) in surface water.

Mitigation measures include the continued use of sediment control measures (e.g., straw bales, silt fencing, vegetative cover), routine inspections and sediment removal from ditches and ponds, and topsoil and seeding of interim cover areas to reduce erosion. With mitigation measures, no net effects to Surface Water Quality from erosion are predicted for the Preferred Alternative.

Leachate Seep Impacts to Surface Water Quality

The increased waste mound height and cap surface area may raise the probability of leachate seeps, and in the short-term, there is the potential for perched leachate conditions to be encountered during interim cap stripping.

Mitigation measures include routine inspections (e.g., weekly during operations, monthly post-closure) to detect and repair seeps, and immediate repair of any identified seeps to prevent runoff into surface water systems. With mitigation measures, no net effects to Surface Water Quality from leachate seeps are predicted for the Preferred Alternative.

Predicted Effects from PAHs on Surface Water Quality within the Roadside Ditch

The longer operational life under the Preferred Alternative could extend the period of ASR use, increasing the potential for polycyclic aromatic hydrocarbon (PAH) contamination in the roadside ditch along Nauvoo Road. Mitigation measures include rigorous inspection and cleanup of ASR track-out, including sweeping, scraping, and vegetation management, and containment of ASR within the landfill working face to minimize exposure to truck tires.

Table 8-11. Surface Water Quality Net Effects Assessment – Preferred Alternative

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Surface Water Quality	Predicted effects on Surface Water Quality on-site prior to off-site discharge (Erosional effects on TSS and heavy metal concentrations in surface water)	Key Design Considerations: • Slope grading and cap surface area proposed for the vertical expansion of the Expansion Landfill with consideration toward the potential of increased erosional effects to Surface Water Quality. • No proposed changes to the landfill base design as well as leachate collection and management for the Expansion Landfill. • The existing TCEC property boundaries and buffer width will remain the same. Key Assumptions: • Under the Preferred Alternative, the slight alterations to the surface water management infrastructure (e.g., swales, ditching, and sedimentation ponds) are not considered to significantly impact Surface Water Quality as flow rates and volumes are similar to the approved Future Baseline Conditions. • Sedimentation Ponds 1 to 4 current designs are sufficient to manage Future Baseline flow conditions, as well as each Alternative Method even when considering climate change (**Supporting Document 2**), thus, the sedimentation ponds' capacities to attenuate chemical constituents are not expected to change. • Stormwater is currently, and will continue to be, managed on-site through swales and sedimentation ponds prior to off-site discharge. • Landfilling operational conditions are expected to remain the same under the Preferred Alternative and be consistent with current-approved Future Baseline operational requirements.	• Potential effects to Surface Water Quality (e.g., elevated TSS and select heavy metals) resulting from precipitation-induced erosion of exposed clayey soil on-site.	• Continue to operate and monitor Surface Water Quality at the TCEC in accordance with the relevant Conditions of the Waste and Sewage ECAs. • Install/maintain sediment control measures (e.g., straw bale/rock check dams, silt fencing, add vegetative controls, etc.) at various locations within the surface water drainage network. As-required sediment control measure placements and replacements based on Site conditions. • Supplement the northern component of the drainage network with erosion control measures as the landfill expands north prior to initiating Expansion Landfill Optimization. • Complete as-required sediment removal where sediment builds up in the surface water drainage network (e.g., at check dams, silt fencing, retention ponds, etc.). • Place topsoil and seed over areas of the Expansion Landfill side slopes completed with interim cover, where appropriate (e.g., 2 years).	• Presuming the mitigation measures presented herein are implemented and maintained as required, the risk for impacts to Surface Water Quality due to erosional effects will be effectively managed.

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
				• Inspect areas of soil stockpiling for erosion. Where necessary, erosion control measures would be installed to protect the drainage network from unacceptable sediment loading (e.g., silt fencing, straw bales, rock check dams, add vegetative controls, etc.).	
	Predicted effects on Surface Water Quality on-site prior to off-site discharge (Leachate seep impacts to Surface Water Quality)	Key Design Considerations: • Increase in waste mound height and the associated cap surface area as it relates to leachate seep probability. • No proposed changes to the landfill base design as well as leachate collection and management for the Expansion Landfill. • The existing TCEC property boundaries and buffer width will remain the same. Key Assumptions: • Within the Expansion Landfill, leachate mounding is not expected to develop based on the landfill's design. • Landfilling operational conditions are expected to remain the same under the Preferred Alternative and be consistent with current-approved Future Baseline operational requirements. • The approach to managing (disposing) leachate generated at the TCEC will remain the same as that presented for Future Baseline Conditions.	• In the short-term, there is the potential for perched leachate conditions to be encountered during interim cap stripping. • In the long-term, the probability of leachate seepage is proportional to the increase in cap surface area and landfill height (e.g., more cap/height, more chances of leachate seepage).	• Continue to operate and monitor Surface Water Quality at the TCEC in accordance with the relevant Conditions of the Waste and Sewage ECAs. • Seep repairs, when identified, should be conducted immediately and if possible, prior to seepage entering and/or running off landfill sideslopes and into the surface water drainage network. • Routine inspections (e.g., monthly during post-closure) of the landfill surface are expected to provide sufficient frequency to identify and, if necessary, address leachate seepage.	• There is no expected net effect to Surface Water Quality from leachate impacts with the implementation of a seepage monitoring and repair program under the Preferred Alternative.
	Predicted effects from PAHs on Surface Water Quality within the roadside ditch of the northbound	Key Design Considerations: • No proposed changes to the landfill base design as well as leachate collection and management for the Expansion Landfill. • The existing TCEC property boundaries and buffer width will remain the same.	• There are no predicted net effects to Surface Water Quality in the Off-Site Study Area, from ASR	• WM actively implements a rigorous routine inspection and where warranted, cleanup of ASR track out. On-site and off-site ASR cleanup efforts are	• None (as long as the Mitigation Measures continue to be carried out).

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
	lane of Nauvoo Road from the Site to Hwy 402 in the Off-Site Study Area	Key Assumptions: • Landfilling operational conditions are expected to remain the same under the Preferred Alternative and be consistent with current-approved Future Baseline operational requirements.	track out as long as mitigation measures continue to be carried out.	completed as needed and consist of sweeping, scraping with light equipment, hand raking/picking, along the roadways, road shoulders, and within the ditches. It is noted that the vegetative growth within Nauvoo Road's roadside ditch is cut as part of cleanup activities such that ASR does not remain entangled in tall vegetation in ditches.	

8.1.3.2 Surface Water Quantity

The effects assessment for the Preferred Alternative is summarized below from **Section 6.2.3.2**. The net effects assessment for the Preferred Alternative is presented in **Table 6-22**.

Change in Runoff Volumes and Peak Flows

The change in side slopes for the Preferred Alternative will not change total runoff volume from the landfill site; however, the timing of peak flows and the redistribution of catchment areas is expected to increase or decrease some of the peak flows leaving through the site outlets. Only four (4) outlets will experience changes in peak flows (Outlets A, B, C, and G). All other outlets show exactly the same peak flows leaving the site since the change in delineation of the catchments only occurred within the optimization area of the landfill. The changes for the 100-year 4-hour Chicago storm compared to Future Baseline Conditions are as follows:

- Outlet A: increase of 7%;
- Outlet B: decrease of 4%;
- Outlet C: decrease of 19%; and
- Outlet G: increase of 10%.

Stormwater Management (SWM) Pond 3 discharges flows to Outlets A and B, which show an increase and decrease of 7% and 4%, respectively. Outlet G shows an approximate increase of 10% in flows when compared to Future Baseline Conditions; however, it should be noted that the swales conveying the flows to Outlet G have sufficient capacity and are able to safely convey the flows downstream.

All four SWM ponds have enough capacity to store the 100-year flows and do not require alteration or enlargement. The existing swales around the landfill site are also able to safely convey the 25-year design storm without overtopping; hence, modification to the existing cross-section geometries is not warranted. The relocated swales and new culvert will also be able to convey these flows appropriately when constructed.

Changes in Drainage Areas On-Site and Off-Site

As a result of the new grading for the Preferred Alternative, the catchment delineation within the landfill optimization area will change when compared to Future Baseline Conditions. Changes in catchment areas within the landfill optimization area are between -22% and 34% when compared to Future Baseline Conditions.

Changes in off-site drainage areas are not anticipated for the Preferred Alternative because the site outlets will not change and the existing drainage areas are able to accommodate the changes in peak flows from the outlets.

Predicted Occurrence and Degree of Off-Site Effects

The downstream receiver of flows from Outlet A is the Auld-Redmond Drain and the downstream receiver of flows from Outlet G is the Gilliland-Geerts Drain. For the Preferred Alternative, both outlets show an increase in peak flows up to 10%. Mitigation is not required as the peak flows are less than 1 cubic metres per second (m^3/s) for Outlets A, B, and C, and 1.8 m^3/s for Outlet G. The off-site drainage areas will not be altered as a result of the Preferred Alternative.

Table 8-12. Surface Water Quantity Net Effects Assessment – Preferred Alternative

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Surface Water Quantity	Change in runoff volumes and peak flows resulting from steeper and longer side slopes	• Increase of final landfill side slopes from 4H:1V to 2.5H:1V between elevation 250 metres above sea level (masl) and elevation 310 masl, about 60 m in grade change, transitioning to a 20H:1V upper slope to a peak elevation of 319 masl over the Expansion Landfill footprint. • Changes in catchment areas within the landfill optimization area. • Four SWM ponds, existing swales and catchments D, E, F, H, I, and J will not be physically altered. • No change in total runoff volume from the landfill site.	• The timing of peak flows and the redistribution of catchment areas is expected to increase or decrease some of the peak flows leaving through the outlets. • Outlets A and G show an increase in peak flows compared to existing levels (up to 10%), while Outlets B and C demonstrate a decrease (up to 19%).	• No mitigation measures required.	• Increase in peak flows of up to 10% from Future Baseline Conditions.
	Changes in drainage areas on-site and off-site	• Changes in catchment areas within the landfill optimization area. • Four SWM ponds, existing swales and catchments D, E, F, H, I, and J will not be physically altered. • No change in off-site areas.	• Changes in catchment areas within the landfill optimization area are between -22% and 34% when compared to Future Baseline Conditions. • No change in off-site areas.	• No mitigation measures required.	• Changes in catchment areas within the landfill optimization area are between -22% and 34% when compared to Future Baseline Conditions. • No change in off-site areas.
	Predicted occurrence and degree of off-site effects	• Changes in catchment areas within the landfill optimization area. • No change in off-site areas. • No change in total runoff volume from the landfill site. • Existing monitoring is expected to continue for the landfill site.	• Increase in peak flows of up to 10% from Future Baseline Conditions. Peak flows are less than 1 m^3/s for Outlets A, B and C and 1.8 m^3/s for Outlet G.	• No mitigation measures required.	• Increase in peak flows of up to 10% from Future Baseline Conditions.

8.1.4 Ecological Environment

The Ecological Environment considers Terrestrial Ecosystems and Aquatic Ecosystems. The effects assessment for the Preferred Alternative is summarized below from **Section 6.2.4**.

8.1.4.1 Terrestrial Ecosystems

The net effects assessment for the Preferred Alternative is presented in **Table 8-13**.

Vegetation Communities and Species

No vegetation communities or species were identified within the Expansion Landfill footprint, so no direct impacts to vegetation communities and species are anticipated. While vegetation communities and species exist in the On-site and Off-site Study Areas, no excavation will occur outside the Expansion Landfill footprint, so no direct impacts are anticipated to vegetation communities and species.

Indirect impacts to vegetation communities and species are not anticipated as the Preferred Alternative is not expected to affect the functionality of the management systems in place for leachate collection, LFG production, and stormwater runoff. Although stormwater peak flow timing may change, modelling shows that existing stormwater ponds can handle 100-year flow scenarios under the Preferred Alternative.

Wildlife and Wildlife Habitat

No vegetation communities were identified in the approved limit of the landfill; therefore, no wildlife habitat is present within the active landfill area and no direct impacts to wildlife and wildlife habitat are anticipated (including to rare, threatened or endangered species). The continued operation of the landfill will prolong the attractiveness of the area for avifaunal scavengers, which will continue to be managed through the continued implementation of Gull Management Plan using acoustic deterrent devices and birds of prey.

Although no wildlife habitat (including significant wildlife habitat [SWH]) or rare, threatened or endangered species were identified in the approved limit of the Expansion Landfill, confirmed SWH types occur within the On-site and Off-site Study Areas including: amphibian breeding habitat (woodland); terrestrial crayfish habitat; and breeding habitat for the Species of Conservation Concern (SCC) species Western Chorus Frog. Within the On-site Study Area, potential breeding habitat may also be present for two other SCC, Eastern Wood-Pewee and Wood Thrush. When confirmed, important habitats of SCC are considered SWH. Within the Off-site Study Area, breeding habitat for Eastern Wood-Pewee was confirmed, and potential habitat was identified for three additional bird SCC: Wood Thrush; Canada Warbler; and Tufted Titmouse. Candidate amphibian breeding habitat (wetland) and bat maternity colony SWH may also be present within the Off-site Study Area.

In addition, natural features within the On-site and Off-site Study Areas have the potential to support habitat for Species at Risk (SAR) listed as Threatened or

Endangered and protected under the provincial *Endangered Species Act* including: Bobolink, Eastern Hog-nosed Snake; Eastern Small-footed Myotis; Little Brown Myotis; Northern Myotis; Tri-colored Bat; Eastern Red Bat; Silver-haired Bat; and Hoary Bat.

Since no excavation for the Project will be conducted outside of the Expansion Landfill footprint, no direct impacts to wildlife and wildlife habitat within the On-site and Off-site Study Areas are anticipated. Due to the adjacent SAR habitat, an Information Gathering Form (IGF) will be submitted to the MECP.

Indirect impacts to wildlife and wildlife habitat are also not anticipated as the Preferred Alternative is not expected to affect the functionality of the management systems in place for leachate collection, LFG production, and stormwater runoff. Although stormwater peak flow timing may change, modelling shows that existing stormwater ponds can handle 100-year flow scenarios under the Preferred Alternative.

No off-site indirect impacts to wildlife and wildlife habitat from noise are anticipated due to the implementation of noise mitigation measures.

Table 8-13. Terrestrial Ecosystems Net Effects Assessment – Preferred Alternative

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Terrestrial Ecosystems	Predicted effects on vegetation communities and species including rare, threatened, or endangered species	Key Design Considerations: • Management systems in place for leachate, LFG, and stormwater. • Increase in surface water quantity. • • Noise mitigation will continue as per current operations. • Site development footprint will be within the approved Expansion Landfill footprint. • Landfill operations – bird management will continue as per current operations. Assumptions: • No changes to traffic patterns • No changes to typical equipment used • No changes to operating hours	• None	• None	• None
	Predicted effects on wildlife and wildlife habitat including rare, threatened, or endangered species	Key Design Considerations: • Management systems in place for leachate, • LFG, and stormwater. • Increase in surface water quantity • . • Noise mitigation will continue as per current operations. • Site development footprint will be within the approved Expansion Landfill footprint. • Landfill operations – bird management will continue as per current operations. Assumptions: • No changes to traffic patterns • No changes to typical equipment used • No changes to operating hours	• Continued operation of landfill will prolong the attractiveness of the area for avifaunal scavengers.	• Continued implementation of Gull Management Plan using acoustic deterrent devices and birds of prey. • Due to adjacent SAR habitat, an Information Gathering Form (IGF) will be submitted to the MECP.	• Minimal with identified mitigation measures.

8.1.4.2 Aquatic Ecosystems

The net effects assessment for the Preferred Alternative is presented in **Table 8-14**.

Aquatic Habitat

No direct aquatic habitat features are located within the footprint of the Expansion Landfill, therefore, no direct impacts to aquatic habitat are anticipated.

Multiple watercourses that provide aquatic habitat are present in the On-site and Off-site Study Areas; however, since no excavation for the Project will be conducted outside of the Expansion Landfill footprint, no direct impacts to aquatic habitat within the On-site and Off-site Study Areas are anticipated. Indirect impacts to aquatic habitat, or downstream aquatic habitat features, are also not anticipated as the Preferred Alternative is not expected to affect the functionality of the management systems in place for leachate collection, LFG production, and stormwater runoff. Although stormwater peak flow timing may change, modelling shows that existing stormwater ponds can handle 100-year flow scenarios under the Preferred Alternative. As such no indirect impacts are anticipated to downstream aquatic habitat features.

Aquatic Biota

No direct aquatic habitat features are located within the footprint of the Expansion Landfill, therefore, no direct impacts to aquatic biota are anticipated (including to rare, threatened or endangered species). Multiple watercourses that support aquatic biota are present in the On-site and Off-site Study Areas; however, since no excavation for the Project will be conducted outside of the Expansion Landfill footprint, no direct impacts to aquatic habitat within the On-site and Off-site Study Areas are anticipated. Indirect impacts to aquatic habitat, or downstream aquatic habitat features, are also not anticipated as the Preferred Alternative is not expected to affect the functionality of the management systems in place for leachate collection, LFG production, and stormwater runoff.

Although stormwater peak flow timing may change, modelling shows that existing stormwater ponds can handle 100-year flow scenarios under the Preferred Alternative. The 75% TSS removal rate achieved by the existing SWM systems minimize the risk of impacts to downstream aquatic habitat features resulting from surface runoff and sediment transfer. No indirect impacts to downstream aquatic habitat features as a result of changes to stormwater runoff are anticipated.

Table 8-14. Aquatic Ecosystems Net Effects Assessment – Preferred Alternative

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Aquatic Ecosystems	Predicted effects on aquatic habitat, including fish habitat	Key Design Considerations: • Leachate runoff in the On-site and Off-site Study Areas. • LFG production. • Increase in surface water quantity. • Stormwater runoff in the On-site and Off-site Study Areas. • Noise mitigation will continue as per current operations. • Site development footprint will be within the approved Expansion Landfill footprint. • Landfill operations – bird management will continue as per current operations. Assumptions: • No changes to traffic patterns • No changes to typical equipment used • No changes to operating hours	• None	• None	• None
	Predicted effects on aquatic biota including rare, threatened, or endangered species	Key Design Considerations: • Leachate runoff in the On-site and Off-site Study Areas. • LFG production. • Increase in surface water quantity. • Stormwater runoff in the On-site and Off-site Study Areas, and downstream aquatic habitat features. • Noise mitigation will continue as per current operations. • Site development footprint will be within the approved Expansion Landfill footprint. • Landfill operations – bird management will continue as per current operations. Assumptions: • No changes to traffic patterns • No changes to typical equipment used • No changes to operating hours	• None	• None	• None

8.1.5 Social Environment

The Social Environment considers Human Health and Effects on the Local Community.

8.1.5.1 Human Health

The Human Health net effects assessment incorporates information from the Human Health Existing Conditions Report (**Supporting Document 1-7**) and details of the Project design provided in the CDR (**Supporting Document 2**). The study areas for Human Health correspond with the general study areas defined for the EA (**Section 4, Figure 4-1**). The detailed net effects assessment is provided in the Human Health Effects Assessment Report (**Supporting Document 3-7**).

The approach for the Human Health Effects Assessment was not to complete a reassessment of risk on a pathway-by-pathway point of view, other than the primary pathway of inhalation of air, soils and dusts; rather, the effects assessment evaluated whether there have been significant changes in chemicals or emissions from the TCEC compared to those modelled as part of the Human Health Risk Assessment (HHRA) conducted as part of the 2005 Warwick Landfill EA, and whether any of the exposure assumptions have changed, or the toxicological knowledge surrounding a given chemical has changed. By evaluating changes in emissions, the effects assessment can qualitatively evaluate the implications on each of the exposure pathways evaluated in the 2005 HHRA to determine whether the conclusions would still hold.

Construction and operation activities at a waste disposal site can lead to increased levels of particulates (dust) and related metals in the air, and waste disposal site and associated operations can emit gaseous contaminants that can degrade air quality. To identify the potential effects of the Project on Human Health, the conceptual design of the Preferred Alternative (Alternative Method 2) for the landfill optimization was examined to determine if it will have an effect on:

- predicted acute and chronic health-based concentration ratios (CRs) arising from air concentrations of PM (dust) and related metals, and gaseous contaminants at identified sensitive receptor locations within the Study Area; and
- frequency of any exceedance of applicable standards, limits, or guidelines from air concentrations at identified receptors.

The Contaminants of Concern (COC) for Human Health from the 2005 HHRA are listed in the Human Health Effects Assessment Report (**Supporting Document 3-7**). The only new COC to be flagged in the Human Health Existing Conditions Report (**Supporting Document 1-7**) as a potential risk based on the modelled emissions for the 2005 HHRA was hydrogen sulphide (H_2S) due to an increase in inhalation risk estimate of about 21-fold. This resulted in a worst-case predicted CR of 3.3 (i.e., a predicted concentration that is slightly higher than 3-fold above the 24-hour AAQC (regulatory value changed from 150 µg/m³ to 7 µg/m³).

For the modelling data for the Preferred Alternative, VOCs, and tailpipe contaminants were modelled for the maximum predicted concentrations at each of the discrete receptor locations for four scenarios: 1) end of Stage 1 of the vertical expansion; 2) end of Stage 2 of the vertical expansion; 3) end of Stage 4 of the vertical expansion; and 4) future no build scenario (the 'Do Nothing' Alternative). The maximum concentration out of Scenarios 1, 2, and 3 was selected for comparison with the 2005 HHRA and monitoring. For the rest of the contaminants, no additional modelling was conducted; instead, scaling factors were developed and applied to the modelling results from other contaminants to determine a reasonable ballpark estimate of potential concentrations. These scaling factors are presented in the Human Health Effects Assessment Report (**Supporting Document 3-7**). Many chemicals were measured at non-detect concentrations, and therefore did not represent a potential risk to human health. TSP was not modelled in the 2005 HHRA.

A review of recent toxicological literature for changes to the exposure limits applied to COCs described in the 2005 HHRA, and to identify exposure limits for new COCs, was completed as part of the Human Health Existing Conditions Report (**Supporting Document 1-7**). Exposure limits used in the 2005 HHRA were compared to the current exposure limits to determine if there was a reduction in risk, an increase in risk, or no change in risk, and the results are presented in the Human Health Effects Assessment Report (**Supporting Document 3-7**).

Predicted Acute and Chronic Health-Based Concentration Ratios Arising from Air Concentrations of Particulate Matter (Dust) and Related Metals at Identified Sensitive Receptor Locations within the Study Area

Measured concentrations of cadmium, lead, and nickel from the Annual Monitoring Reports were greater than the predicted emissions for ground-level air from the 2005 HHRA. In addition, predicted concentrations of PM_{10} for the Preferred Alternative were greater than the predicted emissions for ground-level air from the 2005 HHRA. However, when evaluated against the conclusions of the 2005 HHRA, the predicted risk for all of the chemicals were orders of magnitude below the health-based benchmarks.

Frequency of Exceedance of Applicable Standards, Limits, or Guidelines from Air Concentrations at Identified Receptors

The predicted risks for all chemicals were orders of magnitude below the health-based benchmarks; consequently, no exceedances were predicted.

Predicted Acute and Chronic Health-Based Concentration Ratios Arising from Air Concentrations of Gaseous Contaminants at Identified Sensitive Receptor Locations within the Study Area

The only new COC to be flagged as a potential risk based on the modeled emissions for the 2005 HHRA was H_2S as noted above.

Measured concentrations of benzene, 1,2-dichloroethane, trichloroethylene, and vinyl chloride from the Annual Monitoring Reports were greater than the predicted

emissions for ground-level air from the 2005 HHRA. In addition, predicted concentrations of 1,1-dichloroethane, butan-2-ol, 1,1,2-trichloroethane, 1,1,2,2-tetrachloroethane, 1,1-dichloroethylene, mercuric chloride, methyl mercury, methyl mercaptan, bromodichloromethane, octane, dimethyl sulphide, ethyl mercaptan, chloroethane, hydrogen chloride, benzo(a)pyrene, and carbon dioxide, and carbon monoxide for the Preferred Alternative were greater than the predicted emissions for ground-level air from the 2005 HHRA. However, when these chemicals were evaluated against the conclusions of the 2005 HHRA, the predicted risk for all of the chemicals were still orders of magnitude below the health-based benchmarks. Risks associated with benzo(a)pyrene, bromodichloromethane, 1,1,2,2-tetrachloroethane and vinyl chloride are anticipated to be minimal.

Frequency of Any Exceedance of Applicable Standards, Limits, or Guidelines from Air Concentrations at Identified Receptors

Although there is a potential risk to human health from H_2S due to the change in the toxicological benchmark, this is based on conservative predicted modelling completed in the 2005 HHRA. Overall, predicted concentrations of H_2S and TRS are dominated by elevated background levels; the predicted concentrations and impacts of H_2S and TRS from landfill operations at all discrete receptors and the property boundary are expected to be low.

The net effects assessment of the Preferred Alternative for Human Health is presented in **Table 8-15**.

Table 8-15. Human Health Net Effects Assessment – Preferred Alternative

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Human Health	Predicted acute and chronic health-based CRs arising from air concentrations of PM (dust) and related metals at identified sensitive receptor locations within the Study Area Frequency of any exceedance of applicable standards, limits, or guidelines from air concentrations at identified receptors	• The predicted concentrations of COCs in air in the year 2020 from the 2005 HHRA were compared to the data from the 2019, 2020, 2021, 2022 and 2023 Annual Monitoring Reports for air quality as well as for the Preferred Alternative. • A significant number of COCs were not listed in the 2019, 2020, 2021, 2022 and 2023 Annual Monitoring datasets as many of these are not included in standard monitoring regimes and were therefore theoretically modelled as was done for the 2005 HHRA. • Scaling factors were developed and applied to the modelling results from contaminants that weren't VOCs or tailpipe contaminants to determine a reasonable ballpark estimate of potential concentrations. • A review of recent toxicological literature for changes to the exposure limits applied to COCs described in the 2005 HHRA, and to identify exposure limits for new COCs, was completed. • Exposure limits used in the 2005 HHRA were compared to the current exposure limits to determine if there was a reduction in risk, an increase in risk, or no change in risk. • The current risks were also predicted using the current exposure limits and the expected	• Measured concentrations of cadmium, lead, and nickel from the Annual Monitoring Reports were greater than the predicted emissions for ground-level air from the 2005 HHRA. • Additionally, predicted concentrations of PM_{10} for the Preferred Alternative were greater than the predicted emissions for ground-level air from the 2005 HHRA. • However, when these chemicals were evaluated as to what these higher concentrations may mean with respect to the margin of safety indicated in the 2005 HHRA, the predicted risk for all chemicals under the Preferred Alternative was still orders of magnitude below the health-based benchmarks. • No exceedances were predicted on an annual average basis for either PM_{10} or $PM_{2.5}$. The degree of, and frequency of exceedance over the PM guidelines for 24-hr time frames for $PM_{2.5}$ were predicted to be extremely small (less than 1.3 times the guidelines, for less than 1 day/year in Year 6), and were restricted to only a very small area near the facility. The degree of, and frequency of, exceedance over guidelines for 24-hr time frames for PM_{10} was slightly greater than those predicted for $PM_{2.5}$, but still not considered to	• The TCEC has created a BMPP for dust that is implemented at the site and will be in effect during the Preferred Alternative. • Through the combined efforts of the Air Quality mitigation measures and implementation of the Dust BMPP, the number of total solid particles (TSP) exceedances will be limited during the periods of heavy construction and beyond.	• None

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
		impact on previous risk estimations.	represent a health concern due to the characteristics of the PM present at the TCEC.		
	Predicted acute and chronic health-based CRs arising from air concentrations of gaseous contaminants at identified sensitive receptor locations within the Study Area Frequency of any exceedance of applicable standards, limits, or guidelines from air concentrations at identified receptors	• The predicted concentrations of COCs in air in the year 2020 from the 2005 HHRA were compared to the data from the 2019, 2020, 2021, 2022 and 2023 Annual Monitoring Reports for air quality as well as for the Preferred Alternative. • A significant number of COCs were not listed in the 2019, 2020, 2021, 2022 and 2023 Annual Monitoring datasets as many of these are not included in standard monitoring regimes and were therefore theoretically modelled as was done for the 2005 HHRA. • Scaling factors were developed and applied to the modelling results from contaminants that weren't VOCs or tailpipe contaminants to determine a reasonable ballpark estimate of potential concentrations. • A review of recent toxicological literature for changes to the exposure limits applied to COCs described in the 2005 HHRA, and to identify exposure limits for new COCs, was completed. • Exposure limits used in the 2005 HHRA were compared to the current exposure limits to determine if there was a reduction in risk, an increase in risk, or no change in risk. • The current risks were also predicted using the current	• Predicted concentrations of 1,1-dichloroethane, butan-2-ol, 1,1,2-trichloroethane, 1,1,2,2-tetrachloroethane, 1,1-dichloroethylene, mercuric chloride, methyl mercury, methyl mercaptan, bromodichloromethane, octane, dimethyl sulphide, ethyl mercaptan, chloroethane, hydrogen chloride, benzo(a)pyrene, carbon dioxide, and carbon monoxide for the Preferred Alternative were greater than the predicted emissions for ground-level air from the 2005 HHRA. • Additionally, measured concentrations of benzene, 1,2-dichloroethane, trichloroethylene, and vinyl chloride from the Annual Monitoring Reports were greater than the predicted emissions for ground-level air from the 2005 HHRA. • However, when these chemicals were evaluated as to what these higher concentrations may mean with respect to the margin of safety indicated in the 2005 HHRA, the predicted risk for all chemicals under the Preferred Alternative was still orders of magnitude below the health-based benchmarks. • H_2S was flagged as a potential risk based on the modelled	• Recommended that PAHs, using benzo(a)pyrene as a surrogate, be added to the suite of chemicals being monitored in future air quality sampling events. • The Air Quality Existing Conditions Report has recommended that emissions of LFG should continue to be managed by routine maintenance of the final cap and interim cover areas.	• Risks associated with bromodichloromethane, 1,1,2,2-tetrachloroethane and vinyl chloride are anticipated to be minimal. • No measurable long-term or short-term adverse health impacts were predicted to occur as a result of exposure to LFG combustion emissions, with the exception of worst-case H_2S concentrations.

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
		exposure limits and the expected impact on previous risk estimations.	emissions for the 2005 HHRA due to an increase in inhalation risk estimate of about 21-fold. This resulted in a worst-case predicted CR of 3.3 or in other words a predicted concentration that is slightly higher than 3-fold above the 24-hour AAQC (regulatory value changed from 150 to 7 µg/m³). • Inhalation risks from the calculated Incremental Lifetime Cancer Risk (ILCR) values for benzo(a)pyrene (TEF) (slope factor [SF] of 1.23E-06), bromodichloromethane (SF of 1.04E-06), 1,1,2,2-tetrachloroethane (SF of 1.19E-06), and vinyl chloride (SF of 7.87E-06) were predicted.		

8.1.5.2 Effects on the Local Community

The effects assessment for the Preferred Alternative is summarized below from **Section 6.2.5.2**. The net effects assessment for the Preferred Alternative is presented in **Table 6-31**.

Number of Residents and Residences

Populations can increase or decrease as a result of residential land acquisition (resulting in the demolition of residences) and changes to employment (resulting in people moving to the area to be employed by the proponent) associated with landfill expansions. The Preferred Alternative is not anticipated to result in any changes to the number of employment positions at the TCEC, and the development will occur within the approved Expansion Landfill footprint, so no residential land acquisition is required; consequently, no changes to population (number of residents and residences) are anticipated within the Social Off-site Study Area as a result of the Project.

Number and Type of Local Businesses

The Preferred Alternative is not expected to change the number and type of local businesses. Procurement and provision of products and services are expected to continue as per current operations, and no business activities will be displaced by Project activities.

Nuisance Effects

Nuisance effects from the Project can include disturbance from odour, litter, dust, noise, traffic, and changes to the visual landscape. The assessment of nuisance effects for the Preferred Alternative is provided below by type of effect.

Odour

According to the responses to the Community Survey, 72% of respondents are very concerned about odour resulting from the Project, and 69% of respondents are very concerned that an increase in landfill-related odour may impact them personally.

The Preferred Alternative will increase the predicted concentrations of odour at discrete receptors compared to Future Baseline Conditions, and the frequency of exceedance and the number of affected receptors will vary depending on the stage of landfill operations. No additional mitigation measures to address changes in odour as a result of the Project were identified. WM will continue to implement the Odour BMPP to address odour issues.

Litter

Based on the responses to the Community Survey, 52% of respondents are concerned that an increase in litter resulting from the Project may impact them directly. The proposed height increase in the Preferred Alternative could lead to higher wind speeds at the landfill's working face, potentially raising the frequency of litter events; however,

the Litter BMPP is anticipated to effectively control blowing litter for the Preferred Alternative. As a result, the number of affected receptors is expected to remain unchanged compared to Future Baseline Conditions.

Dust

According to the results of the Community Survey, 35% of respondents are concerned about dust from the Project, while 54% are concerned that an increase in Project-related air emissions, including dust, may impact them directly.

The Preferred Alternative has the potential to increase predicted concentrations of dust at discrete receptors at some points during site operation compared to Future Baseline Conditions; and the frequency of exceedance and the number of affected receptors will vary depending on the stage of landfill operations. The Dust BMPP will continue to be implemented to address dust emissions from landfill operations.

Noise

Based on the results of the Community Survey, 26% of respondents are very concerned about noise from the Project, and 31% are very concerned that Project-related noise may impact them directly.

The most significant potential change in off-site noise levels arises from the reintroduction of landfilling equipment along the perimeter of the approved landfill extents. This could lead to noise levels at receptors exceeding daytime landfilling guidelines, particularly along the west and north portions of the landfill when equipment is closest. The Preferred Alternative has the potential for increased off-site noise due to modifications extending to the landfill limits.

To mitigate these effects, two primary strategies have been proposed. The first strategy is to construct temporary operational berms. Another mitigation strategy is to limit equipment near the perimeter; reducing the number of equipment, such as compactors and dozers operating near the landfill perimeter, which would help meet daytime landfilling noise guidelines. With these mitigations, the Preferred Alternative will result in no net effects to noise.

Traffic

According to the Community Survey, 47% of respondents were very concerned about Project-related traffic. The Preferred Alternative is not expected to have an effect on traffic. There will be no changes from current operations. Background traffic growth is the primary factor influencing future traffic volumes.

Visual Impact

According to the results of the Community Survey, 39% of respondents were very concerned about the visual effects of the Project, and 44% are very concerned about changes to their rural views.

The Visual Landscape Effects Assessment (**Section 6.2.7**) determined the magnitude of visual effects for each of the six (6) identified viewpoints and 121 receptors.

Simulated views of the Preferred Alternative were developed, and combined effect values (CEVs) were determined based on visible landfill area, distance to the site, horizontal angle of view, and visual absorption capacity. The total CEV for the Preferred Alternative is 77. Viewpoints 1, 3, and 5 are considered high CEV. Viewpoints 2 and 4 are considered moderate CEV, and Viewpoint 6 is considered low CEV. The Preferred Alternative was determined to have a high visual effect on 23 receptors, a moderate visual effect on 52 receptors, a low visual effect on 15 receptors, and no visual effect on 31 receptors. The receptors are shown on **Figure 8-2** along with the high and moderate impact zones for the Preferred Alternative, the six viewpoints, and the future existing viewshed.

Since the existing vegetated screening berms are not proposed to be altered, they will continue to grow and increase in height from the present day to the completion of Phase 5. The increase in the size and density of the trees will enhance the visual screening function of the vegetated berms.

A Property Value Protection (PVP) plan was developed after the 2005 EA to mitigate the potential effects from changes to the visual landscape resulting from the landfill; however, none of the eligible property owners have had to make use of the plan to-date, indicating that the real estate market has been good, and residents have been able to achieve their desired sale price. The PVP plan will be continued for the Preferred Alternative (refer to **Section 8.5**).

Use and Enjoyment of Property

Since the Preferred Alternative involves a vertical expansion, it is not anticipated to significantly impact existing land uses. The separation distance from Watford, along with the existing buffer zones, is expected to mitigate potential impacts such as noise and air quality issues to residents, off-site recreational resources, and sensitive land uses, provided that appropriate mitigation measures and nuisance controls are maintained or enhanced. Agricultural operations, which dominate the area surrounding the TCEC, are expected to experience minimal impact from the Project. The existing waste disposal footprint will not change.

For planned land uses, the existing approved waste disposal footprint will remain unchanged, ensuring that setback distances between the landfill and any planned developments are maintained. Future land uses near the landfill, particularly industrial uses, are expected to be compatible.

In the Community Survey, residents were asked how likely it would be that they would decrease their use of outdoor recreational facilities as a result of the Project. Forty-nine percent (49%) of residents said it was likely or somewhat likely. Based on the results of the Odour effects assessment (**Section 8.1.1.4**), recreational resources to the south of the TCEC site, such as the adjacent trail, may experience an increase in odour at the start of landfilling; however, the extent of the odour exceedance decreases as the landfill is developed since the working face will move from west to east. The Odour BMPP will continue to be implemented.

Although the Preferred Alternative could result in a minor increase in odour concentrations at off-site recreational resources to the south of the landfill footprint (e.g., the trail), the increased concentrations are unlikely to result in an overall change in use of property.

Consequently, changes to use and enjoyment of property from the Preferred Alternative are anticipated to be minor.

Level of Satisfaction with Living/Working in the Community

In the Community Survey, residents were asked how satisfied they are with the Township of Warwick as a place to live; 84% of respondents indicated that they were satisfied or somewhat satisfied with the Township as a place to live. When residents were asked about the likelihood that the Project would decrease level of satisfaction within living/working in the Township of Warwick, 62% of residents said it was likely or somewhat likely. Residents who answered likely or somewhat likely expressed concern about landfill size and odour emissions.

Odour and Visual Impact are addressed above. The nuisance level of odour from the Preferred Alternative is not likely to reach the population centre of Watford but rather will be experienced to the north and west of the landfill, mostly at the beginning of operations when the equipment will be working at the landfill perimeter. Views of the landfill from Watford (Viewpoint 4) are predicted to be moderate, and trees planted on the screening berms will continue to grow. Consequently, changes in the level of satisfaction with living and working in the community are predicted to be minor.

Confidence in TCEC Operations

In the Community Survey, 31% of respondents indicated that they are aware that the results of operations and compliance monitoring are reviewed by the Township, and 33% responded that they are aware of the weekly MECP landfill inspections. Almost half (47%) of respondents said that knowing about these activities increases their confidence in TCEC landfill operations. Thirty percent (30%) of respondents said their level of confidence in TCEC operations would not change as a result of the Project, while 27% said it was likely that their opinion of TCEC operations would decrease while 23% said it was somewhat likely.

Operations at the TCEC will continue with no changes to operating hours, haul routes, or equipment. Reviews of monitoring results, and weekly MECP inspections will continue as noted above. WM will continue to provide prompt attention to nuisance complaints to mitigate any adverse effects to the surrounding community. Consequently, no changes to confidence in TCEC operations are anticipated.

Table 8-16. Social Environment Net Effects Assessment – Preferred Alternative

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Social Environment					
Effects on Local Community	Number of residents and residences (e.g., receptors)	• Development of landfill optimization will occur within the currently approved Expansion Landfill footprint. • No changes to number of employment positions at the TCEC.	• No changes to number of residents and residences.	• None required	• No net effects
	Number and type of local businesses	• Development of landfill optimization will occur within the currently approved Expansion Landfill footprint. • Procurement and provision of products and services will continue as per current operations.	• No changes to number and type of local businesses. • No displacement of business activities.	• None required	• No net effects
	Nuisance effects (litter, dust, noise, odour, traffic, visual)	• Development of landfill optimization will occur within the currently approved Expansion Landfill footprint. • No changes to haul routes. • No changes to operating hours. • No changes to catchment area, vehicle origin-destination patterns, and hourly/daily trips. • No increase in the average daily tonnage. • Existing nuisance effect control and management measures will continue.	• Potential increase in predicted concentrations of odour at discrete receptors, frequency of exceedance at discrete receptors, and number of affected discrete receptors. • The proposed height increase could lead to higher wind speeds at the landfill's working face, potentially raising the frequency of litter events. • Potential increase in predicted concentrations of dust at discrete receptors, frequency of exceedance at discrete receptors, and number of affected discrete receptors. • Potential increase in off-site sound levels at receptors due to decreased	• WM will continue to implement the Odour BMPP to address odour emissions. • The Litter BMPP is anticipated to effectively control blowing litter. • WM will continue to implement the Dust BMPP to address dust emissions. • Construction of temporary operational berms when working along the landfill perimeter, and reduction in the number of equipment operating near	• Potential increases in predicted odour concentrations at discrete receptors; the frequency of exceedance and the number of affected receptors will vary depending on the stage of landfill operations. • Potential increases in predicted dust concentrations at discrete receptors at some points during site operation compared to Future Baseline Conditions; the frequency of exceedance and the number of affected receptors will vary depending on the stage of landfill operations.

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
			separation distance from the working face. • The continued use of the landfill beyond the approved design will prolong the attractiveness of the area for gulls and other avifaunal (bird) scavengers. • No changes to the overall volume of vehicles entering and exiting the TCEC. • Visual CEV of 77, with three high CEV viewpoints, two moderate CEV viewpoints, and one low CEV viewpoint. The Preferred Alternative was determined to have a high visual effect on 23 receptors, a moderate visual effect on 52 receptors, a low visual effect on 15 receptors.	the landfill perimeter. • WM will continue to provide prompt attention to nuisance complaints to mitigate any adverse effects to the surrounding community. • Avifaunal (bird) scavengers will continue to be managed following current protocols using deterrents. • Existing vegetated screening berms will continue to grow and increase in height. • Continuation of PVP plan.	• Visual CEV of 77, with three high CEV viewpoints, two moderate CEV viewpoints, and one low CEV viewpoint. The Preferred Alternative was determined to have a high visual effect on 23 receptors, a moderate visual effect on 52 receptors, a low visual effect on 15 receptors. • No net effects from litter, noise, birds, and traffic.
	Predicted changes to use and enjoyment of property	• Existing nuisance effect control and management measures will continue.	• Potential changes to use and enjoyment of property resulting from increases in odour at recreational areas located south of the landfill.	• WM will continue to implement the odour BMPP to address odour emissions.	• Minor changes to use and enjoyment of property are anticipated due to increased odour at recreational areas located south of the landfill.
	Level of satisfaction with living/working in the community	• Development of landfill optimization will occur within the currently approved Expansion Landfill footprint. • No changes to haul routes.	• Potential changes to the level of satisfaction with living and working in the community resulting from	• WM will continue to implement the odour BMPP to	• Minor changes in the level of satisfaction with living and working in the community due to

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
		• No changes to operating hours. • No changes to catchment area, vehicle origin-destination patterns, and hourly/daily trips. • No increase in the average daily tonnage. • Existing nuisance effect control and management measures will continue.	increases in odour and changes to the visual landscape.	address odour emissions. • Existing vegetated screening berms will continue to grow and increase in height.	increased odour and changes to the visual landscape.
	Confidence in TCEC operations	• Operations at the TCEC will continue with no changes to operating hours, haul routes, or equipment. • The Warwick Public Liaison Committee (WPLC), Technical Review Team (TRT), and MECP will continue their activities regarding the site (review, inspections).	• Potential changes to confidence in TCEC operations.	• WM will continue to provide prompt attention to nuisance complaints to mitigate any adverse effects to the surrounding community.	• No net effects.

8.1.6 Economic Environment

The Economic Environment considers Economic Effects on the Local Community.

8.1.6.1 Economic Effects on the Local Community

The effects assessment for the Preferred Alternative is summarized below from **Section 6.2.6**. The net effects assessment for the Preferred Alternative is presented in **Table 6-34**.

Employment at Site

The Preferred Alternative will not result in any changes to the number of employment positions; however, the existing 35 stable employment positions will continue for an additional 12 years.

Contributions to the Host Community

In the Community Survey, 48% of respondents said that continued host community fees would increase their support for the Project, while 52% said it would not; the latter respondents stated that the current level of payments by WM to the Township should be increased, were concerned about the long-term effects of the landfill, and wished for WM to continue paying host fees even after closure of the landfill.

It is expected that WM will continue its host community contributions, municipal tax payments, and community support under the Preferred Alternative. Based on the average annual contributions under the current Host Community Agreement, estimated at approximately $4.1 million, host community payments for the duration of the Preferred Alternative are estimated to amount to approximately $50 million. The host community payments amount to approximately 24% of the Township's total gross annual operating budget and approximately 36% of the Township's total municipal revenue. Based on the trend of increasing tax rates over the past 5 years, it is conservatively assumed that WM's property tax contribution will continue to form at least 3.5% of the Township's property tax revenue for the duration of the Preferred Alternative. WM will also continue to contribute to community projects.

Provision and Procurement of Products and/or Services

WM relies on a variety of local vendors to maintain its operations at the TCEC. Local community contributions are expected to continue under the Preferred Alternative. Based on an annual average of $2.5 million in local expenditures, an estimated $30 million will be contributed to the local economy over the duration of the Preferred Alternative.

In the Economic Survey, 60% of businesses identified that continued operation would be important for their businesses, indicating that continued landfill operation would be positive and potentially result in future business. The same percentage of businesses indicated that they would be negatively affected by the landfill closure, which would result in lost income, sales, and work, effects to their employees.

Table 8-17. Economic Environment Net Effects Assessment – Preferred Alternative

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Economic Environment					
Economic Effects on Local Community	Employment at site (number, type, and duration)	• No additional employment positions will be created as a result of the future development beyond the current number of positions.	• Existing 35 stable employment positions will continue for an additional 12 years during operation of the Preferred Alternative.	• None required.	• Existing 35 stable employment positions will continue for an additional 12 years during operation of the Preferred Alternative.
	Contributions to the host community	• Municipal contributions will continue as per current operations.	• Based on the average annual contributions under the current Host Community Agreement, estimated at approximately $4.1 million, host community payments for the duration of the Preferred Alternative are estimated to amount to approximately $50 million. • Based on the trend of increasing tax rates over the past 5 years, it is conservatively assumed that WM's property tax contribution will continue to form at least 3.5% of the Township's property tax revenue for the duration of the Preferred Alternative. • WM will continue to contribute to community projects during operation of the Preferred Alternative.	• None required.	• Based on the average annual contributions under the current Host Community Agreement, estimated at approximately $4.1 million, host community payments for the duration of the Preferred Alternative are estimated to amount to approximately $50 million. • Based on the trend of increasing tax rates over the past 5 years, it is conservatively assumed that WM's property tax contribution will continue to form at least 3.5% of the Township's property tax revenue for the duration of the Preferred Alternative. • WM will continue to contribute to community projects during operation of the Preferred Alternative.
	Opportunities for the provision and procurement of products and/or services	• The TCEC will continue to require goods and services from local businesses and provide services at the same rates as required for current operations.	• Based on an annual average of $2.5 million in local expenditures, an estimated $30 million will be contributed to the local economy over the duration of the Preferred Alternative.	• None required.	• Based on an annual average of $2.5 million in local expenditures, an estimated $30 million will be contributed to the local economy over the duration of the Preferred Alternative.

8.1.7 Visual Landscape

Visual Landscape considers the Visual Impact of the Facility.

8.1.7.1 Visual Impact of Facility

The effects assessment for the Preferred Alternative is summarized below from **Section 6.2.7**. The net effects assessment for the Preferred Alternative is presented in **Table 8-19**.

Table 6-39 provides a summary of the assessment data for the Preferred Alternative and indicates that the CEV for the six viewpoints (**Figure 6-3** in **Section 6**) is three with a high effect, two with a medium effect and one with a low effect. The total CEV for all six viewpoints for the Preferred Alternative is 77. The visual simulations of the Preferred Alternative from each of the viewpoints are provided in **Figure 8-1**.

Table 8-18. Combined Effect Value – Preferred Alternative

Viewpoint No.	Combined Effect Value 13-20 High 9-12 Moderate ≤8 Low
1	17
2	9
3	14
4	12
5	17
6	8
TOTAL	**77**

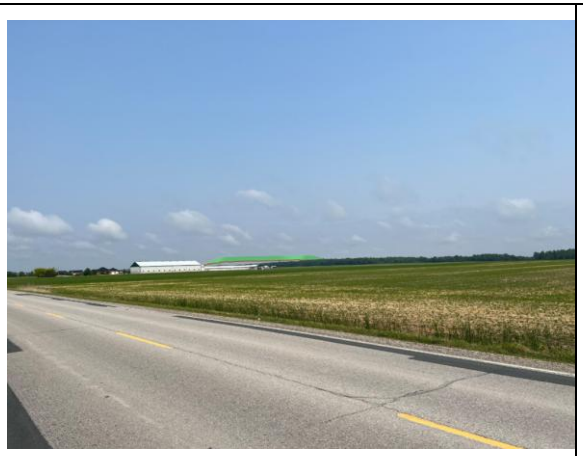
To complete the effects assessment of the Preferred Alternative, receptors were used to generate visual assessment data. For the Preferred Alternative, 121 receptors were identified and assessed for visual impacts, and a CEV was calculated for each receptor.

For receptors and viewpoints that were determined to experience a ‘High Effect’, the view of the Preferred Alternative would demand the viewer’s attention. For receptors and viewpoints that were determined to experience a ‘Moderate Effect’, the view of the Preferred Alternative would be reduced in scale (i.e., would not dominate the view) as a result of the distance from the site, presence of screening elements such as woodlands, topography, and/or existing buildings/structures. For receptors and viewpoints that are determined to experience a ‘Low Effect’, the Preferred Alternative would be expected to blend into the existing landscape and would not be identifiable when viewed from the receptor or viewpoint.

Figure 8-1. Preferred Alternative from Viewpoints 1 to 6



Viewpoint 1 – Preferred Alternative



Viewpoint 2 – Preferred Alternative



Viewpoint 3 – Preferred Alternative



Viewpoint 4 – Preferred Alternative



Viewpoint 5 – Preferred Alternative



Viewpoint 6 – Preferred Alternative

The receptors are shown on **Figure 8-2** along with the high and moderate impact zones for the Preferred Alternative and the approved Expansion Landfill (i.e., 'Do Nothing' Alternative), the six viewpoints, and the future existing viewshed. The Preferred Alternative was determined to have a high visual effect on 23 receptors, a moderate visual effect on 52 receptors, a low visual effect on 15 receptors, and no visual effect on 31 receptors.

Figure 8-2. Visual Impact Zones and Receptors for the Preferred Alternative and 'Do Nothing' Alternative

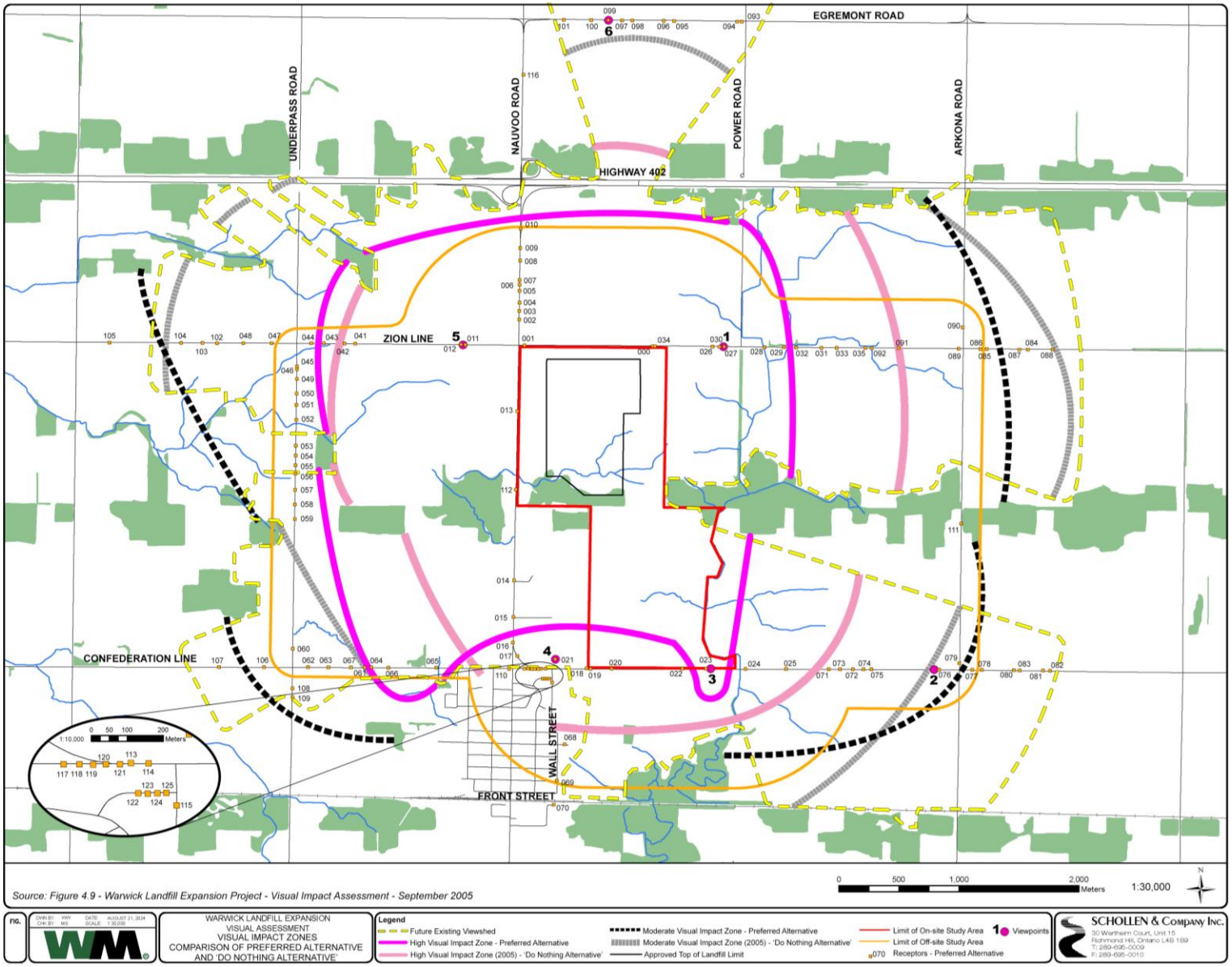


Table 8-19. Visual Landscape Net Effects Assessment – Preferred Alternative

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects

Visual Impact of the Facility	Predicted changes in perception of landscape and views	• Elevation of the top of the Preferred Alternative Method: 319.0 masl
		• Increase in height above approved top of waste elevation: 39.0 m
		• Topographic form: Plateau
		• Area of landform profile:
		  • North = 21,403.33 square metres (m²)
		  • East = 34,977.21 m²
		  • South = 21,042.97 m²
		  • West = 34,977.17 m²
		• Future existing condition corresponds with Year 26 of the approved Expansion Landfill
			Total CEV values for six viewpoints:
			• High = 48
			• Moderate = 21
			• Low = 8
			
			Total CEV = 77
			
			The Preferred Alternative was determined to have a high visual effect on 23 receptors, a moderate visual effect on 52 receptors, a low visual effect on 15 receptors.
				• None proposed – Existing screen plantings will increase in height and density	Total CEV values for six viewpoints:
					• High = 48
					• Moderate = 21
					• Low = 8
					
					Total CEV = 77
					
					The Preferred Alternative was determined to have a high visual effect on 23 receptors, a moderate visual effect on 52 receptors, a low visual effect on 15 receptors.

8.1.8 Cultural Environment

The Cultural Environment considers Cultural Heritage Resources and Archaeological Resources.

8.1.8.1 Cultural Heritage Resources

The effects assessment for the Preferred Alternative is summarized below from **Section 6.2.8.1**. The net effects assessment for the Preferred Alternative is presented in **Table 8-20**.

Proximity of Known or Potential Cultural Heritage Resources

Direct impacts

The Preferred Alternative is not anticipated to result in direct impacts to built heritage resources (BHRs) 1 through 3 or Cultural Heritage Landscapes (CHLs) 1 through 19. While a large portion of CHL 1 (Lot 20-21, Concession 4) is within the On-Site Study Area, none of the proposed work associated with the Preferred Alternative is anticipated to be within the limits of the CHL. CHL 1 is therefore no longer representative of its historical agricultural use due to undergoing considerable alterations.

No mitigation is required and no net effects to the identified heritage attributes of the BHRs and CHLs through direct impacts are anticipated as a result of the work associated with the Preferred Alternative.

Indirect Impacts

Indirect impacts to CHL 5 (Zion Line) are anticipated as a result of the proposed work associated with the Preferred Alternative, including changes to the viewscapes over agricultural fields from the roadway. These changes are not expected to result in adverse effects to CHL 5 as the views toward the TCEC site have already been significantly impacted, and the relationship between Zion Line and the surrounding area is no longer representative of the historical agricultural context of the roadway.

The Preferred Alternative is not anticipated to result in indirect impacts to BHRs 1 through 3 or CHLs 1 through 4 and 6 through 19. No mitigation is required and no net effects to the identified heritage attributes of the BHRs and CHLs through indirect impacts are anticipated as a result of the work associated with the Preferred Alternative.

Table 8-20. Cultural Heritage Resources Net Effects Assessment – Preferred Alternative

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Cultural Heritage Resources	Direct Impacts	• The construction and operation of the Preferred Alternative will take place within the existing On-site Study Area. • The landfill expansion will occur within the existing approved Expansion Landfill footprint. • The buildout of the landfill in the northeast corner will move the bordering swales to the east and new culvert will be constructed south of SWM pond 4.	• No direct impacts are anticipated to the identified BHRs and CHLs.	• None required	• No net effects to the heritage attributes of identified BHRs and CHLs.
	Indirect Impacts	• Vibration related to any and all construction activities. • The construction and operation of the Preferred Alternative will take place within the existing On-site Study Area. • The landfill expansion will occur within the existing approved Expansion Landfill footprint. • The buildout of the landfill in the northeast corner will move the bordering swales to the east and new culvert will be constructed south of SWM pond 4. • Shadows and obstructed views created by the vertical expansion of the landfill.	• Indirect impacts to CHL 5 through changes to historical agricultural viewscapes. Impacts have been determined to not adversely impact the CHL's heritage attributes.	• None required	• No net effects to the heritage attributes of identified BHRs and CHLs.

8.1.8.2 Archaeological Resources

The effects assessment for the Preferred Alternative is summarized below from **Section 6.2.8.2**. The net effects assessment for the Preferred Alternative is presented in **Table 8-21**.

Archaeological Resources and Areas of Archaeological Potential On-Site

Archaeological site AfHl-14 is located within the southeast corner of the On-site Study Area and is the only archaeological site relevant to the Project. The remainder of the On-site Study Area beyond the protected limits of AfHl-14 was previously assessed and has no further archaeological concern.

The landfill optimization will be located within the approved Expansion Landfill footprint and archaeological site AfHl-14 will not be impacted by the construction and operation of the Preferred Alternative. There is no potential for the disturbance of unassessed or documented archaeological resources and there are no net effects for the Preferred Alternative.

Cemetery Property Within Approximately 10 metres

A historic cemetery, Watford Cemetery, is located over 200 m from the approved Expansion Landfill footprint. The Stage 1 Archaeological Assessment (AA) determined that no cemetery investigation is required for the Project. The entire area of the Preferred Alternative is within the On-site Study Area and therefore there will be no impacts to the cemetery property. There is no potential for the disturbance of the cemetery and there are no net effects for the Preferred Alternative.

Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48(1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out an AA, 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 notify the police or coroner and the Registrar of Cemeteries at the Ministry of Public and Business Services Delivery and Procurement, 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 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 8-21. Archaeological Resources Net Effects Assessment – Preferred Alternative

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Archaeological Resources	Archaeological resources and areas of archaeological potential on-site and predicted impacts on them	• The construction and operation of the Preferred Alternative will take place within the existing On-site Study Area. Landfill expansion will only be occurring within the approved Expansion Landfill footprint • There will be no change to any Off-site activities associated with the Project • Archaeological site AfHl-14 is located in the southeastern corner of the TCEC site and will not be impacted by the construction and operation of the Preferred Alternative • The Stage 1 AA determined that the remainder of the On-site Study Area beyond the protected area of site AfHl-14 has been previously assessed and has no further archaeological concern	• No potential for the disturbance of unassessed or documented archaeological resources • Site AfHl-14 has further cultural heritage value or interest and has been protected in perpetuity with the establishment of a protective 10 metre buffer and surrounding conservation area upon the completion of a Stage 3 site-specific assessment in 2007 (P057-307-2006 and P057-374-2007). Continued avoidance and protection is required for the site should the area be impacted by any construction and operation activities.	• None required; however, should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48(1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out an 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 notify the police or coroner and the Registrar of Cemeteries at the Ministry of Public and Business Services Delivery and Procurement, 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 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*.	• No net effects on on-site Archaeological Resources and areas of archaeological potential
	Cemetery property within approximately 10 metres of	• The construction and operation of the Preferred Alternative will take place within the existing On-site	• No potential for the disturbance of the cemetery	• None required	• No net effects on Archaeological Resources

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
	the proposed impacts	Study Area Landfill design and geometry. landfill expansion will only be occurring within the approved Expansion Landfill footprint • There will be no change to any Off-site activities associated with the Project • A historic cemetery, Watford Cemetery, is located adjacent to the western portion of the TCEC site. • The Stage 1 AA determined that no cemetery investigation is required for the Project.			

8.1.9 Transportation

Transportation considers Traffic Operations. The effects assessment for the Preferred Alternative is summarized below from **Section 6.2.9**. The net effects assessment for the Preferred Alternative is presented in **Table 8-22**.

8.1.9.1 Traffic Operations

Peak Hour and Daily Truck Traffic Volumes and Average Annual Daily Traffic

Site traffic volumes in and out of the site were assumed to be the same as existing volumes for both 2032 and 2043 future conditions under the Preferred Alternative. Traffic volumes are presented in the Transportation Effects Assessment Report (**Supporting Document 3-12**). No effects are predicted and no mitigation measures are required.

Intersection Performance

RC Spencer & Associates conducted an Intersection Improvement Study entitled "C.R. 79 / C.R.39 Watford, ON Intersection Improvement Study" dated June 2022 for the intersection of Confederation Line and Nauvoo Road. The study concluded that the intersection should remain under east-west stop-control but should be improved to provide exclusive left turn lanes on all approaches with shared through-right turn lanes. This would entail the removal of the northbound right-turn lane as well as the channelized westbound right turn lane[17]. This proposed lane configuration was adopted for traffic analyses under 2032 and 2043 future conditions.

Under 2032 conditions with the Project, when compared with background conditions, all intersection approach or movement Level of Service (LOS) values will remain the same. There are nominal increases in the volume to capacity (v/c) ratios, however, these increases are small, and all movements are expected to continue operating within acceptable thresholds, with 95th percentile queues under total future conditions nearly identical to 2032 Future Baseline Conditions. TCEC site traffic is anticipated to have negligible impact on queues at all Off-site Study Area intersections except at the TCEC site entrance.

Under 2043 conditions with the Project, most turning movements will operate with similar LOS compared to background conditions; however, there are two movements that are predicted to change due to increasing background traffic: the westbound left-turn at Nauvoo Road and Confederation Line, which would increase from LOS E to LOS F for the PM peak hour (change in control delay of 2.7 seconds); and the eastbound left-turn which would increase from LOS D to LOS E for the a.m. peak hour (change in control delay of 1.5 seconds). There are nominal increases in the v/c ratios

[17] The study recommended that operations be monitored for potential conversion to a traffic signal, when warranted; however, the mode of control has been assumed to remain stop-controlled for the effects assessment.

(0.01 to 0.02), and all movements are expected to operate within acceptable thresholds, with 95th percentile queues under total future conditions nearly identical to 2043 Future Baseline Conditions.

No effects are predicted and no mitigation measures are required.

Road Safety

Cycling volumes are very low within the study area, and there were no collisions with cyclists identified. Furthermore, there were no indications that cycling safety is a concern nor indications that traffic associated with the TCEC would generate safety concerns for cyclists.

Pedestrian volumes are also low, particularly across Nauvoo Road, and no pedestrians were observed north of Confederation Line. Similar to cycling, no pedestrian collisions were identified, and there are no indications of safety concerns related to pedestrians, nor indications that traffic associated with the TCEC would generate safety concerns for pedestrians.

Collision rates are not expected to change as a result of the Project. The effects assessment found no relationship between truck traffic generated by the TCEC and collisions within the Off-site Study Area. While background traffic volumes may increase over time, any potential rise in collision rates is not expected to be linked to the Project.

No effects are predicted and no mitigation measures are required.

Sight Distance at the Primary Site Entrance

The TCEC site entrance will remain unchanged compared to existing conditions; therefore, no effects are predicted.

Table 8-22. Traffic Operations Net Effects Assessment – Preferred Alternative

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Traffic Operations	Change in peak hour and daily truck traffic volume and Average Annual Daily Traffic (AADT) along the Off-site Study Area road segments	• Changes in traffic volumes within Off-site Study Area is the result of background growth and background developments. • TCEC site traffic will not change under 2032 and 2043 future conditions.	• No changes as a result of Preferred Alternative under future conditions. As a result, TCEC will not have any effects on Off-site Study Area in 2032 and 2043 future conditions.	• No mitigation measures required in 2032 and 2043 future conditions.	• No effects predicted.
	Intersection performance – capacity, delay, queues (based on Highway Capacity Manual [HCM] 2000 and generated by Synchro Traffic Signal Coordination Software Version 11) – for the Off-site Study Area intersections	• Exclusive left turn lanes with shared through-right lanes at Confederation Line and Nauvoo Road are assumed to be in place by the 2032 horizon year.	• No changes as a result of Preferred Alternative under future conditions. As a result, TCEC will not have any effects on Off-site Study Area in 2032 and 2043 future conditions.	• No mitigation measures required in 2032 and 2043 future conditions.	• No effects predicted.
	Road safety • Collisions per million vehicles at all Off-site Study Area intersections (severity, involving pedestrians, cyclists, autos, trucks, school buses, and agricultural vehicles) • Collisions per million vehicle-km along all Off-site Study Area road segments (severity, involving pedestrians, cyclists, autos, trucks, school buses, and agricultural vehicles) • Collisions by environmental conditions for segments and intersections	• TCEC site traffic will not change under 2032 and 2043 future conditions.	• No changes as a result of Preferred Alternative under future conditions. As a result, TCEC will not have any effects on Off-site Study Area in 2032 and 2043 future conditions.	• No mitigation measures required in 2032 and 2043 future conditions.	• No effects predicted.
	Sight distance at the primary site entrance	• TCEC site driveway will remain unchanged compared to existing conditions.	• No changes from TCEC site under future conditions. As a result, there are no impacts to consider.	• No mitigation measures required in 2032 and 2043 future conditions.	• No effects predicted.

8.1.10 Current and Planned Future Land Use

Current and Planned Future Land Use considers Effects on Current and Future Land Uses. The effects assessment for the Preferred Alternative is summarized below from **Section 6.2.10**. The net effects assessment for the Preferred Alternative is presented in **Table 8-23**.

Current Land Use

The existing separation distance between the Village of Watford from the landfill, as well as the pre-existing permanent buffer areas, are anticipated to mitigate against potential impacts and land use compatibility issues, including from noise and air quality, assuming appropriate mitigation measures and nuisance controls currently employed by WM are maintained and/or additional measures are implemented.

Current land uses within 500 m of the landfill fill area will be subject to consultation with the Province prior to a *Planning Act* approval being adopted or granted, in the case of new development (i.e., expansion of current use) or a proposed change of land use; however, current land uses within 500 m are permitted to exist and function pursuant to Section 34(9) of the *Planning Act*.

Under the Preferred Alternative, no changes to the landfill footprint are proposed, and therefore, existing setback distances between the TCEC operation and any residences within the agricultural land use designation outside the Watford Settlement Area, will be maintained. Proactive nuisance controls will continue to be employed by WM to minimize nuisance effects related to odour, litter, dust, noise, and birds on the surrounding environment.

Any industrial land uses within the Off-site Study Area are not considered sensitive; as such, industrial and manufacturing uses are compatible uses with the landfill and will not be as susceptible to potential impacts.

In summary, there are no significant effects on the current residential, commercial, parks and open space, institutional, and commercial industrial land uses within the Off-site Study Area, including the entire settlement area of Watford, anticipated as a result of the proposed vertical expansion in the Preferred Alternative.

An amendment to the County of Lambton Official Plan (County OP) and the Township of Warwick OP (Local OP) is required for the Preferred Alternative; specifically, a new OP Amendment is required in response to the updated policy framework of the County OP and Local OP, which require an amendment to the County OP and Local OP prior to the establishment of new waste management facilities or the expansion of existing waste management facilities (s.s. 7.11.5, County OP; s.s. 13.12, Local OP).

An amendment to the Township of Warwick Zoning By-Law (Township ZBL) will also be required to reference the approval of this EA (if approved), as the current zoning on the TCEC site references the EA approved on January 15, 2007.

The Preferred Alternative will require an amendment to the existing Site Plan Control Agreement registered on title, under Section 41 of the *Planning Act*, to permit expansion to the existing landfill with reference to the new EA approval.

Planned Land Use

Planned land use development will be subject to Provincial, County, and/or Municipal policies and/or regulations to ensure compatibility between sensitive land uses and the TCEC. As such, it is anticipated that planned land uses in proximity to the landfill site will be compatible with the landfill use (i.e., industrial uses) and, if a planned sensitive land use is proposed, appropriate measures may be implemented in accordance with Provincial, County, and/or Municipal policies and/or regulations (i.e., appropriate setbacks). The existing buffer area surrounding the landfill site will not change under the Preferred Alternative.

Existing mitigation measures in use at the TCEC will continue or be enhanced as detailed in other effects assessments in **Supporting Document 3**. In summary, there are no significant effects on planned land uses anticipated as a result of the Preferred Alternative.

Type(s) and Proximity of Off-Site Recreational Resources within 1 km

Under the Preferred Alternative, the approved landfill footprint will not change and thus the setback distance between the TCEC operation and any off-site recreational resources will be maintained. If changes in land use are proposed at the off-site recreational areas within 500 m of the landfill, the changes would be subject to consultation with the Province before a *Planning Act* approval is adopted or granted. Existing off-site recreational land uses within 500 metres of the landfill site are permitted to exist pursuant to Section 34(9) of the *Planning Act*.

In summary, there are no significant effects on off-site recreational resources anticipated as a result of the Preferred Alternative.

Type(s) and Proximity of Off-Site Sensitive Land Uses

Under the Preferred Alternative, the approved landfill footprint will not change and thus the setback distance between the TCEC operation and existing off-site sensitive land uses will be maintained.

The existing separation distance between Watford and the landfill, and the pre-existing permanent buffer areas, are anticipated to mitigate against potential impacts and land use compatibility issues, including noise and air quality, assuming appropriate mitigation measures currently employed by WM are maintained and/or additional measures are implemented. In summary, there are no significant effects on existing off-site sensitive land uses anticipated as a result of the Preferred Alternative.

Type(s) and Proximity of Agricultural Land Use/Operations

Under the Preferred Alternative, no significant effects on existing agricultural land use and associated operations are anticipated; the existing landfill footprint will not change.

Expansion of existing agricultural operations will be subject to Provincial, County, and/or Municipal policies and/or regulations to ensure compatibility between the agricultural operation and the TCEC; however, current agricultural land uses and their associated operations within 500 m of the landfill site are considered permitted to exist pursuant to Section 34(9) of the *Planning Act*.

Table 8-23. Current and Future Land Uses Net Effects Assessment – Preferred Alternative

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Effects on Current and Future Land Uses	Current land use	• Current land uses and their locations in proximity to the TCEC will remain as they exist at the time of project commencement. • Under the proposed vertical expansion, the existing approved waste disposal footprint area of the TCEC would not change; the maximum permitted height of waste would be increased. • The Preferred Alternative proposes the smallest elevation maximum for vertical expansion, compared between the three Alternative Methods. • The existing visual impact mitigation measures are anticipated to effectively screen views. • Permanent minimum buffer areas prescribed in the Local OP and Township ZBL will remain. • The establishment of an expanded landfill triggers municipal and provincial policies that restrict sensitive land uses in the Off-site Study Area. • It is anticipated that existing nuisance controls performed by WM at the TCEC will be continued and/or enhanced pending the results of the Effects Assessment reporting completed by other technical consultants (i.e., Air Quality, Archaeology, Cultural Heritage, Ecological Environment, Hydrogeological, Surface Water, Transportation, Noise, and Human Health).	• No significant impacts to the residential, commercial, parks and open space, institutional, and commercial industrial land uses within the settlement area of Watford are anticipated. The existing separation distance between the Village from the landfill site is anticipated to mitigate against potential impacts and land use compatibility issues. • Current land uses within 500 m of the landfill fill area will be subject to consultation with the Province before a *Planning Act* approval is adopted or granted, in the case that new development or change of land use is proposed. • The existing approved waste disposal footprint area of the TCEC would not change and, as such, existing setback distances between the TCEC operation and any current land uses will be maintained. No significant effects anticipated. • The Preferred Alternative will require new planning approvals (County and Local OP, Township ZBL,	• Maintain previously approved setback and buffer distances, and existing berming. • Continued employment or enhancement of nuisance controls by WM, related to odour, litter, dust, noise and birds on the surrounding environment.	• No significant net effects anticipated between the TCEC operation and any current land uses; setback distances are maintained. Legally established existing land uses (considered sensitive) within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*) • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls. • The Preferred Alternative will require new planning approvals (County and Local OP, Township ZBL, and Site Plan Control), and result in continued restrictions for surrounding land uses for an additional 12 years.

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
			and Site Plan Control), and result in continued restrictions for surrounding land uses for an additional 12 years.		
	Planned land use	• Planning land uses will be in keeping with the general land use schedule as it exists in the County OP and Local OP. • Under the proposed vertical expansion, the existing approved waste disposal footprint area of the TCEC would not change, but rather, the maximum permitted height of the waste would be increased. • The Preferred Alternative proposes the smallest elevation maximum for vertical expansion, compared between the three Alternative Methods. • Permanent minimum buffer areas prescribed in the Local OP and Township ZBL will remain. • The establishment of an expanded landfill, as well as any proposed future development potential in proximity to the landfill site, triggers municipal and provincial policies that restrict sensitive land uses in the Off-site Study Area. • It is anticipated that existing nuisance controls performed by WM at the TCEC will be continued and/or enhanced pending the results of the Effects Assessment reporting completed by other technical consultants (i.e., Air Quality, Archaeology, Cultural Heritage, Ecological Environment, Hydrogeological, Surface Water,	• The existing approved waste disposal footprint area of the TCEC would not change and, as such, existing setback distances between the TCEC operation and any planned land uses will be maintained. No significant effects anticipated. • Planned land use development (i.e., expansion of current use or new uses) will be subject to Provincial, County, and/or Municipal polices and/or regulations to ensure compatibility between planned sensitive uses and the existing and/or newly expanded TCEC operation.	• Maintain previously approved setback and buffer distances, and existing berming. • Continued employment or enhancement of nuisance controls by WM, related to odour, litter, dust, noise and birds on the surrounding environment.	• No significant net effects anticipated between the TCEC operation and any planned land uses; setback distances are maintained. • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls.

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
		Transportation, Noise, and Human Health).			
	Type(s) and proximity of off-site recreational resources within 1 km of a landfill footprint potentially affected	• Under the proposed vertical expansion, the existing approved waste disposal footprint area of the TCEC would not change, but rather, the maximum permitted height of the waste would be increased. • The Preferred Alternative proposes the smallest elevation maximum for vertical expansion, compared between the three Alternative Methods. • Permanent minimum buffer areas prescribed in the Local OP and Township ZBL will remain. • The establishment of an expanded landfill, as well as any proposed future development potential in proximity to the landfill site, triggers municipal and provincial policies that restrict sensitive land uses in the Off-site Study Area. • It is anticipated that existing nuisance controls performed by WM at the TCEC will be continued and/or enhanced pending the results of the Effects Assessment reporting completed by other technical consultants (i.e., Air Quality, Archaeology, Cultural Heritage, Ecological Environment, Hydrogeological, Surface Water, Transportation, Noise, and Human Health).	• The existing approved waste disposal footprint area of the TCEC would not change and, as such, existing setback distances between the TCEC operation and off-site recreational resources will be maintained. No significant effects anticipated.	• Maintain previously approved setback and buffer distances, and existing berming. • Continued employment or enhancement of nuisance controls by WM, related to odour, litter, dust, noise and birds on the surrounding environment.	• No significant net effects anticipated between the TCEC operation and any off-site recreational resources; setback distances are maintained. Existing off-site recreational resources (considered sensitive) within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*) • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls.
	Type(s) and proximity of off-site sensitive	• Under the proposed vertical expansion, the existing approved waste disposal footprint area of the TCEC would not change, but rather,	• The existing approved waste disposal footprint area of the TCEC would not change and, as such, existing setback distances	• Maintain previously approved setback and buffer distances, and existing berming.	• No significant net effects anticipated between the TCEC operation and any sensitive land use;

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
	land uses as defined by the Provincial Policy Statement (now Provincial Planning Statement) and the MECP D-1 Guidelines (e.g., dwellings, churches, parks) within 1 km of a landfill footprint potentially affected	the maximum permitted height of the waste would be increased. • The Preferred Alternative proposes the smallest elevation maximum for vertical expansion, compared between the three Alternative Methods. • Permanent minimum buffer areas prescribed in the Local OP and Township ZBL will remain. • The establishment of an expanded landfill, as well as any proposed future development potential in proximity to the landfill site, triggers municipal and provincial policies that restrict sensitive land uses in the Off-site Study Area. • It is anticipated that existing nuisance controls performed by WM at the TCEC will be continued and/or enhanced pending the results of the Effects Assessment reporting completed by other technical consultants (i.e., Air Quality, Archaeology, Cultural Heritage, Ecological Environment, Hydrogeological, Surface Water, Transportation, Noise, and Human Health).	between the TCEC operation and any existing off-site sensitive land uses will be maintained. No significant effects anticipated. • Off-site sensitive land uses within 500 m of the landfill fill area will be subject to consultation with the Province before a *Planning Act* approval is adopted or granted, in the case that new development or change of land use is proposed.	• Continued employment or enhancement of nuisance controls by WM, related to odour, litter, dust, noise and birds on the surrounding environment.	setback distances are maintained. Legally established existing sensitive land use (considered sensitive) within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*) • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls.
	Type(s) and proximity of agricultural land use/operations (e.g., organic, cash crop, livestock)	• Under the proposed vertical expansion, the existing approved waste disposal footprint area of the TCEC would not change, but rather, the maximum permitted height of the waste would be increased. • The Preferred Alternative proposes the smallest elevation maximum for vertical expansion, compared between the three Alternative Methods.	• Under the proposed vertical expansion, no potential effects are anticipated on existing agricultural land uses and associated operations; the existing approved waste disposal footprint area of the TCEC would not change.	• Maintain previously approved setback and buffer distances, and existing berming. • Continued employment or enhancement of nuisance controls by WM, related to odour, litter, dust,	• No significant net effects anticipated between the TCEC operation and any existing and operating agricultural land use; setback distances are maintained. Legally established existing agricultural land uses within 500 m of the

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
		• Permanent minimum buffer areas prescribed in the Local OP and Township ZBL will remain. • The establishment of an expanded landfill, as well as any proposed future development potential in proximity to the landfill site, triggers municipal and provincial policies that restrict sensitive land uses in the Off-site Study Area. • It is anticipated that existing nuisance controls performed by WM at the TCEC will be continued and/or enhanced pending the results of the Effects Assessment reporting completed by other technical consultants (i.e., Air Quality, Archaeology, Cultural Heritage, Ecological Environment, Hydrogeological, Surface Water, Transportation, Noise, and Human Health).	• Expansion of existing agricultural operations will be subject to Provincial, County, and/or Municipal polices and/or regulations to ensure compatibility between the agricultural operation and the existing and/or newly expanded TCEC operation.	noise and birds on the surrounding environment.	landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*) • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls.

8.1.11 Solar Exposure

During consultation and engagement on the effects assessment of the Alternative Methods and identification of the Preferred Alternative, feedback was received regarding the potential for the vertical landfill expansion to obstruct sunlight on neighbouring properties. The concern was that the landfill may create shadows resulting in a reduction of solar energy, which may limit the growth of planted crops and vegetation. Consequently, a solar exposure assessment was undertaken for the Preferred Alternative and the currently approved Expansion Landfill (the 'Do Nothing' Alternative). The Solar Exposure Assessment is included as **Supporting Document 6**. The results of the assessment are presented in **Table 8-24**.

A computer modelling analysis and simulations were completed to quantify the potential reduction in solar energy reaching the ground in the area around the landfill due to the approved Expansion Landfill and the Preferred Alternative. The assessment concluded that both the approved Expansion Landfill and the Preferred Alternative were predicted to create shadows on the areas immediately around the landfill at specific times of the year; however, only a very small difference in solar energy reduction was determined between the two configurations.

The total solar energy received over the entire envelope of the adjacent existing greenhouses immediately east of the site (Phase 1-4) was predicted to be at most 0.09% lower under the Preferred Alternative compared to the approved Expansion Landfill (Do Nothing) during the colder months of the year. During the summer months, the higher solar angles and generally stronger sunlight, resulted in differences in monthly solar energy of less than 0.03% between the two configurations.

When considering the planned development of the greenhouses further south (Phase 5-8), this area was predicted to be even less impacted due to the increased distance from the landfill. The maximum difference in available solar energy on the envelope of these greenhouses did not exceed 0.04% in any month.

The areas around the TCEC where the reduction in solar energy was predicted were isolated to the western edge of the adjacent greenhouses, mainly on the western edge of Phase 1-4, which indicates that any potential effect of the Preferred Alternative is limited to the evening hours when the sun is low in the western sky. On average, localized energy losses on this elevation were predicted to range between a maximum of 2% to 3% on an annual basis, and less than 7% on a monthly basis. The total energy loss across the entire envelope of each group of greenhouses was predicted to be less than 0.09% during all months.

No reductions in solar energy greater than 1% were predicted at grade at any location beyond approximately 250 m west of the TCEC.

Table 8-24. Solar Exposure Net Effects Assessment – Preferred Alternative

Evaluation	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects

Solar Exposure	Change in amount of solar energy received	• The landfill expansion will occur within the existing approved Expansion Landfill footprint.
		• The greenhouses were modelled as if they were fully constructed.
			• Consistent with approved Expansion Landfill:
			  • Maximum 2% to 3% reduction in solar energy on the western edge of the adjacent greenhouse on an annual basis, and less than 7% on a monthly basis.
			  • Total solar energy loss across the entire greenhouses of less than 0.09% during all months.
			  • No reductions in solar energy greater than 1% at any location beyond 250 m west of the TCEC.
			• Decrease in total solar energy received over the entire Phase 1-4 greenhouse for the Preferred Alternative compared to the approved Expansion Landfill:
			  • maximum 0.09% decrease during the colder months
			  • less than 0.03% decrease during the summer months
			• Decrease in total solar energy received over the entire Phase 5-8 greenhouse for the Preferred Alternative compared to the approved Expansion Landfill:
			  • Maximum 0.04% decrease during any month.
				• None required.	• Decrease (maximum 0.09% during the colder months and less than 0.03% during the summer months) in total solar energy received over the entire Phase 1-4 greenhouse.
					• Decrease (maximum 0.04% during any month) in total solar energy received over the entire Phase 5-8 greenhouse.

8.1.12 Climate Change

Climate change considerations for the Alternative Methods are discussed in **Section 5.9**, including the effects of climate change on landfill design and operations (i.e., SWM design, operational practices, LFG management, and leachate collection), and the effect of the landfill on climate change. The effect of the Preferred Alternative on climate change and the effect of climate change on the Preferred Alternative are discussed below with consideration of the MECP guidance document Considering Climate Change in the Environmental Assessment Process (MECP, 2017a).

The conceptual design of the Preferred Alternative addresses adapting to changes in climate and the mitigation of greenhouse gas (GHG) emissions through the evaluation of the impact of extreme weather events on stormwater and leachate management, and LFG generation and management system capacity.

8.1.12.1 Effect of the Preferred Alternative on Climate Change

The effect of the Preferred Alternative on climate change is mostly related to LFG emissions (i.e., methane (CH_4) and CO_2), emissions from the combustion of LFG (CO_2), and GHG emissions from on-site equipment, stationary sources, and vehicles.

Climate change was evaluated through the quantification of GHG emissions. The details of the evaluation are provided in the Air Quality Effects Assessment Report (**Supporting Document 3-1**). The most common GHGs are carbon dioxide (CO_2), methane (CH_4), and nitrogen oxide (NO_2). Emissions of GHG are typically reported in terms of carbon dioxide equivalents or CO_2e.

A GHG inventory was developed considering the following sources:

- Release of fugitive emissions from the landfill mound;
- Combustion of LFG in the flares;
- Combustion of fossil fuels in generators and boilers; and
- Tailpipe emissions from on-site vehicle traffic.

The TCEC also operates two GHG diversion programs:

- LFG diversion for heat production at an adjacent greenhouse; and
- LFG diversion into the Renewable Natural Gas (RNG) Facility as RNG for distribution to the local network.

For Future Baseline Conditions, the closed Old Landfill was assumed to have an LFG collection efficiency of 70% and the Expansion Landfill was assumed to be under interim cover with a collection efficiency of 75%. LFG collected is sent to either the flare for destruction or to the RNG facility or greenhouse for heating; the remaining 30% of LFG from the closed Old Landfill and 25% of LFG from the Expansion Landfill are released through the mound as fugitive emissions. Approximately 10% of CH_4 passing through the landfill mound was assumed to be converted to CO_2; CO_2

produced from the landfill is considered biomass and was not included in the quantification of GHG emissions.

Assumptions regarding the portion of LFG combusted through the flares, diverted to the greenhouse, and diverted to the RNG Facility, combustion equipment emissions, tailpipe emissions, and GHG sinks are provided in **Supporting Document 3-1**.

A summary of the estimated GHG emissions under Future Baseline Conditions excluding CO_2 from biomass is provided in **Table 8-25** using global warming potential (GWP) for carbon dioxide and methane emissions to estimate the equivalent carbon emissions.

Table 8-25. Summary of Estimated GHG Emissions excluding CO_2 from Biomass under Future Baseline Conditions (2031)

Source	CO_2 Estimated Annual Emissions (tonnes/year) GWP [a]	CH_4 Estimated Annual Emissions (tonnes/year) GWP [a]	NO_2 Estimated Annual Emissions (tonnes/year) GWP [a]	CO_2e Annual Total (t CO_2e / year) [b] [c]	Percent of Total (%)
Fugitive LFG (Mound) [d]	0	12,899	0	361,180	97%
LFG Flare [e]	0	56.5	0	1,581	0%
Mobile Combustion [f]	6,780	0.0357	0.00704	6,782	2%
Stationary Combustion [g]	4,592	0.0619	0.0341	4,603	1%
Total	11,372	12,956	0.0411	374,147	100%
GHG Avoided through Direct Use of LFG and Production of RNG [h]				-84,129	-22%

Notes:

[a] Global warming potential (GWP) or carbon dioxide equivalent (CO_2e) of greenhouse gases based on 100-year time horizon, from Environment and Climate Change Canada (ECCC) (2024).
https://www.canada.ca/en/environment-climate-change/services/climate-change/greenhouse-gas-emissions/quantification-guidance/global-warming-potentials.html

[b] Total CO_2e is the sum of annual emissions of each greenhouse gas times its global warming potential.

[c] Estimates assume 14,883,335 m³ of LFG transferred to the greenhouse, and on-spec production and distribution of RNG 50% of the time at the maximum RNG Facility LFG flow rate.

[d] LFG collection efficiency: 75% open landfills, and 90% closed landfills; closed Old landfill, 70%.

[e] Flare destruction efficiency: 99.7%.

[f] Based on maximum vehicle traffic in this modelled scenario and United States Environmental Protection Agency MOVES contaminant emission factors.

[g] Amine reboiler and emergency generators.

[h] Environment and Climate Change Canada. (2022). Greenhouse Gas Calculator for Organic Waste Management: Methodology Report. Table 20 and Section 7.

LFG generated over the lifespan of the Preferred Alternative will increase compared to Future Baseline Conditions, but the LFG collection efficiency is also expected to increase. The transfer of LFG to the neighbouring greenhouse, or refinement at the RNG Facility for general distribution, would decrease the percentage of LFG sent for flaring and the GHG emissions associated with this process.

For the evaluation of the Preferred Alternative, the landfill was assessed as a whole (i.e., not evaluated in terms of individual stages). This approach resulted in an assessment of the worst-case potential GHG emissions in the worst-case year of landfill operations. The largest source of GHG emissions from landfilling activities is fugitive releases from the landfill mound, which are directly proportional to the quantity of waste in place. Therefore, GHG emissions were evaluated for the year 2042 as it represents the final year of landfill operations when the maximum waste capacity is achieved.

Increases in collection efficiencies of LFG were considered in the assessment as most of the landfill will be under final cover in 2042. Final cover efficiency was assumed to be 90% based on the installation of the vertical gas collection system as well as a 1.85 m thick clay landfill cap with 0.15 m of topsoil on top. The only stage not under final cover in 2042 is Stage 4, which is under interim cover with a collection efficiency of 75%. The collection efficiency of the closed Old Landfill remained at 70%.

Diversion of GHGs to the greenhouse and RNG Facility are expected to continue in the Preferred Alternative. Due to the increase in collection efficiency, the quantity of gas diverted to the RNG Facility is expected to increase.

A summary of the estimated GHG emissions for the Preferred Alternative excluding CO_2 from biomass is provided in **Table 8-26** using GWP for carbon dioxide and methane emissions to estimate the equivalent carbon emissions.

Table 8-26. Summary of Estimated GHG Emissions excluding CO_2 from Biomass for the Preferred Alternative (2042)

Source	CO_2 Estimated Annual Emissions (tonnes/year) GWP [a]	CH_4 Estimated Annual Emissions (tonnes/year) GWP [a]	NO_2 Estimated Annual Emissions (tonnes/year) GWP [a]	CO_2e Annual Total (t CO_2e / year) [b] [c]	Percent of Total (%)
Fugitive LFG (Mound) [d]	0	11,344	0	317,631	96%
LFG Flare [e]	0	124	0	3,481	1%
Mobile Combustion [f]	5,355	0.0285	0.00592	5,357	2%
Stationary Combustion [g]	4,351	0.0549	0.0323	4,361	1%
Total	9,706	11,468	0.0382	330,830	100%
GHG Avoided through Direct Use of LFG and Production of RNG [h]				-90,446	-27%

Notes:

[a] Global warming potential (GWP) or carbon dioxide equivalent (CO_2e) of greenhouse gases based on 100-year time horizon, from ECCC (2024). https://www.canada.ca/en/environment-climate-change/services/climate-change/greenhouse-gas-emissions/quantification-guidance/global-warming-potentials.html

[b] Total CO_2e is the sum of annual emissions of each greenhouse gas times its global warming potential.

[c] Estimates assume 14,883,335 m^3 of LFG transferred to the greenhouse, and on-spec production and distribution of RNG 50% of the time at the maximum RNG Facility LFG flow rate.

[d] LFG collection efficiency: 75% open landfills, and 90% closed landfills. Emissions of carbon dioxide from decomposition of organic waste are not included in the total GHG emissions for Ontario and Canada.

[e] Flare destruction efficiency: 99.7%. Emissions of carbon dioxide from decomposition of organic waste are not included in the total greenhouse gas emissions for Ontario and Canada.

[f] Based on maximum vehicle traffic in this modelled scenario and United States Environmental Protection Agency MOVES contaminant emission factors.

[g] Amine reboiler and emergency generators.

[h] Environment and Climate Change Canada. (2022). Greenhouse Gas Calculator for Organic Waste Management: Methodology Report. Section 7.

A comparison of GHG emissions for the Future Baseline (2031) and Preferred Alternative (2042) to total annual GHG emissions for Ontario and Canada is shown in **Table 8-27**. The Ontario and Canadian totals do not include carbon dioxide from biomass decomposition and destruction; therefore, the annual emissions exclude carbon dioxide from these sources.

Table 8-27. Comparison of GHG Peak Year Emissions to Ontario and Canadian Emission Totals

Source	Future Baseline Conditions Peak Year Emissions (2031) (kt/year CO_2e)	Preferred Alternative Peak Year Emissions (2042) (kt/year CO_2e)	Change in Peak Year Emissions (kt/year CO_2e)
TCEC Landfill GHG Emissions [1]	374	331	-43.3
Percentage of Ontario Total GHG Emissions	0.24%	0.21%	-0.03%
Percentage of Canada Total GHG Emissions	0.05%	0.05%	-0.01%
Ontario GHG Emissions [2]	157,200	157,200	0
Canada GHG Emissions [3]	719,400	719,400	0

Notes:

[1] Estimates assume 14,883,335 m³ of LFG transferred to the greenhouse, and on-spec production and distribution of RNG 50% of the time at the maximum RNG Facility LFG flow rate.

[2] Environment and Climate Change Canada. (2024). "National Inventory Report 1990-2022: Greenhouse Gas Sources and Sinks in Canada, Part 3. Average of total greenhouse gas emissions for Ontario for 2018 - 2022 from Table A11-12. The Ontario total does not include carbon dioxide emissions from the decomposition of organic waste in a landfill.

[3] Environment and Climate Change Canada. (2024). "National Inventory Report 1990-2022: Greenhouse Gas Sources and Sinks in Canada, Part 3. Average of total greenhouse gas emissions for Canada for 2018 - 2022 from Table A9-2. The Canadian total does not include carbon dioxide emissions from the decomposition of organic waste in a landfill.

The predicted LFG generation by year is provided in **Section 5.6.5**. In total, the TCEC has an approved combined treatment/flare operational capacity of 49,627 cubic metres per hour (m³/hr) (considering the four flares, the RNG Facility capacity and two flares), which provides an excess capacity of approximately 63% more than the estimated peak volume of LFG being generated at the site.

The net effects assessment for climate change as it relates to GHGs is presented in **Table 8-28**. Since the Preferred Alternative introduces more total waste to the landfill mound when compared to Future Baseline Conditions, the total release of GHGs are expected to increase. However, despite the significant increase in total waste tonnage in the Preferred Alternative the total predicted GHG emissions remain relatively similar

to Future Baseline Conditions, with 584,777 tonnes of CO_2e estimated for the Preferred Alternative compared to the 513,649 tonnes of CO_2e estimated for Future Baseline with a net difference of 71,128 tonnes of CO_2e. This relatively small increase is a result of increased collection efficiency which significantly reduces the quantity of GHG emissions due to the flare's high destruction efficiency of methane. Every additional tonne of methane combusted through the LFG flare represents a 28:1 reduction in GHG emissions. This represents a net decrease in GHG intensity from landfilling activities in the Preferred Alternative. In addition, LFG diversion activities are expected to continue in the Preferred Alternative, with a focus on improving GHG diversion as more financial and environmental incentives become available.

Table 8-28. Climate Change (Greenhouse Gas) Net Effects Assessment – Preferred Alternative

Evaluation	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Climate Change (Greenhouse Gas)	Annual emissions of GHGs (CO, CH_4, and NO_2), reported in carbon dioxide equivalent (CO_2e).	• Quantity of waste in place. • Collection efficiency of LFG. • GHG diversion activities.	• GHG emissions of approximately 584,777 tonnes CO_{2e} per year • GHG emissions of approximately 330,830 tonnes CO_{2e} per year when CO_2 from biomass is excluded.	No Mitigation is required for climate change.	No significant net effect was identified.

8.1.12.2 Effect of Climate Change on the Preferred Alternative

The effect of climate change on the design of the Preferred Alternative is discussed in **Section 5.9.1**.

The release of GHGs from a wide range of human activity is causing climate change. Emissions scenarios are used to understand possible impacts of climate change many years into the future. Representative Concentration Pathways (RCPs) are a set of scenarios intended to provide reasonable projections of future climate impacts based on assumed emissions and degree of mitigation (ECCC, 2018). RCP8.5 is a high global emission scenario with limited mitigation, and this scenario represents a plausible "worst-case" for climate change impacts in the future.

An early study prepared for the Ministry of Natural Resources and Forestry, "Climate change projections for Ontario: An updated synthesis for policymakers and planners", projected regional changes in temperature and precipitation for Ontario, and indicated that summer and winter temperatures are projected to increase, and annual and winter precipitation will increase while summer precipitation will decrease.

A recent study prepared for the MECP by the Climate Risk Institute assessed the potential risks to Ontario's environment, infrastructure, and economy from direct and indirect climate change impacts (MECP, 2023). The current risk profile for the waste management sector in Ontario's Southwest Region has been characterized as

"medium". Under RCP8.5, the projected risk profile for waste management in Southwest Ontario remains at "medium" mid-century, but increases to "high" toward the end of the century. Potential risks related to climate change which may impact air quality include:

- Extreme precipitation associated with more intense storms may cause slope instability or erosion of cover materials allowing increased emissions of fugitive LFG and odour;
- Increased precipitation and water infiltration into the landfill may change the rate of LFG generation and potential for odour from the site;
- Increased temperatures and heat events of longer duration may lead to increased odour generation;
- Increased temperatures and drier summers may lead to drier road surfaces requiring more frequent watering for dust suppression; and
- Higher wind speeds may impact levels of blowing litter.

The current BMPPs for Dust, Odour, and Litter include processes for monitoring, maintenance, and response that can address these risks, and will continue to be valuable as extreme weather events become more common. Enhancements to the BMPPs that may be required to adapt to changing climatic conditions could be considered and implemented through regulatory approval. The future wind, climate, and meteorological conditions are not expected to change to a degree within the lifespan of the proposed landfill optimization in a way that would affect conclusions of the effects assessment.

Extreme weather events caused by climate change are relevant to the design of SWM systems in the diversion/control of runoff, as well as erosion and sedimentation control. Climate change will impact the SWM system by increasing the intensity and frequency of storms, which will cause larger peak flows, sometimes by a significant amount. It is for this reason that the future conditions were modelled for the currently approved landfill buildout and the Preferred Alternative using current and future climate change intensity-duration-frequency (IDF) curves. These curves were taken from the Sarnia weather station as reported/predicted by Environment and Climate Change Canada. The 2071-2100 SSP2-4.5 (moderate emissions scenario) was used, representing a 27-29% increase in peak intensity. The analysis demonstrated that despite the increase in peak flows climate change will cause, the existing ponds and swales have sufficient capacity to manage the runoff under the design storms.

TSS concentrations could potentially increase, thereby increasing other constituent concentrations associated with erosional effects such as heavy metals (e.g., zinc, nickel, and chromium). The correlation between TSS and soil-related metals constituents within the surface water has already been well documented at the TCEC. With respect to sediment control measures, their implementation and maintenance may need to adapt to changing climate conditions, such as, but not limited to, enlarging check dams, more frequent replacement of sediment capture dams, more frequent

sediment removal either from ditching or sedimentation ponds, ditch and swale reshaping due to flow scouring, etc.

With the large cap surface area, under Future Baseline Conditions or the Preferred Alternative, there is the increased area for probable leachate seeps to occur after potentially more frequent and intense rain events. As such the Surface Water Quality events and monthly inspections will continue to be valuable to assess for these potential occurrences at an on-going regular frequency. As further monitoring is completed at the TCEC over time, changes to the Surface Water Quality monitoring programs that may be required to adapt to changing climatic conditions could be considered and implemented through regulatory approval.

The increase in intense inclement weather is not expected to significantly impact the Groundwater Quantity on-site or off-site in the hydrostratigraphic units, except minorly for the Active Aquitard, as that hydrostratigraphic unit is subject to influences by precipitation (e.g., seasonal patterns). Similar to Groundwater Quantity, Groundwater Quality is not expected to be significantly impacted by this increase in intense inclement weather. As further monitoring is completed at the TCEC over time, changes to the Groundwater Quantity and/or Quality monitoring programs that may be required to adapt to changing climatic conditions could be considered and implemented through regulatory approval.

8.2 Summary of Net Effects of the Preferred Alternative

The net effects of the Preferred Alternative are provided in **Table 8-29**. No net effects are predicted for the following evaluation criteria:

• Air Quality – Landfill Gas and Combustion By-Products • Air Quality – Blowing Litter • Groundwater Quantity • Surface Water Quality	• Aquatic Ecosystems • Cultural Heritage Resources • Archaeological Resources • Traffic Operations • Climate Change (GHG emissions)[18]

Table 8-29. Summary of Net Effects Assessment – Preferred Alternative

Evaluation Criteria	Indicator	Net Effects
Atmospheric Environment		
Air Quality – Dust	Off-site POI air concentrations of PM (dust) compounds at identified receptors in the	Concentrations of 24-hour TSP and 24-hour PM_{10} are predicted to exceed their respective criteria at discrete receptor locations under the three development scenarios. The maximum predicted 24-hour TSP concentrations ranged from 172 µg/m³ to 281 µg/m³ (criteria is

[18] This is not an evaluation criteria; rather, it is an assessment that was conducted for the Preferred Alternative.

Evaluation Criteria	Indicator	Net Effects
	immediate vicinity of the site, and community	120 µg/m³), and the maximum predicted 24-hour PM_{10} concentrations ranged from 67 µg/m³ to 100 µg/m³ (criteria is 50 µg/m³).
	Frequency of any exceedance of applicable standards, limits, or guidelines at identified receptors	The maximum predicted frequency of exceedance of 24-hour TSP and 24-hour PM_{10} at discrete receptor locations under the three development scenarios ranged from 0.5% (approximately 2 days per year) to 2.2% (approximately 8 days per year) at R4 for 24-hour TSP, and 0.4% (approximately 1.5 days per year) to 1.3% (approximately 5 days per year) at R4 for 24-hour PM_{10}.
	Number of off-site identified receptors potentially affected (e.g., residential properties, public facilities, businesses/farms, institutions)	Changes in the number of discrete receptors experiencing exceedances varies under the three development scenarios. A total of between 3 and 9 sensitive receptors were predicted to be affected by the exceedances of 24-hour TSP, while 3 sensitive receptors were predicted to be affected by the exceedances of 24-hour PM_{10}.
Air Quality – LFG and Combustion By-Products	Off-site POI air concentrations of indicator compounds at identified receptors in the immediate vicinity of the site, and community (within 5 km)	None. Changes in predicted concentrations will be minimal.
	Frequency of any exceedance of applicable standards, limits, or guidelines at identified receptors	None. No frequency of exceedance at receptors due to landfill operations.
	Number of off-site receptors potentially affected (e.g., residential properties, public facilities, businesses/farms, institutions)	None. No receptors with predicted concentrations exceeding criteria due to landfill operations.
Air Quality – Blowing Litter	Extent of zones potentially impacted by blowing litter	None.
	Number of off-site receptors potentially affected (e.g., residential properties, public facilities, businesses/farms odour sensitive area(s), institutions)	None.
Odour	Off-site odour concentrations (odour units) at identified odour sensitive receptors in the immediate vicinity of the site	• Changes in the predicted concentration at each receptor vary depending on the stage of landfill operations. The maximum predicted odour concentrations exceed 1 OU/m³ at all receptors under all three development scenarios. Exceedances of 3 OU/m³ were predicted at between one (1) and 8 receptors depending on the development scenario. No exceedances of 5 OU/m³ were predicted at any of the receptors under any development scenario.

Evaluation Criteria	Indicator	Net Effects
		• Predicted concentrations at discrete receptors are expected to be similar to Future Baseline Conditions and decrease over the life of the Project as final cover is applied.
	Frequency of any odour levels above defined odour benchmarks	• Changes in frequency of predicted exceedances at each receptor vary depending on the stage of landfill operations. The highest overall frequency of exceedance of 1 OU/m³ ranged between 0.45% of the time at receptor R4 and 2.9% of the time at receptor R7 depending on the development scenario, compared to 1% of the time at R4 and R7 under Future Baseline Conditions. The highest overall frequency of exceedance of 3 OU/m³ ranged between 0.002% and 0.12% of the time at receptor R4, compared to 0.01% of the time at R4 under Future Baseline Conditions. • The frequency of predicted exceedance at discrete receptors are expected to be similar to Future Baseline Conditions and decrease over the life of the Project as final cover is applied.
	Number of off-site receptors potentially affected (e.g., residential properties, public facilities, businesses/farms odour sensitive area(s), institutions)	• Changes in the number of discrete receptors with predicted concentrations the exceed criteria vary depending on the stage of landfill operations. Exceedances of 1 OU/m³ greater than 0.5% of the time were predicted to occur at between zero (0) and 19 receptors depending on the development scenario, compared to 6 under Future Baseline Conditions. Exceedances of 3 OU/m³ were predicted to occur at between one (1) and 8 receptors depending on the development scenario compared to two (2) under Future Baseline Conditions. • The number of discrete receptors that exceed criteria are expected to be similar to Future Baseline Conditions and decrease over the life of the Project as final cover is applied.
Noise	Predicted site-related noise levels (measured in dBA or dBAI)	Noise levels will meet applicable landfilling noise guidelines during daytime hours, with the implementation of the identified mitigation measures.
	Change in sound levels (dB)	Changes in sound levels were qualitatively rated as insignificant (less than or equal to 3 dB).
Hydrogeology		
Groundwater Quality	Predicted effects on Groundwater Quality on-site from increased waste quantities disposed within the Expansion Landfill	None, so long as the hydraulic trap design is maintained as required under the Waste and Sewage ECAs.
	Predicted CLS	Under the Preferred Alternative, the at-capacity CLS will increase 61 years to 163 years post-closure.
Groundwater Quantity	Predicted effect of Landfill Optimization on Groundwater flow and Quantity both on-site and off-site	None, so long as the hydraulic trap design is maintained as required under the Waste and Sewage ECAs.
Surface Water Environment		
Surface Water Quality	Predicted effects on Surface Water Quality on-site prior to off-site discharge (Erosional effects on TSS and heavy metal	Presuming the mitigation measures presented herein are implemented and maintained as required, the risk for impacts to Surface Water Quality due to erosional effects will be effectively managed.

Evaluation Criteria	Indicator	Net Effects
	concentrations in surface water)	
	Predicted effects on Surface Water Quality on-site prior to off-site discharge (Leachate seep impacts to Surface Water Quality)	There is no expected net effect to Surface Water Quality from leachate impacts with the implementation of a seepage monitoring and repair program under the Preferred Alternative.
	Predicted effects from PAHs on Surface Water Quality within the roadside ditch of the northbound lane of Nauvoo Road from the Site to Hwy 402 in the Off-Site Study Area	None (as long as the mitigation measures continue to be carried out).
Surface Water Quantity	Change in runoff volumes and peak flows resulting from steeper and longer side slopes	Increase in peak flows of up to 10% from Future Baseline Conditions.
	Changes in drainage areas on-site and off-site	Changes in catchment areas within the landfill optimization area are between -22% and 34% when compared to Future Baseline Conditions.
	Predicted occurrence and degree of off-site effects	Increase in peak flows of up to 10% from Future Baseline Conditions.
Ecological Environment		
Terrestrial Ecosystems	Predicted effects on vegetation communities and species including rare, threatened, or endangered species	None.
	Predicted effects on wildlife and wildlife habitat including rare, threatened, or endangered species	Minimal net effect from prolonged attractiveness of the landfill to avifaunal scavengers with the implementation of identified mitigation measures.
Aquatic Ecosystems	Predicted effects on aquatic habitat, including fish habitat	None.
	Predicted effects on aquatic biota including rare, threatened, or endangered species	None.
Social Environment		
Human Health	• Predicted acute and chronic health-based CRs arising from air concentrations of PM (dust) and related metals at identified sensitive receptor	None.

Evaluation Criteria	Indicator	Net Effects
	locations within the Study Area • Frequency of any exceedance of applicable standards, limits, or guidelines from air concentrations at identified receptors	
	• Predicted acute and chronic health-based CRs arising from air concentrations of gaseous contaminants at identified sensitive receptor locations within the Study Area • Frequency of any exceedance of applicable standards, limits, or guidelines from air concentrations at identified receptors	• Risks associated with bromodichloromethane, 1,1,2,2-tetrachloroethane, and vinyl chloride are anticipated to be minimal. • No measurable long-term or short-term adverse health impacts were predicted to occur as a result of exposure to LFG combustion emissions, with the exception of worst-case H_2S concentrations.
Effects on Local Community	Number of residents and residences (e.g., receptors)	None.
	Number and type of local businesses	None.
	Nuisance effects (litter, dust, noise, odour, traffic, visual)	• Potential increases in predicted odour concentrations at discrete receptors; the frequency of exceedance and the number of affected receptors will vary depending on the stage of landfill operations. • Potential increases in predicted dust concentrations at discrete receptors at some points during site operation compared to Future Baseline Conditions; the frequency of exceedance and the number of affected receptors will vary depending on the stage of landfill operations. • Visual CEV of 77, with three high CEV viewpoints, two moderate CEV viewpoints, and one low CEV viewpoint. The Preferred Alternative was determined to have a high visual effect on 23 receptors, a moderate visual effect on 52 receptors, a low visual effect on 15 receptors. • No net effects from litter, noise, birds, and traffic.
	Predicted changes to use and enjoyment of property	Minor changes to use and enjoyment of property are anticipated due to increased odour at recreational areas located south of the landfill.
	Level of satisfaction with living/working in the community	Minor changes in the level of satisfaction with living and working in the community due to increased odour and changes to the visual landscape.
	Confidence in TCEC operations	None.
Economic Environment		
Economic Effects on	Employment at site (number, type, and duration)	Existing 35 stable employment positions will continue for an additional 12 years during operation of the Preferred Alternative.

Evaluation Criteria	Indicator	Net Effects
Local Community	Contributions to the host community	• Based on the average annual contributions under the current Host Community Agreement, estimated at approximately $4.1 million, host community payments for the duration of the Preferred Alternative are estimated to amount to approximately $50 million. • Based on the trend of increasing tax rates over the past 5 years, it is conservatively assumed that WM's property tax contribution will continue to form at least 3.5% of the Township's property tax revenue for the duration of the Preferred Alternative. • WM will continue to contribute to community projects during operation of the Preferred Alternative.
	Opportunities for the provision and procurement of products and/or services	Based on an annual average of $2.5 million in local expenditures, an estimated $30 million will be contributed to the local economy over the duration of the Preferred Alternative.
Visual Landscape		
Visual Impact of the Facility	Predicted changes in perception of landscape and views	Total CEV values for six viewpoints: • High = 48 • Moderate = 21 • Low = 8 Total CEV = 77 The Preferred Alternative was determined to have a high visual effect on 23 receptors, a moderate visual effect on 52 receptors, a low visual effect on 15 receptors.
Cultural Environment		
Cultural Heritage Resources	Direct Impacts	No net effects to the heritage attributes of identified BHRs and CHLs.
	Indirect Impacts	No net effects to the heritage attributes of identified BHRs and CHLs.
Archaeological Resources	Archaeological resources and areas of archaeological potential on-site and predicted impacts on them	No net effects on on-site Archaeological Resources and areas of archaeological potential.
	Cemetery property within approximately 10 metres of the proposed impacts	No net effects on Archaeological Resources.
Transportation		
Traffic Operations	Change in peak hour and daily truck traffic volume and AADT along the Off-site Study Area road segments	None.
	Intersection performance – capacity, delay, queues – for the Off-site Study Area intersections	None.
	Road safety	None.
	Sight distance at the primary site entrance	None.

Evaluation Criteria	Indicator	Net Effects
Current and Planned Future Land Use		
Effects on Current and Planned Land Uses	Current land use	• No significant net effects anticipated between the TCEC operation and any current land uses; setback distances are maintained. Legally established existing land uses (considered sensitive) within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*). • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls. • The Preferred Alternative will require new planning approvals (County and Local OP, Township ZBL, and Site Plan Control), and result in continued restrictions for surrounding land uses for an additional 12 years.
	Planned land use	• No significant net effects anticipated between the TCEC operation and any planned land uses; setback distances are maintained. • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls.
	Type(s) and proximity of off-site recreational resources within 1 km of a landfill footprint potentially affected	• No significant net effects anticipated between the TCEC operation and any off-site recreational resources; setback distances are maintained. Existing off-site recreational resources (considered sensitive) within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*). • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls.
	Type(s) and proximity of off-site sensitive land uses as defined by the Provincial Policy Statement and the MECP D-1 Guidelines (e.g., dwellings, churches, parks) within 1 km of a landfill footprint potentially affected	• No significant net effects anticipated between the TCEC operation and any sensitive land use; setback distances are maintained. Legally established existing sensitive land use (considered sensitive) within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*). • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls.
	Type(s) and proximity of agricultural land use/operations (e.g., organic, cash crop, livestock)	• No significant net effects anticipated between the TCEC operation and any existing and operating agricultural land use; setback distances are maintained. Legally established existing agricultural land uses within 500 m of the landfill site are permitted to exist (pursuant to Section 34(9) of the *Planning Act*). • No net effects anticipated with respect to nuisance effects associated with the TCEC operation with employed nuisance controls.
Other		
Solar Exposure*	Change in amount of solar energy received	• Decrease (maximum 0.09% during the colder months and less than 0.03% during the summer months) in total solar energy received over the entire Phase 1-4 greenhouse. • Decrease (maximum 0.04% during any month) in total solar energy received over the entire Phase 5-8 greenhouse.
Climate Change (GHG emissions)*	Annual emissions of GHGs (CO, CH_4, and NO_2), reported in carbon	No significant net effect was identified.

Evaluation Criteria	Indicator	Net Effects
	dioxide equivalent (CO_2e)	

Note: * This is not an evaluation criteria; rather, it is an assessment that was conducted on the Preferred Alternative.

8.3 Comparison to the 'Do Nothing' Alternative

The 'Do Nothing' Alternative represents what is anticipated to occur if the Project does not proceed, and is represented by the Future Baseline Conditions presented in **Section 6**, which correspond to the completion of the approved Expansion Landfill in 2031 and thereafter, once operations cease. The 'Do Nothing' Alternative is used as a benchmark against which the Preferred Alternative is compared.

Under the 'Do Nothing' Alternative, WM would not proceed with the landfill optimization to develop additional disposal capacity within the TCEC, and would only be able to continue operations until the currently approved Expansion Landfill reaches capacity in approximately 2031, at which time landfill operations will cease.

With a lack of sufficient and secure long-term disposal capacity available in Ontario, there is an on-going requirement for the TCEC to continue to provide this landfill disposal service, supporting stable operation and growth for municipalities and businesses across Southern Ontario. The 'Do Nothing' Alternative would not allow WM to continue to provide disposal services to its customers and fulfill long-term contractual commitments within Ontario. These customers, including a number of municipalities across Southern Ontario, would need to find alternate ways to manage their waste. The opportunity to optimize the investment in the facility infrastructure would be lost along with the economic contributions to the local economy. The 'Do Nothing' Alternative is not a viable option for WM's on-going business, its customers, and the Province of Ontario.

The comparison of the predicted effects of the Preferred Alternative against the 'Do Nothing' Alternative is provided in **Table 8-30**. Details are provided in **Supporting Document 3**. The advantages and disadvantages of the Preferred Alternative are described in **Section 8.4**.

Table 8-30. Comparison of the Preferred Alternative to the 'Do Nothing' Alternative

Evaluation Criteria	Effects of the 'Do Nothing' Alternative	Effects of the Preferred Alternative	Comparison of the Preferred Alternative to the 'Do Nothing' Alternative
Atmospheric Environment			
Air Quality – Dust	Dust emissions are dominated by haul route traffic and final cap construction. With the removal of these sources, significant decreases in predicted concentrations are expected at all discrete receptor locations. Small quantities of fine particulates will be emitted from the LFG flare and other stationary combustion equipment, but these sources are not expected to significantly contribute to concentrations at discrete receptors.	• Changes in predicted concentrations and frequency of predicted exceedances at each receptor, and the number of discrete receptors experiencing exceedances, vary depending on the stage of landfill operations. • With the application of mitigation strategies, the predicted concentrations and frequencies of predicted exceedances at discrete receptors, and the numbers of off-site receptors potentially affected, are expected to decrease to levels similar to Future Baseline Conditions.	Predicted concentrations for all criteria at all discrete receptor locations, the frequency of predicted exceedances, and the number of discrete receptors experiencing exceedances will be higher for the Preferred Alternative because, in the 'Do Nothing' Alternative, all landfill activities related to dust have ceased with the exception of the RNG Facility and stationary combustion equipment (flares, generators, and boilers).
Air Quality – LFG and Combustion By-products	LFG emissions of VOCs are expected to decrease with the application of the final cap, increasing collection efficiency. Without the continued addition of waste to the landfill mound, the overall generated LFG will decrease over time. Emissions of tailpipe contaminants will be reduced to infrequent maintenance vehicles and are considered insignificant. Overall, predicted concentrations of LFG and combustion byproducts are expected to decrease at all discrete receptors.	• No frequency of exceedance at receptors due to landfill operations. • The predicted concentrations at discrete receptors for all LFG and combustion byproduct under the Preferred Alternative remain below applicable criteria except for H_2S and TRS. However, in both the Future Baseline Conditions and the Preferred Alternative, predicted concentrations of H_2S and TRS are dominated by elevated background concentrations.	Predicted concentrations for all criteria at all discrete receptor locations will be higher for the Preferred Alternative. Similar to the Preferred Alternative, elevated concentrations of H_2S and TRS are predicted for the 'Do Nothing' Alternative resulting from elevated background concentrations. The evaluation of H_2S and TRS emissions in the 'Do Nothing' Alternative use the same flux rates for final cover applied in the Preferred Alternative, which reflect emissions from an active landfill site and are conservative, as emissions of H_2S and TRS are expected to decrease as the waste ages.
Air Quality – Blowing Litter	With no active landfilling on site there will be no exposed waste and therefore no potential for the migration of wind-blown litter.	No net effects. There will be no change in the extent of zones potentially impacted by blowing litter or the number off-site receptors potentially affected.	In the 'Do Nothing' Alternative the landfill is closed and there are no active waste filling areas or exposed waste subject to wind erosion. Therefore, when comparing the Preferred Alternative to the 'Do Nothing" Alternative the potential for blowing litter is increased.

Evaluation Criteria	Effects of the 'Do Nothing' Alternative	Effects of the Preferred Alternative	Comparison of the Preferred Alternative to the 'Do Nothing' Alternative
Odour	Odour emissions are expected to be reduced as a result of the completion of the final cap. Emissions of odour compounds like H_2S and VOCs generated by the decomposition of waste will decrease over time as the waste mound ages and produces less LFG, resulting in decreased odour emissions. However, it is difficult to quantify the decrease in odour emissions and as a result the 'Do Nothing' Alternative and, since emissions are based on the same flux rates used to assess the Future Baseline and Preferred Alternative, it is likely that odour impacts from the 'Do Nothing' Alternative are overpredicted. Overall, odour concentrations at discrete receptor locations are expected to decrease.	• Changes in predicted concentrations and frequency of predicted exceedances at each receptor, and the number of discrete receptors experiencing exceedances vary depending on the stage of landfill operations. • The predicted concentrations and frequencies of predicted exceedances at discrete receptors, and the numbers of off-site receptors potentially affected, are expected to be similar to Future Baseline Conditions and decrease over the life of the Project as final cover is applied.	Predicted odour concentrations at all discrete receptor locations will be higher for the Preferred Alternative resulting from the increased quantity of waste in the landfill, absence of final cap, and the addition of new waste to the mound. The frequency of exceedances of 1 OU/m^3 are expected to increase at all receptors.
Noise	For the 'Do Nothing' Alternative, sound levels will be dominated by local traffic noise contributions, with the ancillary source contributions being audible during very quiet periods of the day and night. Based on the background traffic volumes to the predicted year of 2043, sound levels will gradually increase by 1 to 2 dB at all considered PORs.	Noise levels will meet applicable landfilling noise guidelines during daytime hours, with some mitigation measures.	There is an increase in the sound levels for the Preferred Alternative due to active landfilling operations compared to the site only operating the ancillary sources for the "Do Nothing" Alternative. The magnitude of the difference in sound levels is dependent on the proximity of the landfilling sources to the PORs as the Preferred Alternative progresses. The sound levels due to the ancillary sources are significantly below the traffic background levels, so the change in the cumulative noise impact at the PORs between the two Alternatives will be less.
Hydrogeology			
Groundwater Quality	• Under the 'Do Nothing' Alternative, the at-Capacity CLS would be 102 years post-closure. • No other net effects are predicted as long as the hydraulic trap design is maintained as required under the Waste and Sewage ECAs.	• Under the Preferred Alternative, the at-Capacity CLS will increase 61 years to 163 years post-closure. • No other net effects are predicted as long as the hydraulic trap design is maintained as required under the Waste and Sewage ECAs.	Under the Preferred Alternative, the at-Capacity CLS is predicted to be 163 years post-closure, which is an increase of 61 years from the 'Do Nothing' Alternative CLS of 102 years.

Evaluation Criteria	Effects of the 'Do Nothing' Alternative	Effects of the Preferred Alternative	Comparison of the Preferred Alternative to the 'Do Nothing' Alternative
Groundwater Quantity	No net effects are predicted as long as the hydraulic trap design is maintained as required under the Waste and Sewage ECAs.	No net effects are predicted as long as the hydraulic trap design is maintained as required under the Waste and Sewage ECAs.	There is no difference between the Preferred Alternative and the 'Do Nothing' Alternative with respect to Groundwater Quantity.
Surface Water Environment			
Surface Water Quality	• Provided the mitigation measures are implemented and maintained as required, the risk for impacts to Surface Water Quality due to erosional effects will be effectively managed. • There is no expected net effect to Surface Water Quality from leachate impacts with the implementation of a seepage monitoring and repair program. • There are no predicted net effects to Surface Water Quality in the Off-Site Study Area, from ASR track out as long as mitigation measures continue to be carried out.	• Provided the mitigation measures are implemented and maintained as required, the risk for impacts to Surface Water Quality due to erosional effects will be effectively managed. • There is no expected net effect to Surface Water Quality from leachate impacts with the implementation of a seepage monitoring and repair program. • There are no predicted net effects to Surface Water Quality in the Off-Site Study Area, from ASR track out as long as mitigation measures continue to be carried out.	• Given that the Expansion Landfill footprint and leachate management practices are not proposed to be altered for the Preferred Alternative nor under the 'Do Nothing' Alternative, and, with adequate mitigative measures in place to manage sediment buildup, leachate seepage, and ASR trackout, there are no substantial differences in expected net effects to Surface Water Quality. • The period of landfilling activities for the Preferred Alternative would extend beyond that of the 'Do Nothing' Alternative. This implies that the potential risk to Surface Water Quality impacts from construction activities would continue for a longer period than they would for the 'Do Nothing' Alternative.
Surface Water Quantity	• The landfill development will alter the outlets' catchment areas, land cover, and time of concentration, as well as the path of the swales in the northeast corner. • Increase in peak flows of up to 12% from existing conditions. • Changes in catchment areas within the landfill optimization area are between -22% and 29% when compared to existing conditions. • No changes to off-site drainage areas	• Increase in peak flows of up to 10% from existing conditions. • Changes in catchment areas within the landfill optimization area are between -22% and 34% when compared to existing conditions. • No changes to off-site drainage areas	• The maximum predicted change in the increase in peak flows between the Preferred Alternative and the 'Do Nothing' Alternative is 2%, with the 'Do Nothing' Alternative increasing existing peak flows by 12% versus 10% for the Preferred Alternative. • The Preferred Alternative is predicted to result in a maximum 5% greater change in on-site catchment areas than the 'Do Nothing' Alternative. • No changes to off-site drainage areas

Evaluation Criteria	Effects of the 'Do Nothing' Alternative	Effects of the Preferred Alternative	Comparison of the Preferred Alternative to the 'Do Nothing' Alternative
Ecological Environment			
Terrestrial Ecosystems	No negative impacts to terrestrial ecosystems, including vegetation communities, wildlife, wildlife habitat, or rare, threatened, or endangered species are anticipated for the 'Do Nothing' Alternative as long as the current mitigation measures continue.	• No effects on vegetation communities and species including rare, threatened, or endangered species. • With the continued implementation of the identified mitigation measures, there will be a minimal net effect from continued operation prolonging the attractiveness of the area for avifaunal scavengers.	Compared to the 'Do Nothing' Alternative, the continued operation of the landfill for the Preferred Alternative will prolong the attractiveness of the area to avifauna scavengers. It will also prolong the time for the landfill to be closed and the restoration plan to be implemented. The restoration of the capped landfill may include a native meadow community which in turn could provide habitat for wildlife (e.g., grassland birds, insects). If the landfill was not expanded, on-going disturbances through landfill operations (dust, noise, traffic on site) would cease earlier and thereby reduce such disturbances on wildlife earlier than if the landfill operations continued through the Preferred Alternative.
Aquatic Ecosystems	No negative impacts to aquatic ecosystems, including fish and aquatic habitat (or downstream aquatic habitat features), or rare, threatened, or endangered species are anticipated for the 'Do Nothing' Alternative as long as the current mitigation measures continue.	No net effects on aquatic habitat, including fish habitat, or on aquatic biota including rare, threatened, or endangered species.	No differences were identified between the Preferred Alternative and the 'Do Nothing' Alternative for Aquatic Ecosystems.
Social Environment			
Human Health	• No significant health concerns from PM (dust) and related metals. • No measurable long-term or short-term adverse health impacts would result from LFG combustion emissions at the maximum discrete receptor location. • Long-term cancer and non-cancer human health risks as a result of predicted exposures to LFGs were considered minimal. • Chronic human health risks associated with exposure to emissions resulting from the	• No effects on human health from PM (dust) and related metals. • Risks associated with bromodichloromethane, 1,1,2,2-tetrachloroethane and vinyl chloride are anticipated to be minimal. • No measurable long-term or short-term adverse health impacts were predicted to occur as a result of exposure to LFG combustion emissions, with the exception of worst-case H_2S concentrations.	No measurable long-term or short-term adverse health impacts were predicted to occur as a result of exposure to LFG combustion emissions, with the exception of worst-case H_2S concentrations based on the modelling results for the Preferred Alternative. Any impacts from the Preferred Alternative compared to the 'Do Nothing' Alternative are considered minimal. Therefore, based on the comparison between the modelled changes in air concentrations related to the Preferred Alternative and the air

Evaluation Criteria	Effects of the 'Do Nothing' Alternative	Effects of the Preferred Alternative	Comparison of the Preferred Alternative to the 'Do Nothing' Alternative
	landfill flare plus evaporation/incineration activities (dioxin/furans, benzo(a)pyrene, lead, cadmium, arsenic, nickel and mercury) were not considered significant. • Long-term human health risks associated with exposure to emissions resulting from the landfill flare only scenario (PAHs, dioxin/furans) were also considered insignificant.		concentrations modelled in the 2005 HHRA, the Preferred Alternative is not predicted to result in any additional unacceptable health risks above those identified and mitigated in the 2005 HHRA for the 'Do Nothing' Alternative.
Effects on Local Community	• No changes to number of residents and residences. • There may be the loss of some businesses that rely on income from the TCEC upon closure of the landfill. • Predicted odour concentrations at discrete receptor locations are expected to decrease after closure. • Reduction of all predicted dust concentrations at all receptors after closure. • Visual impact: 39 high-effect receptors and 37 moderate-effect receptors. • No net effects from litter, noise, birds, and traffic after closure. • Minor changes to use and enjoyment of property are anticipated due to decreased odour at recreational areas located south of the landfill after closure. • No net effects on the level of satisfaction with living and working in the community, and confidence in TCEC operations.	• No changes to number of residents and residences, number and type of local businesses, or confidence in TCEC operations. • Potential increases in predicted odour concentrations at discrete receptors; the frequency of exceedance and the number of affected receptors will vary depending on the stage of landfill operations. • Potential increases in predicted dust concentrations at discrete receptors at some points during site operation compared to Future Baseline Conditions; the frequency of exceedance and the number of affected receptors will vary depending on the stage of landfill operations. • Visual impact using the same receptors as the 'Do Nothing' Alternative: 23 high-effect receptors and 52 moderate-effect receptors. • No net effects from litter, noise, birds, and traffic. • Minor changes to use and enjoyment of property are anticipated due to increased odour at recreational areas located south of the landfill. • Minor changes in the level of satisfaction with living and working in the community due to increased odour and changes to the visual landscape.	• There is no difference between the Preferred Alternative and the 'Do Nothing' Alternative regarding the number of residents and residences, and confidence in TCEC operations. • The Preferred Alternative will not result in any changes to local businesses for an additional 12 years. • The Preferred Alternative will result in an increase in odour at discrete receptor locations, and continued dust emissions, litter, noise, birds, and traffic during operations for an additional 12 years. • The Preferred Alternative will result in 16 fewer 'high' effect visual receptors but will result in an increase in the number of 'moderate' effect receptors by 15. • The Preferred Alternative will result in minor changes to the use and enjoyment of property due to increased odour at recreational areas located south of the landfill, and minor changes in the level of satisfaction with living and working in the community due to increased odour and changes to the visual landscape.

Evaluation Criteria	Effects of the 'Do Nothing' Alternative	Effects of the Preferred Alternative	Comparison of the Preferred Alternative to the 'Do Nothing' Alternative
Economic Environment			

Economic Effects on Local Community	• Loss of 35 stable employment positions upon closure.
	• Based on the average annual contributions under the current Host Community Agreement, estimated at approximately $4.1 million, host community payments are estimated to amount to an overall total of $66.3 million by 2031.
	• Host community contributions will end at closure resulting in an approximately 24% decrease in the Township's total gross annual operating budget and an approximately 36% decrease in the Township's total municipal revenue.
	• Property tax contributions may differ after closure depending upon Municipal Property Assessment Corporation (MPAC) assessment.
	• Contributions to community projects will end upon closure.
	• Based on an annual average of $2.5 million in local expenditures, an estimated $15 million will be contributed to the local economy by landfill closure in 2031, after which the procurement of products and services will cease.
		• Existing 35 stable employment positions will continue for an additional 12 years during operation of the Preferred Alternative.
		• Based on the average annual contributions under the current Host Community Agreement, estimated at approximately $4.1 million, host community payments for the duration of the Preferred Alternative are estimated to amount to approximately $50 million.
		• Based on the trend of increasing tax rates over the past 5 years, it is conservatively assumed that WM's property tax contribution will continue to form at least 3.5% of the Township's property tax revenue for the duration of the Preferred Alternative.
		• WM will continue to contribute to community projects during operation of the Preferred Alternative.
		• Based on an annual average of $2.5 million in local expenditures, an estimated $30 million will be contributed to the local economy over the duration of the Preferred Alternative.
			• The Preferred Alternative will result in:
			  • the continuation of 35 stable employment positions for an additional 12 years;
			  • continued host community payments, which make up approximately 24% of the Township's total gross annual operating budget and 36% of the Township's total municipal revenue, for an additional 12 years, amounting to approximately $50 million (based on the current Host Community Agreement);
			  • continued property tax contributions of at least 3.5% of the Township's property tax revenue for an additional 12 years;
			  • continued contributions to community projects for an additional 12 years; and
			  • an estimated $30 million in contributions to the local economy over 12 years.

Visual Landscape			
Visual Impact of the Facility	• Visual impact: 39 high-effect receptors and 37 moderate-effect receptors.	• Visual impact using the same receptors as the 'Do Nothing' Alternative: 23 high-effect receptors and 52 moderate-effect receptors.	• The Preferred Alternative will result in a decrease of 16 high-effect receptors, and an increase of 15 moderate-effect receptors. • Changes in the visual landscape will occur between 2031 and 2043 (within the operational timeframe of the Preferred Alternative) that will reduce the visual prominence of the 'Do Nothing Alternative'.

Evaluation Criteria	Effects of the 'Do Nothing' Alternative	Effects of the Preferred Alternative	Comparison of the Preferred Alternative to the 'Do Nothing' Alternative
Cultural Environment			
Cultural Heritage Resources	The 'Do Nothing' Alternative is not anticipated to result in any net effects from direct or indirect impacts to identified BHRs and CHLs.	The Preferred Alternative is not anticipated to result in any net effects to identified BHRs and CHLs.	There are no net effects from direct or indirect impacts to identified BHRs or CHLs from the 'Do Nothing' Alternative or the Preferred Alternative.
Archaeological Resources	The 'Do Nothing' Alternative is not anticipated to result in any net effects to archaeological resources.	The Preferred Alternative is not anticipated to result in any net effects to archaeological resources.	There are no net effects to documented archaeological resources and areas of archaeological potential from the 'Do Nothing' Alternative or the Preferred Alternative.
Transportation			
Traffic Operations	• *There would be a reduction in traffic volume resulting from the removal of landfill operations for the 'Do Nothing' Alternative.* • The reduction in traffic volume resulting from the removal of the TCEC-associated traffic under the 'Do Nothing' Alternative will result in a marginal improvement in traffic operations (i.e., intersection performance) as site traffic is a small component of the total traffic volumes. • *No changes in collision rates are anticipated under the 'Do Nothing' Alternative since no correlations were identified between TCEC site traffic and collisions.* • *Sightline considerations are not applicable for the 'Do Nothing' Alternative since the site driveway would no longer be operational.*	• The Preferred Alternative will not result in any changes to traffic operations from existing conditions (i.e., no effects on traffic volumes, traffic operations, road safety, or sightlines are anticipated as a result of the Preferred Alternative). • Any changes to traffic operations are related to an increase in background traffic over time.	• The Preferred Alternative will result in continued site traffic for an additional 12 years; however, no net effects to traffic operations are anticipated as a result of the continued landfill operations. • The removal of landfill-related traffic for the 'Do Nothing' Alternative will result in marginal improvements to traffic operations since site traffic is a small component of the total traffic volumes.
Current and Planned Future Land Use			
Effects on Current and Future Land Uses	• No negative effects with respect to current and future land uses are anticipated as a result of the 'Do Nothing' Alternative. • Existing approved setback distances and buffer areas between the TCEC operation and any existing and/or planned land uses will be maintained for 25 years post-	• No significant potential effects are anticipated on surrounding current and future land uses as a result of the Preferred Alternative recognizing that land use setbacks and buffers are to be maintained. • New Planning Approvals (i.e., County and Local OP Amendment, Township ZBL	• The Preferred Alternative will require new planning approvals (County and Local OP, Township ZBL, and Site Plan Control), and result in continued restrictions for surrounding land uses for an additional 12 years.

Evaluation Criteria	Effects of the 'Do Nothing' Alternative	Effects of the Preferred Alternative	Comparison of the Preferred Alternative to the 'Do Nothing' Alternative
	closure, and new development will require approval from the Minister, in accordance with Section 46 of the *Environmental Protection Act*. • Should the 'Do Nothing' Alternative be maintained, at the time the existing landfill area reaches capacity in 2031, waste will need to be accommodated at another existing landfill or a new landfill elsewhere.	Amendment, and Site Plan Control) required. • The Preferred Alternative will result in continued restrictions for surrounding land uses for an additional 12 years.	• The 'Do Nothing' Alternative will result in the need to accommodate waste at another existing landfill or a new landfill elsewhere
Other			

Solar Exposure*	• Maximum 2% to 3% reduction in solar energy on the western edge of the adjacent greenhouse on an annual basis, and less than 7% on a monthly basis.
	• Total solar energy loss across the entire greenhouses of less than 0.09% during all months.
	• No reductions in solar energy greater than 1% at any location beyond 250 m west of the TCEC.
		• Decrease (maximum 0.09% during the colder months and less than 0.03% during the summer months) in total solar energy received over the entire Phase 1-4 greenhouse:
		• Decrease (maximum 0.04% during any month) in total solar energy received over the entire Phase 5-8 greenhouse.
			• Decrease in total solar energy received over the entire Phase 1-4 greenhouse for the Preferred Alternative compared to the 'Do Nothing' Alternative:
			  • maximum 0.09% decrease during the colder months; and
			  • less than 0.03% decrease during the summer months.
			• Decrease in total solar energy received over the entire Phase 5-8 greenhouse for the Preferred Alternative compared to the to the 'Do Nothing' Alternative:
			  • Maximum 0.04% decrease during any month.

Climate Change (GHG Emissions)*	GHG emissions are expected to be reduced in the 'Do Nothing' Alternative. The total volume of waste in the landfill will be lower if the vertical expansion does not proceed. In the absence of new waste being added to the mound, the generation of GHG emissions will gradually decrease. There will be no emissions of GHG associated with vehicle tailpipes. LFG diversion will continue to the RNG Facility and neighbouring greenhouse. LFG flares will continue to operate releasing GHG emissions.	• No significant net effect was identified. • Despite the significant increase in total waste tonnage for the Preferred Alternative, the total predicted GHG emissions remain relatively similar to Future Baseline Conditions, with 584,777 tonnes of CO_2e estimated for the Preferred Alternative compared to the 513,649 tonnes of CO_2e estimated for Future Baseline with a net difference of 71,128 tonnes of CO_2e.	• GHG emissions are expected to be slightly higher for the Preferred Alternative because similar landfill operations are expected to continue. • Differences from the 'Do Nothing' Alternative include the addition of tailpipe emissions and an increase in total LFG generated due to the addition of new waste to the landfill mound. • When compared to the 'Do Nothing' Alternative, overall GHG emissions are expected to be higher due to the increase in total tonnage in place in the Preferred Alternative and continuation of on-site traffic.

Evaluation Criteria	Effects of the 'Do Nothing' Alternative	Effects of the Preferred Alternative	Comparison of the Preferred Alternative to the 'Do Nothing' Alternative
			• Emission intensities related to landfill operations are expected to be similar between the 'Do Nothing' Alternative and the Preferred Alternative due to the increased collection efficiency resulting from final cap in both scenarios. GHG diversion practices continue for the Preferred Alternative and 'Do Nothing' Alternative.

Note: * This is not an evaluation criteria; rather, it is an assessment that was conducted on the Preferred Alternative.

8.4 Advantages and Disadvantages of the Preferred Alternative

The net effects of the Preferred Alternative presented in **Section 8.1** were used to identify the advantages and disadvantages of the Preferred Alternative over the 'Do Nothing' Alternative. As previously noted, the 'Do Nothing' Alternative represents the future conditions if the Project does not proceed, and is used as a benchmark against which the Preferred Alternative is compared.

Under the 'Do Nothing' Alternative, WM would not proceed with the development of additional disposal capacity within the TCEC, and landfill operations would cease in 2031 when the currently approved Expansion Landfill reaches capacity. WM would be unable to continue to provide disposal services to its customers and fulfill long-term contractual commitments within Ontario, and these customers, including a number of municipalities across Southern Ontario, would need to find alternate ways to manage their waste. The opportunity to optimize the investment in the facility infrastructure would be lost along with the economic contributions to the local economy. The 'Do Nothing' Alternative is not a viable option for WM's on-going business, its customers, and the Province of Ontario.

The advantages and disadvantages of the Preferred Alternative compared to the 'Do Nothing' Alternative are presented in **Table 8-31** based on the net effects of the Preferred Alternative.

Table 8-31. Advantages and Disadvantages of the Preferred Alternative over the 'Do Nothing' Alternative

Evaluation Criteria	Advantages of the Preferred Alternative over the 'Do Nothing' Alternative	Disadvantages of the Preferred Alternative over the 'Do Nothing' Alternative
Atmospheric Environment		
Air Quality - Dust	None.	The predicted concentrations of dust contaminants at discrete receptors, the frequency of predicted exceedances, and the number of discrete receptors experiencing exceedances will be higher for the Preferred Alternative than for the 'Do Nothing' Alternative. With the application of mitigation strategies, the predicted concentrations at discrete receptors, the frequencies of predicted exceedances at discrete receptors, and the numbers of off-site receptors potentially affected are expected to decrease to levels similar to Future Baseline Conditions.
Air Quality - LFG and Combustion Byproducts	None.	None.

Evaluation Criteria	Advantages of the Preferred Alternative over the 'Do Nothing' Alternative	Disadvantages of the Preferred Alternative over the 'Do Nothing' Alternative
Air Quality - Blowing Litter	None.	The Preferred Alternative has a higher potential for blowing litter than the 'Do Nothing' Alternative.
Odour	None.	The predicted odour concentrations, the frequency of predicted exceedances, and the number of discrete receptors experiencing exceedances will be higher for the Preferred Alternative than for the 'Do Nothing' Alternative resulting from the increased quantity of waste in the landfill, absence of final cap, and the addition of new waste to the mound.
Noise	• Cumulative noise levels at PORs for some portions of the Preferred Alternative will be equal to the 'Do Nothing' Alternative such that the dominant noise source will be background traffic. • Off-site haul route noise is generally rated as 'insignificant' (less than 3 dB difference) compared to the 'Do Nothing' Alternative.	• The Preferred Alternative will result in higher sound levels due to active landfilling operations compared to the site only operating the ancillary sources for the 'Do Nothing' Alternative; however, this depends on the stage of landfill development. • One hour of off-site haul route noise (at 07:00) may be rated as 'noticeable', with a potential difference of 4 dB from the 'Do Nothing' Alternative.
Hydrogeology		
Groundwater Quality	None.	The Preferred Alternative will not result in any disadvantages related to Groundwater Quality when compared to the 'Do Nothing' Alternative. The CLS will be extended by 61 years relative to the 'Do Nothing' Alternative.
Groundwater Quantity	None.	None.
Surface Water Environment		
Surface Water Quality	None.	None. The potential risk to Surface Water Quality from landfilling activities would continue for a longer period than for the 'Do Nothing' Alternative due to the extended operational life of the landfill.
Surface Water Quantity	• The peak storage used for SWM Ponds_2 and 4 is slightly lower for the Preferred Alternative. • The Preferred Alternative will result in a 2% reduction in peak flows leaving the site compared to the 'Do Nothing' Alternative.	None.
Ecological Environment		
Terrestrial Ecosystem	None.	The Preferred Alternative will prolong the attractiveness of the area to avifauna scavengers and delay the time for the naturalization of the land above the landfill.
Aquatic Ecosystem	None.	None.

Evaluation Criteria	Advantages of the Preferred Alternative over the 'Do Nothing' Alternative	Disadvantages of the Preferred Alternative over the 'Do Nothing' Alternative
Social Environment		
Human Health	None.	None. Any impacts from the Preferred Alternative compared to the 'Do Nothing' Alternative are considered minimal. Based on the comparison between the modelled changes in air concentrations related to the Preferred Alternative and the air concentrations modelled in the 2005 HHRA, the Preferred Alternative is not predicted to result in any additional unacceptable health risks above those identified and mitigated in the 2005 HHRA for the 'Do Nothing' Alternative.
Effects on Local Community	• There is no difference between the Preferred Alternative and the 'Do Nothing' Alternative regarding the number of residents and residences, and confidence in TCEC operations. • The Preferred Alternative will not result in any changes to local businesses for an additional 12 years. • The Preferred Alternative will result in 16 fewer 'high' effect visual receptors overall compared to the 'Do Nothing' Alternative.	The Preferred Alternative will result in: • an increase in odour at discrete receptor locations, and continued dust emissions, litter, noise, birds, and traffic during operations for an additional 12 years; • an increase in the number of 'moderate' effect receptors by 15 compared to the 'Do Nothing' Alternative; • minor changes to the use and enjoyment of property due to increased odour at recreational areas located south of the landfill; and • minor changes in the level of satisfaction with living and working in the community due to increased odour and changes to the visual landscape.
Economic Environment		
Economic Effects on Local Community	The Preferred Alternative will result in: • the continuation of 35 stable employment positions for an additional 12 years; • continued host community payments, which make up approximately 24% of the Township's total gross annual operating budget and an approximately 36% of the Township's total municipal revenue, for an additional 12 years, amounting to approximately $50 million; • continued property tax contributions of at least 3.5% of the Township's property tax revenue for an additional 12 years; • continued contributions to community projects for an additional 12 years; and • an estimated $30 million in contributions to the local economy over 12 years.	None.
Visual Landscape		
Visual Environment	The Preferred Alternative will result in 16 fewer 'high' effect receptors.	The Preferred Alternative will result in an increase of 15 'moderate' effect receptors.

Evaluation Criteria	Advantages of the Preferred Alternative over the 'Do Nothing' Alternative	Disadvantages of the Preferred Alternative over the 'Do Nothing' Alternative
Cultural Environment		
Cultural Heritage Resources	None.	None.
Archaeological Resources	None.	None.
Transportation		
Traffic Operations	None.	The Preferred Alternative will result in continued site traffic for an additional 12 years; however, no net effects to traffic operations are anticipated as a result of the continued landfill operations. The removal of landfill-related traffic for the 'Do Nothing' Alternative will result in marginal improvements to traffic operations since site traffic is a small component of the total traffic volumes.
Current and Planned Future Land Use		
Effects on Current and Future Land Uses	There would be no need to accommodate future waste at another existing landfill or a new landfill elsewhere, when compared against the 'Do Nothing' Alternative.	The Preferred Alternative will require new planning approvals (County and Local OP, Township ZBL, and Site Plan Control), and result in continued restrictions for surrounding land uses for an additional 12 years.
Other		
Solar Exposure*	None.	None.
Climate Change (GHG Emissions)*	The Preferred Alternative increases the quantity of LFG available for use as a source of RNG as an alternative to fossil fuels.	The Preferred Alternative results in overall higher releases of GHGs compared to the 'Do Nothing' Alternative due to the increase in total tonnage in place in the Preferred Alternative and continuation of on-site traffic.

Note: * This is not an evaluation criteria; rather, it is an assessment that was conducted on the Preferred Alternative.

8.5 Impact Management Plan

As part of the 2005 EA for the Expansion Landfill, WM established and implemented an impact management plan for the TCEC Landfill. This included monitoring of landfill operations and the associated effects to evaluate if the landfill is operating as designed and impacts are occurring as predicted in the EA. An extensive range of monitoring programs has been implemented at the site and monitoring programs are on-going as discussed in this EA. Adjustments and modifications to operations have occurred to address any concerns or issues identified through monitoring and community feedback. The monitoring programs and any associated contingency measures have been established and approved as part of the ECAs for the TCEC.

8.5.1 Impact-Related Compensation to Residents

In the event that residual nuisance effects related to dust, odour, and noise cannot be addressed through the application of mitigation measures, WM has established impact-related compensation measures for the local community. WM currently provides financial compensation to owners in residences that meet the criteria developed as part of the 2005 EA and specified in **Table 8-32** below. The financial compensation was to be provided from the start of Expansion Landfill site preparation and continue for the active life of the approved Expansion Landfill. The impact-related compensation plan became effective following approval of the ECA for the landfill, allowing construction to commence.

Table 8-32. Criteria for Impact-Related Compensation (2005 EA)

Nuisance Impact		Description	Impact Criterion for Compensation
Dust	TSP	Total Suspended Particulate Matter – causing reduced visibility.	Any exceedance of the MECP 24-hour AAQC of 120 µ/m³ in any year.
	Dustfall	Larger particles of sufficient weight to settle quickly from the air and produce a dust film on surfaces.	Any exceedance of the MECP 24-hour AAQC of 7 g/m² in any year.
Odour		The response to olfactory stimulation that produces annoyance. Effects of odours are primarily based on subjective experiences of individuals.	• If predicted odour is 1 OU/m³ or more for 0.6% of the time or more in any modelled year, or • Predicted odour is over 3 OU/m³ at any frequency.
Noise	Construction	Noise due to landfill construction activities, particularly the construction of perimeter berms.	Noise increases greater than 6 dBA above ambient.
	Landfill Operations	Noise due to landfill operations.	Any noise exceedances of landfill standards guideline of 55 dBA in any year.
	Traffic	• Noise due to landfill-related truck traffic. • Increase in traffic volume.	All residences along the primary haul route for landfill traffic (County Road 79 and Highway 402 ramps to the proposed landfill entrance.

It is WM's intention to continue the impact-related compensation plan for the extended life of the landfill related to the Project (i.e., for approximately an additional 12 years). Financial nuisance impact-related compensation is paid by WM to residences predicted to experience one or more nuisance impacts (i.e., dust, odour, noise). WM will continue to provide financial compensation to impacted residences. The Project is predicted to result in residential nuisance effects at additional residences for limited or short durations (i.e., during the development of a portion of a landfill stage). Financial compensation will be provided to these additional residences consistent with the impact criterion as outlined below.

8.5.1.1 Dust

Individual impact-related compensation will be provided to residences that are predicted to experience an exceedance of 24-hour TSP (i.e., a concentration greater than the AAQC of 120 µ/m³) at any point during a particular Stage of landfill development based on the results of the Air Quality effects assessment. Compensation will be provided during the entire corresponding Stage of landfill development. As noted in **Section 8.1.1.1**, after mitigation, a total of between 3 and 9 sensitive receptors were predicted to be affected by the exceedances of 24-hour TSP depending on the Stage of landfill development. The residence locations meeting the criteria for individual compensation due to exceedances of 24-hour TSP are identified in **Table 8-33**.Residences currently compensated for Dust under the existing Impact Management Plan will continue to be compensated until the end of life of the currently-approved Expansion Landfill, at which time, the compensation for the Landfill Optimization Project will begin for the identified residences.

8.5.1.2 Odour

Individual impact-related compensation will be provided to residences that are predicted to experience an exceedance in odour of 1 OU/m³ or greater for at least 0.6% of the time at any Stage of landfill development, or over 3 OU/m³ at any frequency. Exceedances of 1 OU/m³ greater than 0.6% of time occur at 19 receptors under Scenario 1, 13 receptors under Scenario 2, and no receptors under Scenario 3. Exceedances of 3 OU/m³ occur less than 0.5% of the time, with eight (8) receptors affected under Scenario 1, two (2) receptors affected under Scenario 2, and one (1) receptor affected under Scenario 3. The residence locations meeting the criteria for individual compensation due to Odour are identified in **Table 8-33**.

Residences currently compensated for Odour under the existing Impact Management Plan will continue to be compensated until the end of life of the currently-approved Expansion Landfill, at which time, the compensation for the Landfill Optimization Project will begin for the identified residences.

8.5.1.3 Noise

Noise compensation under the Impact Management Plan is divided into three subsets: construction noise, landfilling noise, and traffic noise. Each of these subsets is discussed below. The residence locations meeting the criteria for individual compensation due to Noise are identified in **Table 8-33**.

Construction

Individual impact-related compensation will be provided to residences that are predicted to experience construction noise greater than 6 dBA above ambient noise levels. Based on the noise modelling, two residences have been identified for construction noise-related compensation.

Residences currently compensated for Construction Noise under the existing Impact Management Plan will continue to be compensated until the end of life of the currently-approved Expansion Landfill, at which time, the compensation for the Landfill Optimization Project will begin for the identified residences.

Landfill Operations

No residences will experience exceedances of the 55 dBA landfill standards guideline in any year of the Project due to landfill operations; however, residences currently receiving compensation due to noise from landfill operations will continue to be part of the impact-related compensation plan.

Traffic

The haul route to and from the TCEC and the volume of site-related traffic are not changing as a result of the Project. Residences that are part of the current compensation plan will continue to receive impact-related compensation for the extended operational life of the landfill.

8.5.1.4 Summary of Impact-Related Compensation for the Project

The residences subject to receiving individual impact-related compensation are presented in **Table 8-33** below. The receptor locations are shown on **Figure 8-3**.

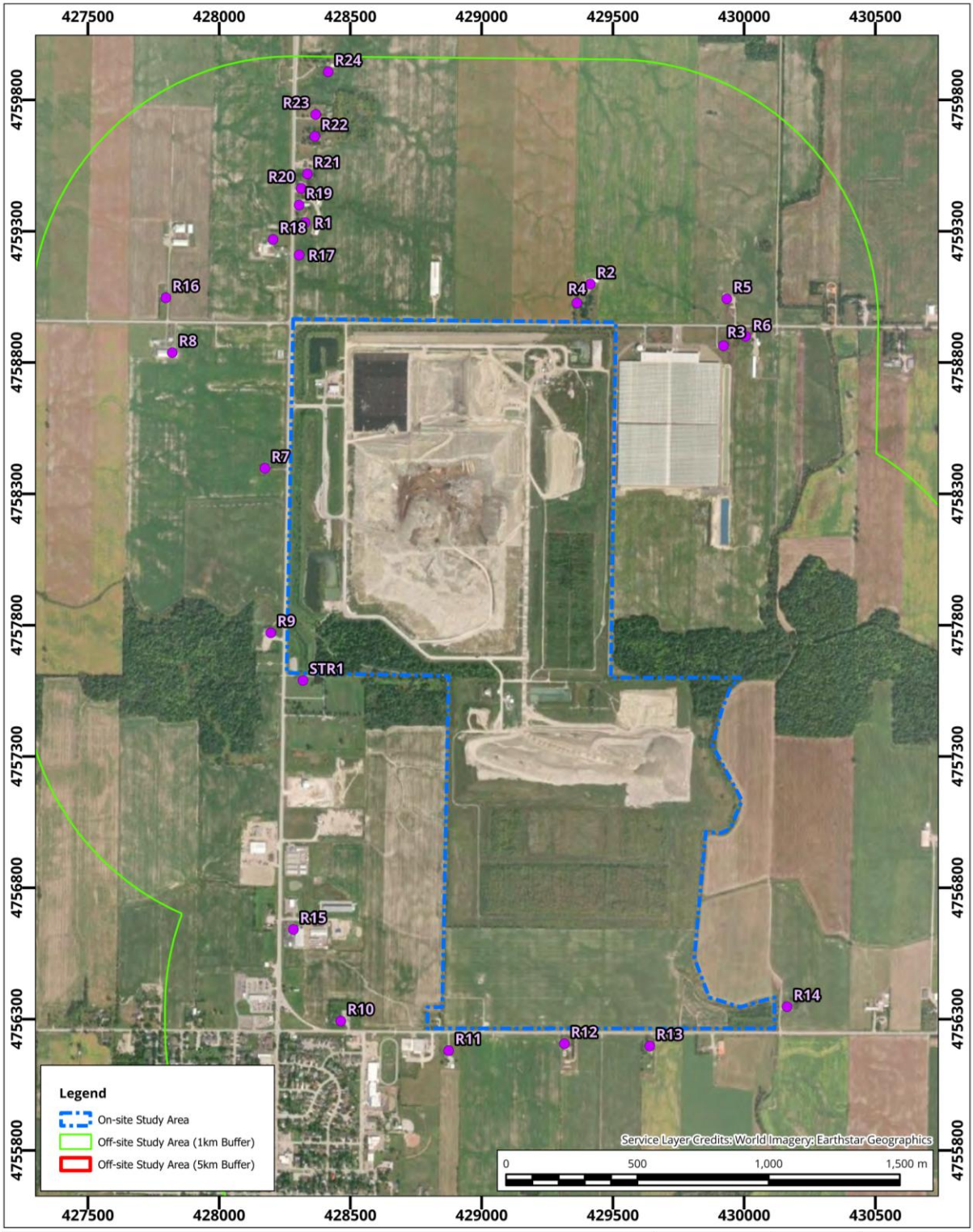
Table 8-33. Residences Identified for Impact-Related Compensation (Landfill Optimization Project)

Receptor	Receptor (2005 EA)	24-hour TSP[1]	Traffic	Construction Noise	Odour	
		Over 120 µ/m³	Traffic Volume or Noise[2]	Over 6 dBA above ambient	Over 1 OU/m³ over 0.6% of the time	Over 3 OU/m³
R1	R4	Scenario 1	X	—	Scenario 1 & 2	Scenario 1
R2	R34	Scenario 2 & 3	—	X	Scenario 1 & 2	Scenario 1 & 2
R3	R26	—	—	X	Scenario 1 & 2	—
R4	R14	All Scenarios	—	—	Scenario 1 & 2	All Scenarios
R5	R30	—	—	—	Scenario 1 & 2	—
R6	R27	—	—	—	Scenario 1 & 2	—
R7	R13	All Scenarios	X	—	Scenario 1 & 2	—
R8	R12	Scenario 1	—	—	Scenario 1 & 2	—
R9	*	—	—	—	Scenario 1 & 2	—
R10	*	—	—	—	—	—
R11	*	—	—	—	—	—
R12	*	—	—	—	Scenario 1	—
R13	*	Scenario 1 & 3	—	—	—	—
R14	*	—	—	—	—	—

Receptor	Receptor (2005 EA)	24-hour TSP[1]	Traffic	Construction Noise	Odour	
		Over 120 µ/m³	Traffic Volume or Noise[2]	Over 6 dBA above ambient	Over 1 OU/m³ over 0.6% of the time	Over 3 OU/m³
R15	*	—	—	—	Scenario 1	—
R16	R11	Scenario 1	—	—	Scenario 1 & 2	—
R17	R2	Scenario 1	X	—	Scenario 1 & 2	Scenario 1
R18	R3	Scenario 1	X	—	Scenario 1 & 2	Scenario 1
R19	R5	Scenario 1	X	—	Scenario 1 & 2	Scenario 1
R20	R6	—	X	—	Scenario 1	Scenario 1
R21	R7	—	X	—	Scenario 1	Scenario 1
R22	R8	—	X	—	Scenario 1	—
R23	R9	—	X	—	Scenario 1	—
R24	R10	—	X	—	—	—
STR1	*	N/A	—	—	—	—
Total Residences		**10**	**10**	**2**	**19**	**8**

Notes:
N/A = not applicable; – = no compensation.
* Not identified in the 2005 EA.
[1] Based on the three worst-case scenarios modelled for the Project.
[2] Based on the current Impact Management Plan; no changes as a result of the Project.

Figure 8-3. Impact Management Plan Receptor Locations



8.5.2 Property Value Protection

WM has established a zone around the TCEC for PVP based on high-level visual impacts. Owners of residential and non-residential properties within the high visual impact zone identified in the 2005 EA will be able to access the plan. Based on this criteria, the PVP plan includes all owners with properties or portions of properties located within the zone. The specific details and application of the plan will continue in a manner consistent with how they were established as part of the 2005 EA. The PVP plan will extend through the operating life of the Expansion Landfill as currently approved.

The Project will extend the operating life of the TCEC landfill by approximately 12 years. This EA for the Landfill Optimization has identified a high visual impact zone for the Preferred Alternative. It is WM's intention to continue with the PVP plan which will include the owners of with properties or portions of properties within the identified high visual impact zone for the Preferred Alternative. All properties or portions of land parcels remaining in the existing PVP plan for the approved Expansion Landfill will continue to be included. The PVP plan will be extended to the end of the operating life of the Project. The high visual impact zone to which the PVP plan will be applied is shown on **Figure 8-2**.

8.5.3 Community Wide Compensation

WM entered into a Host Community Agreement with the Township of Warwick, which helps alleviate tax burdens to local residents, reduces the Township's reliance on residential tax assessment, and offsets net increases in the Township's operating costs associated with residential development. From 2009 through 2024, WM has contributed over $41.3 million in host community fees to the Township. The average annual payment of host community fees to the Township under the current Host Community Agreement is approximately $4.1 million, which amounts to approximately 24% of the Township's gross annual operating budget and approximately 36% of the Township's total municipal revenue.

Municipal taxes levied on the TCEC form a portion of the tax base for the Township of Warwick, thus alleviating tax burden on the local residents and reducing the Township's reliance on residential tax assessment. Based on the data from Township of Warwick, WM has contributed between 1.7% and 3.5% of the Township's property tax revenue over the past 5 years.

Over the past 10 years, WM has provided additional support for community projects such as walking trails, soccer fields, arena upgrades, dog park, yard waste and recycling depots, and local festivals and events. Since 2009, WM has contributed over $800,000 to important projects across the County of Lambton.

WM will continue contributions to the Township of Warwick through host community fees, municipal taxes, and support for community projects during the Project.

8.6 Cumulative Effects

A cumulative effects assessment was conducted for the Preferred Alternative. Cumulative effects for this EA are defined as those effects that are likely to result from the Preferred Alternative in combination with other past, present and reasonably foreseeable projects or activities. Effects can be considered cumulatively when they overlap in terms of time, space, and type of effect. The focus of the cumulative effects assessment is the net effects of the Preferred Alternative presented in **Section 8.2**.

The net effects of the Preferred Alternative, shown in **Table 8-29**, relate to dust, odour, groundwater quality, surface water quantity, socio-economic effects on the local community, the visual impact of the facility, current land use, and solar exposure. The net effects take into account existing operations at the TCEC, and other past and current projects and developments as part of existing conditions. In addition, the Future Baseline Conditions take into account changes that will occur between existing conditions and the start of the Project, including additional residential developments and background traffic growth. Consequently, the focus of the cumulative effects assessment is on planned and future projects that have not been included in existing or Future Baseline Conditions.

8.6.1 Identification of Planned and Future Projects

The County of Lambton was contacted to identify active development applications within the Off-site Study Area. Three planned residential developments in Watford were identified for inclusion in the EA as follows:

1. Ontario Street Subdivision (Final Approved Plan – File #38T-20002), consisting of nineteen (19) lots for single-detached dwellings;
2. Watford Quality Care (Final Approved Plan – Plan 655), consisting of thirty-one (31) lots for single-detached dwellings; and
3. Castell Homes Subdivision (Draft Plan Approved – File #38T-21001) proposing fifty (50) lots for single and semi-detached dwellings.

In addition, in November 2024, the Township of Warwick approved a subdivision plan by Richfield Homes to develop 147 homes (56 single-detached dwellings, 79 townhouses, and 12 lots for semi-detached dwellings) at the west end of St. Clair Street in Watford[19]. The application was forwarded to the County of Lambton for approval.

Intersection improvements are planned for the intersection of Nauvoo Road and Confederation Line, which will provide exclusive left-turn lanes for all approaches and will remove the westbound right-turn channelization (ramp).

[19] Wright, H. (2024, November 21). Warwick OKs 147 unit subdivision. The Independent. https://petrolialambtonindependent.ca/2024/11/21/warwick-oks-147-unit-subdivision.

The Ontario Ministry of Transportation (MTO) does not have any future projects planned for Highway 402 north of the TCEC with the exception of road resurfacing, which is planned for 2027-2028.

The Enbridge Watford Pipeline Project, involving the construction of a 15.3-km pipeline in the Municipality of Brooke-Alvinston and the Township of Warwick to transport RNG from WM's RNG Facility to the local natural gas distribution network is slated for completion in 2025.

These planned and future projects have been incorporated into the description of existing conditions and Future Baseline Conditions as applicable and are assumed to be in place at the time of Project commencement. No additional planned or future projects have been identified.

8.6.2 Assessment of Cumulative Effects

No planned or future projects have been identified that would overlap with the net effects of the Preferred Alternative in terms of time, space, and type of effect; therefore, no cumulative effects have been identified for the Project.

8.7 Geotechnical Feasibility of the Preferred Alternative

A geotechnical feasibility study of potential vertical expansion alternative methods was completed during the ToR. A commitment was made in the ToR to determine in the EA the need for a more detailed geotechnical assessment of the Preferred Alternative. During consultation on the effects assessment of the alternative methods and identification of the Preferred Alternative, feedback was received regarding geotechnical issues related to settlement of the landfill base and stability of the landfill side slopes. The additional geotechnical feasibility review for the Preferred Alternative can be found in **Supporting Document 5**.

The purpose of the settlement analysis was to assess if the landfill base grades would meet the 0.5% minimum grade design toward the leachate collection system under the increased waste loading. The analysis concluded that for the Preferred Alternative, cell floor settlement will not have a significant effect on functionality of the leachate collection systems. Overall slope in a westerly direction will be maintained, and leachate will continue to drain toward the designated withdrawal points.

The stability analysis was conducted to determine the safety factor associated with increasing the side slopes from 4H:1V to 2.5H:1V. The static safety factors for the Preferred Alternative are expected to be 1.51 and 1.50 under waste loads of 12 and 15 kiloNewtons per cubic metres (kN/m^3), respectively, and the seismic safety factors are expected to be 1.48 under both load cases. The values are satisfactory for proposed 2.5H:1V slopes, as compared to typical target values in the order 1.3 to 1.5 for static stability conditions.

9 Consultation and Engagement

This section of the Draft Environmental Assessment (EA) Study Report provides a summary of the consultation and engagement activities carried out as part of the EA. Detailed information regarding the consultation and engagement program for the EA is provided in **Supporting Document 4 – Record of Consultation and Engagement**.

9.1 Overview of the Consultation and Engagement Process for the EA

In accordance with the Ontario Ministry of Environment, Conservation, and Park's (MECP) Code of Practice: Preparing and Reviewing Environmental Assessments in Ontario (MECP, 2014a), Code of Practice: Consultation in Ontario's Environmental Assessment Process (MECP, 2014b), and as required by Section 5.1 of the *Ontario Environmental Assessment Act* (*OEAA*), a consultation and engagement program involving agencies, Indigenous communities and groups, and the public was carried out during the EA process.

A Record of Consultation and Engagement has been prepared as part of the EA and is included as **Supporting Document 4**. The Record of Consultation and Engagement includes more detailed information for each of the consultation and engagement activities undertaken during the EA and discussed above. This includes information presented and received at the Public Information Sessions (PIS), Notices, and copies of comments, questions, issues and concerns from agencies, Indigenous communities and groups, and members of the public, and how those questions, issues and concerns were addressed.

The following principles guided the consultation and engagement carried out during the preparation of the EA as per the approved Terms of Reference (ToR):

- Engage residents and neighbours within proximity of the proposed undertaking, Indigenous communities, and other participants from the beginning of the process through the use of a variety of consultation and engagement events and activities and to establish that there were adequate opportunities to provide input, feedback, and comments concerning the EA undertaking and process, and that these comments are considered by the Project team;
- Engage local elected officials in the development of the EA, and to confirm that they were provided with regular and timely information concerning the EA development process;
- Engage Indigenous communities and groups in a manner consistent with any requests that might be received from each community and includes providing any specific engagement activities, such as meetings, at the request of the community;
- Ensure that the consultation and engagement process is open, transparent, and inclusive; and

- Document all issues and concerns identified by the public, Indigenous communities and groups, agencies, and other participants.

The consultation and engagement program outlines the components and activities to be undertaken during the EA. A commitment was also made to continue to engage Indigenous groups and organizations with a potential interest in the Project. The following subsections describe how each of these activities was implemented during the course of the EA.

By following the consultation and engagement program and consulting with interested people, WM was able to provide opportunities for input before decisions were finalized and respond by making changes as appropriate.

9.2 Participants in the EA Process

A broad group of participants were consulted and engaged in the EA process. This included:

- governmental departments, ministries, and agencies with an interest in the Project, typically referred to as the Government Review Team (GRT);
- local municipalities, including the host Township of Warwick and the County of Lambton;
- Indigenous communities in the vicinity of the study areas or with an interest in the Project; and
- the general public including residents, landowners, businesses and other participants with an interest in the outcome of the EA.

A list of participants for the EA was prepared based on the consultation and engagement process completed during the ToR. The list of participants was updated throughout the EA process including both the addition and removal of participants as required and when requested. A copy of the complete participant contact list is included in Appendix A of **Supporting Document 4**.

A list of the GRT members including federal provincial, and municipal agencies consulted during the EA process is provided below:

Government Review Team (GRT)

- Environment and Climate Change Canada
- Ministry of Agriculture, Food and Rural Affairs
- Ministry of Citizenship and Multiculturalism (MCM)
- Ministry of Mines
- Ministry of Natural Resources (MNR)
- Ministry of the Environment, Conservation and Parks (MECP)
- Ministry of the Solicitor General
- Ontario Provincial Police

- Ministry of Municipal Affairs and Housing

Municipal agencies and organizations

- Township of Warwick
- Warwick Public Liaison Committee (WPLC)
- County of Lambton
- Lambton Public Health
- Conseil Scolaire Catholique Providence
- Lambton Kent District School Board
- St. Clair Catholic District School Board

During the preparation of the ToR, the following Indigenous communities and organizations were identified for engagement about the ToR and EA. These Indigenous communities and organizations were contacted during the development of the ToR and throughout the EA process.

Indigenous communities and groups

- Aamjiwnaang First Nation
- Caldwell First Nation
- Chippewas of Kettle and Stony Point First Nation (CKSPFN)
- Chippewas of the Thames First Nation (COTTFN)
- Delaware Nation at Moraviantown
- Métis Nation of Ontario
- Munsee Delaware Nation
- Oneida Nation of the Thames
- Walpole Island First Nation – Bkejwanong Territory (WIFN)

Local residents within the vicinity of the TCEC and neighbouring property owners were contacted as part of the Notice of Commencement of the EA. Additional members of the public were added to the list of participants during the course of the EA upon request. Members of the WPLC were also included in the list of participants.

A participant contact list including the GRT, municipal agencies, Indigenous communities and groups, and members of the public was compiled for the Project and can be found in Appendix A of **Supporting Document 4**.

9.3 Consultation and Engagement Activities

The following consultation activities took place with the above parties during the EA:

- Distribution of Notices (Notice of Commencement and PIS 1, Notice of PIS 2, Notice of PIS 3, and Notice of PIS 4);
- Three PISs, with a fourth to be held concurrent with the release of the Draft EA Study Report for review;

- Review of Draft Existing Conditions Reports and Draft Effects Assessment Reports by Agencies, Indigenous communities and groups, and members of the public;
- Project website, email, and telephone numbers;
- Consultation with Agencies and organizations;
- Engagement with Indigenous communities and groups;
- Municipal Council meetings;
- WPLC meetings;
- Site Tours;
- Phone calls;
- Media publications regarding the Project; and
- Review of the Draft EA Study Report.

These activities are described in further detail in **Supporting Document 4**.

9.3.1 Project Notices

At key stages of the EA Process, notices were distributed to the participant groups, via letters, email and newspaper advertisements. **Table 9-1** highlights the type of notice and its method and dates of publication.

Agencies, Indigenous communities and groups, and members of the public, including neighbouring property owners, were notified of the commencement of the EA, PISs, and review period of the Draft EA Study Report.

Table 9-1. Project Notices

Notice	Date of Mail/Electronic Delivery of Letters	Date of Publication in Local Newspapers	Date of Posting to Project Website
Notice of Commencement of EA and PIS 1	Mail: April 4, 2023 Email: April 5, 2023	The Sarnia Observer on April 4 and 13, 2023 The Independent of Petrolia and Central Lambton on April 6, 2023 Sarnia This Week on April 13, 2023	April 5, 2023
Notice of PIS 2	Mail: November 15, 2023 Email: November 16, 2023	The Sarnia Observer, The Independent of Petrolia and Central Lambton and Sarnia This Week on November 16 and 23, 2023	November 15, 2023
Notice of PIS 3	Mail: November 13, 2024 Email: November 14, 2024	The Sarnia Observer, The Independent of Petrolia and Central Lambton, and Sarnia This Week on November 14 and 21, 2024	November 15, 2024

Notice	Date of Mail/Electronic Delivery of Letters	Date of Publication in Local Newspapers	Date of Posting to Project Website
Notice of PIS 4	Mail: October 31, 2025 Email: November 5, 2025	The Sarnia Observer, The Independent of Petrolia and Central Lambton, and Sarnia This Week on November 6 and 13, 2025	November 11, 2025

The Notice of Commencement included information about PIS 1. Additional notifications were shared with participants by email, including the posting of PIS display panels on the Project website and the review periods for the Draft Existing Conditions and Effects Assessment Reports. On December 8, 2023, participants were advised that the PIS 2 display panels and Draft Existing Conditions Reports were available online, and on December 6, 2024, they were notified that the Draft Effects Assessment Reports were also available for review.

A copy of the Notices is provided in Appendix B of **Supporting Document 4**. Copies of the Notice distribution emails to Indigenous communities, Agencies, and the Public are provided in Appendices D, E, and F of **Supporting Document 4**, respectively.

9.3.2 Project Website, Email, and Telephone

A Project specific website (https://www.wm.com/ca/en/twin-creeks-landfill/landfill-optimization-project) was launched as part of the commencement of the ToR. The website was established to provide clear and accurate information to participants as well as opportunities for participants to give feedback to WM. The website was updated regularly and includes up-to-date information about the Project, notices of upcoming events, and a summary of previous consultation and engagement events. In addition, the Draft Existing Conditions Reports, Effects Assessment Reports and PIS Summary Reports were posted on the website. Materials and notices will continue to be added to the website as the Project progresses. The Draft EA Study Report will be posted on the Project website for participant review and comments.

All notifications and Project materials identify the email address and telephone number for the WM contact person:

Wayne Jenken
Landfill Engineering Manager, Canada Area
WM Canada
5768 Nauvoo Road, Watford, ON, N0M 2S0
Phone: 519.849.5810
E-mail: wjenken@wm.com

9.3.3 Public Information Sessions

WM hosted three PISs during the EA from April 19, 2023 to November 27, 2024, with a fourth PIS planned for November 19, 2025.

9.3.3.1 Public Information Session 1

PIS 1 was held on April 19, 2023 from 4:00 p.m. to 8:00 p.m. at the WM TCEC Site Office at 5768 Nauvoo Road, Watford, Ontario. WM presented background information on the TCEC. The presentation covered the Project's purpose and need, alternatives considered, the EA process, EA study areas, planned consultation and engagement (including how to participate), next steps, and Project team contact information. There were 26 people in attendance in addition to WM and consulting staff.

The Notice of PIS 1 was provided in advance to agencies, Indigenous communities and organizations, and the public (see **Section 9.3.1**).

Information was presented on 13 large displays panels set up on easels around the room. WM staff and consultants were available to discuss the information panels, receive comments, and answer questions. Members of the public were asked to sign-in as they arrived and were given a comment form which included questions regarding the information presented. All presentation materials were posted on the Project website following the PIS.

Completed comment forms were requested by May 3, 2023. Two completed comment forms were received. The comments received are included in **Table 9-2**.

Table 9-2. Summary of Comments Received from Public Information Session 1

4. My **interest** in the Project is: (please check all that apply)			
1	residential property	1	air quality (dust, noise, odour)
0	business	0	ecology (plants, wildlife)
0	member of interest group	2	groundwater / surface water
0	agency representative	2	land use / visual
0	other:	2	transportation

5. Please provide any **general comments** about the information presented at this PIS.
A total of 2 responses were received to this question. General comments included the following: • Create a scale model of the Project • Revise permit to allow on-site recycling

6. After reviewing the information presented, do you have any additional comments, concerns, questions, or recommendations regarding the **current operations at the Twin Creeks Environmental Centre or the proposed Project**? (Yes/No)
A total of 2 responses were received to this question (2 yes). The responses included the following: • Odour is perceived as an on-going issue that will become a bigger issue with increase in landfill height along with runoff and leachate disposal • Improve the waste stream by removing renewables and other non-waste articles

7. Do you have any specific comments or questions regarding the **Environmental Assessment Process**, **Evaluation Process**, and/or **Study Areas**? (Yes/No)
A total of 2 responses were received to this question (2 yes). The responses included the following: • Increase the study area by 3x as the landfill is going 3x higher • Increased landfill height will increase odour in Watford and what will be done to mitigate this?

8. Do you have any specific comments, questions, or recommendations regarding the **consultation and engagement opportunities**? (Yes/No)
A total of 2 responses were received to this question (2 yes). The responses included the following: • Include a sign at the road to direct attendees on where to park • Few residents receive newspapers and most flyers are just recycled without being read, so perhaps social media could be used with a regular bi-weekly update regarding the landfill

9. Are there any **other questions or concerns** you have about the Environmental Assessment? (Yes/No)
A total of 2 responses were received to this question (2 yes). The responses included the following: • Open meetings with presentations on all aspects of the Project • Have open question and answer period for all residents to engage in • Concern about original liner thickness and ability to support the additional height and weight load

As outlined in the consultation and engagement program included in the approved ToR (**Appendix A**), a PIS 1 Summary Report was prepared following the event and was posted to the Project website. The Summary Report included a description of all aspects of PIS 1, a summary of results as well as comments received and responses, as appropriate. A copy of the PIS 1 Summary Report is included as Appendix C of **Supporting Document 4**.

9.3.3.2 Public Information Session 2

PIS 2 was held on November 29 and December 5, 2023 from 4:00 p.m. to 8:00 p.m. at the WM TCEC Site Office. WM presented an overview of the TCEC site and Landfill Optimization Project, including an update on the EA, the three representative Alternative Methods and their screening, the approved Evaluation Criteria and related Existing Conditions, as well as consultation and engagement opportunities, ways to participate in the EA, next steps, and Project staff contact information. There were 22 people (18 people on November 29, and 4 people on December 5) in attendance in addition to WM and consulting staff.

The Notice of PIS 2 was provided in advance to agencies, Indigenous communities and organizations, and the public (see **Section 9.3.1**).

Information was presented on 32 large displays panels set up on easels around the room. WM staff and consultants were available to discuss the information panels, receive comments, and answer questions. Members of the public were asked to sign-in as they arrived and were given a comment form which included questions regarding the information presented. All presentation materials were posted on the Project website following PIS 2.

Completed comment forms were requested by December 22, 2023. No completed comment forms were received during or after the PIS.

Participants raised questions and comments related to air quality and odour, noise, groundwater quality, leachate management, surface water quality, terrestrial species, WM's host community contributions and community funding, visual effects of the landfill, truck traffic, and zoning. Details are provided in the PIS 2 Summary Report in Appendix C of **Supporting Document 4**.

As outlined in the consultation and engagement program included in the approve ToR (**Appendix A**), a PIS 2 Summary Report was prepared following the event and was posted to the Project website. The Summary Report included a description of all aspects of PIS 2, a summary of results as well as comments received and responses, as appropriate. A copy of the PIS 2 Summary Report is included as Appendix C of **Supporting Document 4**.

9.3.3.3 Public Information Session 3

PIS 3 was held November 27, 2024 from 4:00 p.m. to 8:00 p.m. at the East Lambton Community Complex at 61 Centennial Avenue, Watford, Ontario. WM presented an overview of the TCEC site and Landfill Optimization Project, an update on the EA, the three representative Alternative Methods, preliminary results of the effects assessment and comparative evaluation to identify a Preferred Alternative, as well as consultation and engagement opportunities, ways to participate in the EA, next steps, and Project staff contact information. There were 35 people in attendance in addition to WM and consulting staff.

The Notice of PIS 3 was provided in advance to agencies, Indigenous communities and organizations, and the public (see **Section 9.3.1**).

Information was presented on 26 large displays panels set up on easels around the room. WM staff and consultants were available to discuss the information panels, receive comments, and answer questions. Members of the public were asked to sign-in as they arrived and were given a comment form which included questions regarding the information presented. All presentation materials were posted on the Project website following PIS 3.

Completed comment forms were requested by December 13, 2024. There were three completed comment forms received during the PIS, and one comment form received after the event. The comments received are included in **Table 9-3**.

Table 9-3. Summary of Comments Received from Public Information Session 3

1. My **interest** in the Project is: (please check all that apply)			
0	residential property	0	air quality (dust, noise, odour)
0	business	0	ecology (plants, wildlife)
0	member of interest group	1	groundwater / surface water
0	agency representation	1	land use / visual
2	other:	0	transportation
2. Please provide any **general comments** about the information presented at this PIS.			
One (1) response was received for this. One participant was concerned about the increased surface water due to the new road and ditch construction. They inquired about the inclusion of a berm along Confederation and the potential impact to property value.			
3. After reviewing the information presented, do you have any comments or questions regarding the **conceptual design of the Alternative Methods for the Project**? (Yes/No)			
No responses (0) were received for this question.			
4. Do you have any specific comments or questions about the **assessment of Alternative Methods**? (Yes/No)			
Two (2) responses were received to this question (yes). One participant questioned if the new landfill height would create a shadow that could reduce the heat units west of site. The other participant was concerned about litter/odour.			
5. Do you have any specific comments, questions, or recommendations about the **results of the comparative evaluation of Alternative Methods**? (Yes/No)			
No responses (0) were received for this question.			
6. Do you have any specific comments or questions about the **Preferred Alternative** identified? (Yes/No)			
No responses (0) were received for this question.			

As outlined in the consultation and engagement program included in the approved ToR (**Appendix A**), a PIS 3 Summary Report was prepared following the event and posted to the Project website. The Summary Report included a description of all aspects of PIS 3, a summary of results as well as comments received and responses, as appropriate. A copy of the PIS 3 Summary Report is included as Appendix C of **Supporting Document 4**.

9.3.3.4 Public Information Session 4

PIS 4 is planned for November 19, 2025 from 4:00 p.m. to 8:00 p.m. at East Lambton Community Complex to provide an update on the EA, present the Preferred Alternative

for the vertical expansion and the effects assessment of the Preferred Alternative, and present an overview of the Draft EA Study Report and next steps in the EA process. WM and consulting staff will be in attendance to discuss the information panels, receive comments, and answer questions.

The Notice of PIS 4 was provided in advance to agencies, Indigenous communities and organizations, and the public (see **Section 9.3.1**). A PIS 4 Summary Report will be prepared following the event and will be posted to the Project website.

A summary of PIS 4 will be provided in the Final EA Study Report.

9.3.4 Indigenous Community Engagement and Communications

WM is committed to engagement with potentially affected Indigenous communities and groups during the EA process. The list of potentially-affected Indigenous communities and groups was developed in consultation with the MECP. The MECP identified nine (9) Indigenous communities and groups:

- Aamjiwnaang First Nation;
- Chippewas of Kettle and Stony Point First Nation (CKSPFN);
- Chippewas of the Thames First Nation (COTTFN);
- Oneida Nation of the Thames;
- Walpole Island First Nation – Bkejwanong Territory (WIFN);
- Caldwell First Nation;
- Delaware Nation at Moraviantown;
- Métis Nation of Ontario; and
- Munsee Delaware Nation.

These Indigenous communities and groups were provided Notices and meeting materials via hard copy mail (Canada Post Xpresspost) and electronic mail. Caldwell First Nation, COTTFN, and CKSPFN (after February 1, 2025) were also notified through their consultation protocols. The Notices included the Notice of Commencement, and Notices of PIS 2 through 4. All Indigenous engagement documents including distribution of Project notices, meeting materials, comments and written correspondence are included in Appendix D of **Support Document 4**.

9.3.4.1 Review and Comments

The Stage 1 Archaeological Assessment for the Project was provided to the Aamjiwnaang First Nation, WIFN, CKSPFN and COTTFN. Feedback was provided by CKSPFN and COTTFN.

The Draft Existing Conditions Reports were made available for review on the WM website on December 8, 2023, with comments requested by February 2, 2024. Feedback was provided by CKSPFN, COTTFN, and WIFN (see **Section 9.3.9.1**).

WM posted the Draft Effects Assessment Reports on December 6, 2024 and requested feedback by January 31, 2025. Feedback was provided by CKSPFN, COTTFN, and WIFN (see **Section 9.3.9.2**).

The Draft EA Study Report will be made available for review on the WM website beginning on November 19, 2025. Questions and comments on the Draft EA Study Report will be requested to be received by January 30, 2026.

9.3.4.2 Other Activities

Four TCEC site tours were conducted by WM for Indigenous communities:

- WIFN on August 29, 2023;
- COTTFN on September 25, 2023;
- Caldwell First Nation on April 4, 2024; and
- CKSPFN on September 11, 2024.

WM attended two CKSPFN community events. On December 4, 2024, CKSPFN hosted a Community Open House at the Kinomaagaazda Education Hub, Lambton Shores. The event aimed to introduce the Project, provide an update on the EA, present the three Alternative Methods, the Draft Effects Assessment Reports, and a comparison of the Alternative Methods to select the Preferred Alternative, and outline next steps and upcoming engagement opportunities. On March 26, 2025, CKSPFN hosted a community workshop at the Kinomaagaazda Education Hub. WM provided an overview presentation of the Project and CKSPFN facilitated a technical review discussion.

WM attended the WIFN Nindawaabjig Heritage Centre Open House on March 19, 2024, to present an overview of the EA.

In addition to the above, WM has attended several meetings with Indigenous communities as detailed in **Supporting Document 4**. The communities included CKSPFN, COTTFN, WIFN, and Caldwell First Nation.

9.3.5 Agency and Organizations Consultation and Engagement

Government and municipal agency groups as well as business organizations were engaged throughout the EA process including the GRT, which comprised governmental departments, ministries, and agencies with an interest in the Project, as well as municipal agencies and organizations such as the Township of Warwick and County of Lambton.

These agencies and organizations were provided Notices as per **Section 9.3.1**, above. All agency consultation documents including Project notices, meeting materials, comments, and written correspondence are included in Appendix E of **Supporting Document 4**.

9.3.5.1 Review and Comments

The Draft Existing Conditions Reports were made available for review on the WM website on December 8, 2023, with comments requested by February 2, 2024. Feedback was provided by MECP, MCM, and the Township of Warwick (see **Section 9.3.9.1**)

WM posted the Draft Effects Assessment Reports on December 6, 2024 and requested feedback by January 31, 2025. Feedback was provided by MECP, MCM and the Township of Warwick (see **Section 9.3.9.2**).

The Draft EA Study Report will be made available for review on the WM website beginning on November 19, 2025. Questions and comments on the Draft EA Study Report will be requested to be received by January 30, 2026.

9.3.5.2 Other Activities

MECP staff attended three WPLC site tours on September 13, 2023, September 11, 2024 and September 17, 2024, as listed below in **Table 9-4**.

WM conducted 2 site tours for the Township of Warwick Council and staff members on July 29, 2024, and September 22, 2025. A site tour was provided to the Watford and Warwick Fire Department on October 15, 2025.

9.3.6 Public Consultation and Communications

9.3.6.1 Public Communications

Notices were provided as per **Section 9.3.1**, above.

Members of the public participated in PIS 1 through PIS 3. Further detail is provided in **Section 9.3.3**, above.

In September 2023, two members of the public requested a hard copy of the Socio-Economic Community Survey form via email and phone calls to WM. WM delivered hard copies of the survey to the addresses provided.

Hard copies of the Draft Existing Conditions Reports were provided at the WM office, the Township of Warwick Office, and the Watford Library on December 5, 2023, so that the documents were available for review by those who were not able to access the documents via the Project website. On December 22, 2023, a member of the public requested that WM make digital comment forms available for individuals wishing to submit a comment form who are unable to submit them in person. WM responded by creating a digital version of the comment form and made it available on the Project website.

WM delivered hard copies of the Draft Effects Assessment Reports to the Township of Warwick Office on December 13, 2024, and Watford Library in early January 2025, so that the documents were available for review by those who were not able to access the documents via the Project website.

On January 31, 2025, an individual emailed WM requesting updated and detailed information regarding the Project to be informed on the process and decision approvals. WM responded on February 3, 2025 with further information including a link to the Project website which includes access to the Existing Conditions Reports and Effects Assessment Reports.

9.3.6.2 Warwick Public Liaison Committee

WM has developed a positive working relationship with the Township of Warwick and the WPLC. These meetings provide opportunities for WM to meet with representatives of the local community to discuss the TCEC and proactively discuss any matters of concern to the local community.

Between March 2023 (just prior to the Notice of Commencement of EA) and October 2025, ten meetings were held with the WPLC where the proposed Project was discussed as summarized in **Supporting Document 4**.

WM conducted 3 site tours for the WPLC on September 13, 2023, September 11, 2024, and September 17, 2025.

9.3.7 Site Tours

WM has conducted 10 site tours at the TCEC throughout the EA process to-date. Details of the site tours are provided in **Table 9-4**.

Table 9-4. Site Tours

Date	Participants	Topics of Discussion
September 13, 2023	WPLC members, MECP, councillors and RWDI consultants	• Proposed landfill expansion
August 29, 2023	WIFN	• Proposed landfill expansion • Renewable natural gas (RNG) Facility • Facility operations
September 25, 2023	COTTFN	• Archaeological studies
April 4, 2024	Caldwell First Nation	• TCEC history and the Project overview • Caldwell First Nation technical work plan • Future EA reviews
September 11, 2024	WPLC members, MECP, councillors and RWDI consultants	• Draft Existing Conditions Reports presented in November 2023 • Draft Effects Assessment Reports were under development • PIS 3 scheduled for November 2024 • Participant consultation plan
July 29, 2024	Township of Warwick council and staff members	• Proposed landfill expansion

Date	Participants	Topics of Discussion
September 11, 2024	CKSPFN	• Facility operations • Process Funding Agreement (PFA)
September 17, 2025	WPLC members, MECP, councillors and RWDI consultants	• On-going landfill development • RNG Facility
September 22, 2025	Township of Warwick council and staff members	• Land use and zoning amendment • Draft Effects Assessment Report responses to Township comments • PIS 4 scheduled for November 2025 • Draft EA Study Report scheduled for Fall 2025
October 15, 2025	Watford and Warwick Fire Department	• LFG and RNG facility walkthrough

9.3.8 Media Publications

General news articles that were written in a local newspaper during the EA Process are provided in Appendix I of **Supporting Document 4**.

9.3.9 Review of Existing Conditions and Effects Assessment Reports

The Draft Existing Conditions Reports and Effects Assessment Reports were released to agencies, Indigenous communities and groups, and members of the public on the participant contact list. Participants were provided feedback periods to review the draft documents and submit comments.

9.3.9.1 Draft Existing Conditions Reports

The Draft Existing Conditions Reports were released to participants on December 8, 2023 via email (links to the documents were provided). Comments on the Draft Existing Conditions Reports were requested by February 2, 2024. Feedback was provided as outlined in **Table 9-5**. No public comments were received on the Draft Existing Conditions Reports.

Table 9-5. Draft Existing Conditions Report Review

Reviewer	Date Comments Received
Indigenous Communities	
CKSPFN	• February 21, 2025 • February 24, 2025
COTTFN	• May 28, 2025
WIFN	• March 4, 2024
Agencies	
MECP	• January 7, 2025 • February 7, 2025 • February 11, 2025

Reviewer	Date Comments Received
MCM	• February 2, 2024 • September 2, 2025
Township of Warwick	• February 20, 2024 • November 13, 2024

Comments received on the Draft Existing Conditions Reports and the WM responses to each comment are provided in the Comment Response Tables in Appendix H of **Supporting Document 4**.

9.3.9.2 Draft Effects Assessment Reports

The Draft Effects Assessment Reports were provided to participants on December 6, 2024 via email (links to the documents were provided). Comments on the Draft Effects Assessment Reports were requested by January 31, 2025. Feedback was provided as outlined in **Table 9-6**. No public comments were received on the Draft Effects Assessment Reports.

Table 9-6. Draft Effects Assessment Report Review

Reviewer	Date Comments Received
Indigenous Communities	
CKSPFN	• February 21, 2025 • February 24, 2025 • April 5, 2025
COTTFN	• May 28, 2025
WIFN	• February 14, 2025
Agencies	
MECP	• January 8, 2025 • January 10, 2025 • February 3-11, 2025
MCM	• January 31, 2025 • September 2, 2025
Township of Warwick	• April 9, 2025 • August 12, 2025

Comments received on the Draft Effects Assessment Reports and the WM responses to each comment are provided in the Comment Response Tables in Appendix H of **Supporting Document 4**.

9.3.10 Review of Draft Environmental Assessment

A Draft EA Study Report will be made available to the public, Indigenous communities and groups, agencies, and all other participants on the Project mailing list for their

review and comments. Responses will be prepared for any comments and included as part of the Final EA Study Report.

9.4 Commitments for On-going Consultation and Engagement

All comments received within the review period for the Draft EA Study Report will be tabulated and a response prepared by WM. Any changes to the Draft EA Study Report will be identified. The final EA Study Report will include details on the draft review, copies of all comments and responses, and describe any changes made to the EA Study Report.

The Final EA Study Report will be formally submitted to the MECP and circulated to agencies, Indigenous communities, and the public for review and comment. The Notice of Submission for the final EA Study Report will be posted to the Project website.

10 Monitoring and Commitments

This section of the Environmental Assessment (EA) Study Report presents a summary of the monitoring and commitments identified for the Preferred Alternative. A list of commitments made in the approved Terms of Reference (ToR) and how and where the commitments are addressed in the EA Study Report is provided in **Appendix B**. The additional approvals expected to be required following EA approval are discussed in **Section 11**.

Monitoring strategies were developed so that environmental effects can be monitored during construction, operation and maintenance of the landfill to confirm that:

- predicted net effects are not exceeded;
- unexpected negative effects are addressed; and
- implemented mitigation measures are effective.

A Compliance Monitoring Program will be developed to demonstrate compliance with the commitments made in the EA Study Report. Compliance monitoring is an assessment of whether an undertaking has been designed, constructed, and/or operated in accordance with the commitments in the EA Study Report and the conditions of approval. Under the Compliance Monitoring Program, the results of compliance monitoring will be reported to the Ontario Ministry of Environment, Conservation, and Parks (MECP) and will include details of the implementation of mitigation measures and completion of commitments.

Table 10-1 summarizes the environmental effects mitigation commitments, commitments for monitoring, and proposed compliance monitoring for the Preferred Alternative.

Table 10-1. Monitoring and Commitments

Environmental Component	Evaluation Criteria	Commitment for Mitigation	Commitment for Monitoring	EA Compliance Monitoring
Natural Environment				
Atmospheric Environment	Air Quality – Dust	• Replacement of the south haul ramp with a hard material equivalent to a paved surface. • Enhanced water protocols for paved roadways to achieve 95% control. • Updating and continued implementation of the Dust Best Management Practices Plan (BMPP).	• No additional monitoring required beyond what is included in the Environmental Compliance Approval (ECA).	• Dust monitoring will continue as per Condition 13.8 of Waste ECA A032203.
	Air Quality – LFG and Combustion Byproducts	• No mitigation required.	• No additional monitoring required beyond what is included in the ECA.	• Hydrocarbon and VOC monitoring will continue as per Condition 13.8 of Waste ECA A032203.
	Air Quality – Blowing Litter	• Continued implementation of the Litter BMPP.	• No monitoring required.	• No compliance monitoring required.
	Odour	• Continued implementation of the Odour BMPP.	• No direct odour monitoring required. • As a surrogate for odour, adding H_2S monitoring to the existing VOC monitoring program, following the same timeline and methodology for H_2S as used for VOCs.	• No compliance monitoring required.
	Noise	• Limit the number of active equipment near the perimeter of the landfill when redeveloping the side slopes for Stages 1 and 2 in proximity to residential points of reception (PORs) R2 and R7. • Implement operational berms (3 m in height) along the northern edge of the 270 m elevation during Stage 2.	• Annual (once per year) acoustic audits at critical POR locations R2 and R7 during the development of Stages 1 and 2. • When landfilling operations trigger a mitigation requirement (i.e., operational berms or restricted landfilling equipment) an acoustic audit will be conducted. This audit will meet the	• Annual compliance monitoring will verify that the Landfilling Noise Guidelines are being met. If levels are found to exceed sound level limits, operations will be modified or additional mitigation measures employed.

Environmental Component	Evaluation Criteria	Commitment for Mitigation	Commitment for Monitoring	EA Compliance Monitoring
			requirement for the annual audit (above). No additional monitoring required beyond what is included in the ECAs.	
Hydrogeology	Groundwater Quantity	• No mitigative measures are required with the continuation of leachate management practices and continued monitoring of Groundwater Quantity in accordance with the Waste and Sewage ECAs.	• No additional monitoring required beyond what is included in the ECAs.	• Groundwater Quantity monitoring (e.g., liquid levels for both leachate and groundwater) will continue at the Twin Creeks Environmental Centre (TCEC) in accordance with the relevant conditions of the Waste and Sewage ECAs.
	Groundwater Quality	• No mitigative measures are required with the continuation of leachate management practices and continued monitoring of Groundwater Quality in accordance with the Waste and Sewage ECAs.	• No additional monitoring required beyond what is included in the ECAs.	• Groundwater Quality monitoring (e.g., analytical testing for leachate and groundwater) will continue at established groundwater and leachate monitoring locations in accordance with the relevant conditions of the Waste and Sewage ECAs. • Groundwater environmental monitoring programs will continue into the CLS of the Expansion Landfill.

Surface Water Environment	Surface Water Quality	• Continue to operate and monitor Surface Water Quality at the TCEC in accordance with the relevant Conditions of the Waste and Sewage ECAs.
		• Install/maintain sediment control measures (e.g., straw bale/rock check dams, silt fencing, add vegetative controls, etc.) at various locations within the surface water drainage network. As-required sediment control measure placements and replacements based on Site conditions.
		• Supplement the northern component of the drainage network with erosion control measures as the landfill
			• No additional monitoring required beyond what is included in the ECA.	• Routine and verification monitoring to be completed at established surface water monitoring stations for the following Surface Water Quality monitoring programs in accordance with the relevant conditions of the Waste and Sewage ECAs:
				  • Compliance
				  • Poplar System
				  • Poplar Plantation

Environmental Component	Evaluation Criteria	Commitment for Mitigation	Commitment for Monitoring	EA Compliance Monitoring
		expands north prior to initiating Expansion Landfill Optimization. • Complete as-required sediment removal where sediment builds up in the surface water drainage network (e.g., at check dams, silt fencing, detention ponds, etc.). • Place topsoil and seed over areas of the Expansion Landfill side slopes completed with interim cover, where appropriate (e.g., 2 years). • Inspect areas of soil stockpiling for erosion. Where necessary, erosion control measures would be installed to protect the drainage network from unacceptable sediment loading (e.g., silt fencing, straw bales, rock check dams, add vegetation. • Implement seepage monitoring and repair program. Seep repairs, when identified, should be conducted immediately and if possible, prior to seepage entering and/or running off landfill sideslopes and into the surface water drainage network. • Routine inspections (e.g., monthly during post-closure) of the landfill surface are expected to provide sufficient frequency to identify and, if necessary, address leachate seepage • WM actively implements a rigorous routine inspection and where warranted, cleanup of automobile shredder residue (ASR) track out. On-site and off-site ASR cleanup efforts are completed as needed and consist of sweeping, scraping with light equipment, hand raking/picking, along the roadways, road shoulders, and within the ditches. It is noted that the vegetative growth within Nauvoo Road's roadside ditch is cut as part of cleanup activities such that ASR does not remain entangled in tall vegetation in ditches.	• Implement seepage monitoring and repair program. • No additional monitoring required (as long as the mitigation measures continue to be carried out).	• Compost and Waste Diversion Area • No compliance monitoring required (as long as the mitigation measures continue to be carried out).
Surface Water Environment	Surface Water Quantity	• No additional mitigation measures required beyond the 'in-design mitigation measures' which falls under periodic maintenance.	• No additional monitoring required beyond what is included in the ECA.	• Annually during current site inspection program for surface water in accordance with the relevant conditions of the Waste and Sewage ECAs.

Environmental Component	Evaluation Criteria	Commitment for Mitigation	Commitment for Monitoring	EA Compliance Monitoring
Ecological Environment	Terrestrial Ecosystems	• No additional mitigation measures required beyond the 'in-design mitigation measures' (e.g., continued implementation of Gull Management Plan using acoustic deterrent devices and a bird of prey). • Due to adjacent Species at Risk (SAR) habitat, an Information Gathering Form (IGF) will be submitted to the MECP.	• No additional monitoring required beyond what is included in the ECAs.	• No compliance monitoring required.
	Aquatic Ecosystems	• No additional mitigation measures required beyond the 'in-design mitigation measures'.	• No additional monitoring required beyond what is included in the ECAs.	• No compliance monitoring required.
Socio-Economic Environment				
Social Environment	Human Health	• No mitigation measures required with the continued implementation of the Dust BMPP and routine maintenance of the final cap and interim cover areas.	• No additional monitoring required beyond what is included in the ECAs; however, it is recommended that polycyclic aromatic hydrocarbons (PAH), using benzo(a)pyrene as a surrogate, be added to the suite of chemicals being monitored in future air quality sampling events.	• No compliance monitoring required.
	Effects on Local Community	• Nuisance effects will continue to be managed through the Odour BMPP, Dust BMPP, Litter BMPP, bird control protocols, and maintenance of visual screening berms. • Noise mitigation measures as outlined above. • Continue to provide prompt attention to nuisance complaints to mitigate adverse effects to the surrounding community.	• No additional monitoring required beyond what is included in the ECAs.	• No compliance monitoring required. Air quality, odour and noise compliance monitoring are described above.
Economic Environment	Economic Effects on Local Community	• No mitigation measures required.	• No monitoring required.	• No compliance monitoring required.

Environmental Component	Evaluation Criteria	Commitment for Mitigation	Commitment for Monitoring	EA Compliance Monitoring
Visual Landscape	Visual Impact of Facility	• No mitigation is proposed. Existing screen plantings will mature.	• No additional monitoring required beyond the current annual inspections (late spring) to assess health of existing trees on screening berm.	• No compliance monitoring required.
Cultural Environment				
Cultural Environment	Cultural Heritage Resources	• No mitigation measures required.	• No monitoring required.	• No compliance monitoring required.
	Archaeological Resources	• Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48(1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out an 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 notify the police or coroner and the Registrar of Cemeteries at the Ontario Ministry of Public and Business Services Delivery and Procurement, 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 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*.	• No monitoring required.	• No compliance monitoring required.

Environmental Component	Evaluation Criteria	Commitment for Mitigation	Commitment for Monitoring	EA Compliance Monitoring
Built Environment				
Transportation	Traffic Operations	• Continue to schedule arrivals of trucks to distribute them throughout the day.	• No monitoring required.	• No compliance monitoring required.
Current and Planned Future Land Use	Effects on Current and Future Land Uses	• No mitigation measures required beyond maintaining previously approved setback and buffer distances, and existing berming, and continued employment of nuisance controls related to odour, litter, dust, noise and birds.	• No monitoring required.	• No compliance monitoring required.

11 Approvals

This section of the Environmental Assessment (EA) Study Report outlines the additional approvals expected to be required following EA approval of the proposed undertaking.

11.1 Environmental Compliance Approvals

The TCEC has three existing Environmental Compliance Approvals (ECA) for the site. Each of these ECAs will require amendments to incorporate the proposed undertaking. The applications to amend the ECAs will include supporting documents to address the proposed changes and mitigation measures as outlined in this EA Study Report. These supporting documents will address: Design and Operations; Air Quality; Hydrogeology; Noise; Surface Water Quality; and Surface Water Quantity. The ECAs to be amended and a summary of the changes that may be required are as follows:

- Waste ECA Number A032203
    - Changes to the Design and Operations Report for the proposed optimization including LFG collection system.
    - Incorporate updated noise monitoring protocols.
    - Updates to Best Management Practices Plans (BMPPs) to account for new mitigation controls.
    - Updates to the 2007 Environmental Monitoring Program (EMP) regarding groundwater and surface water quality monitoring.
- Industrial Sewage Works ECA Number 8177-CUSNXX
    - Changes to the Design and Operations Plan for the proposed optimization.
    - Updates to the 2007 EMP regarding groundwater and surface water quality monitoring.
    - Updates to the Surface Water Contingency and Remedial Action Plan Warwick Landfill Site (Jagger Hims Limited, 2008) to account for any new mitigative measures.
- Air ECA Number 6318-CX4NFX
    - Modifications to the emission control equipment for LFG management.
    - Updates to BMPPs to account for new mitigation controls.
    - Incorporate updated noise monitoring protocols.

11.2 Species at Risk

An Information Gathering Form (IGF) has been submitted to the Ontario Ministry of Environment, Conservation, and Parks (MECP) for review and concurrence that the proposed undertaking will not result in effects to Species at Risk (SAR) or their habitat.

11.3 Archaeological Resources

The Stage 1 Archaeological Assessment (AA) report has been submitted to the Ministry of Citizenship and Multiculturalism (MCM) as a condition of licensing in accordance with Part VI of the *Ontario Heritage Act*, RSO 1990, c 0.18. The report is currently under review by the MCM to ensure that it complies with the standards and guidelines that are issued by the Minister, and that the archaeological field work and report recommendations ensure the conservation, preservation, and protection of the cultural heritage of Ontario. When all matters relating to archaeological sites within the project area of a development proposal have been addressed to the satisfaction of the MCM, a letter will be issued by the Ministry stating that there are no further concerns with regards to alterations to archaeological sites by the proposed development.

11.4 Land Use

The following municipal approvals are anticipated, and their requirements will be coordinated directly with the County of Lambton and Township of Warwick.

11.4.1 Official Plan Amendment (County and Local)

The County Official Plan (OP) and Township of Warwick OP both indicate that private commercial waste management facilities (such as the existing landfill) are to be located on lands designated and zoned for such purposes and that an amendment to the County OP and Local OP is required, “prior to the establishment of new waste management facilities or the expansion of existing facilities” (s.s. 7.11.5, County OP; s.s. 13.12, Township OP). The County OP and Township OP policies do not differentiate between vertical and horizontal landfill expansions. Any expansion proposals must comply with the County OP, the provisions of the *Environmental Protection Act*, and relevant Provincial legislation (s.s. 7.11.6).

11.4.2 Zoning By-law Amendment

An amendment to the Township of Warwick Zoning By-law 121 of 2012 will be required to reference an approval of the Landfill Optimization EA, as the existing zoning references the approval of the Warwick Landfill Expansion EA dated January 15, 2007.

11.4.3 Amendment to Site Plan Control Agreement

An application to amend the existing Site Plan Control Agreement that is currently registered on title will be required to permit the vertical expansion, in accordance with the provisions of Section 41 of the *Planning Act*.

12 References

Baker Turner Inc.

2005 Warwick Landfill Expansion Project Visual Impact Assessment. September 2005.

Canadian Biogas Association

2023 Canadian Biogas & RNG Market Summary Report. October 2023. https://www.biogasassociation.ca/images/uploads/documents/2023/resources/CBA_Market_Summary_2023.pdf

ECCC (Environment and Climate Change Canada)

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2022 Recyclable Organic Feedstock Supply Assessment in Ontario. The Atmospheric Fund. January 2022. https://taf.ca/custom/uploads/2022/03/The-Atmospheric-Fund-ROF-Supply-Assessment-in-Ontario-January-2022-v3.pdf

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2021 Federal Contaminated Site Risk Assessment in Canada: Toxicological Reference Values (TRVs), Version 3.0. Contaminated Sites Division, Safe Environments Directorate, Health Canada, Ottawa, Ontario. March 2021.

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2017 TCEC Environmental Screening Report. March 2017.

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2007 Environmental Monitoring Plan, Warwick Landfill Expansion, Township of Warwick, Ontario, Prepared for Waste Management of Canada Corporation.

MCM (Ontario Ministry of Citizenship and Multiculturalism)

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2016 Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes.

MECP (Ontario Ministry of Environment, Conservation and Parks)

1990a *Ontario Environmental Assessment Act*, R.S.O. 1990, Chapter E.18. https://www.ontario.ca/laws/statute/90e18.

2007a Ontario Regulation 101/07: Waste Management Projects. https://www.ontario.ca/laws/regulation/070101#act-verion.

2007b *Endangered Species Act, 2007*, S.O. 2007, c. 6. https://www.canlii.org/en/on/laws/stat/so-2007-c-6/latest/so-2007-c-6.html

2009 Ontario Regulation 419/05: Air Pollution – Local Air Quality. December 22, 2009. https://www.ontario.ca/laws/regulation/050419

2014a Code of Practice: Preparing and Reviewing Environmental Assessments in Ontario. January 2014. https://www.ontario.ca/document/preparing-and-reviewing-environmental-assessments-ontario-0

2014b Code of Practice: Consultation in Ontario's Environmental Assessment Process. January 2014. https://www.ontario.ca/page/consultation-ontarios-environmental-assessment-process.

2016a *Waste Free Ontario Act*, S.O. 2016, Chapter 12. https://www.ontario.ca/laws/statute/s16012.

2016b *Resource Recovery and Circular Economy Act*, S.O. 2016, Chapter 12, Schedule 1. https://www.ontario.ca/laws/statute/16r12.

2016c *Water Diversion Transition Act*, S.O. 2016, Chapter 12, Schedule 2. https://www.ontario.ca/laws/statute/16w12?search=ontario+building++code.

2016d Methodology for modeling assessments of contaminants with 10-minutes average standards and guidelines under O. Reg. 419/05. September 2016. https://files.ontario.ca/moecc_63_10minute_aoda_en.pdf

2017a Considering Climate Change in the Environmental Assessment Process. https://www.ontario.ca/page/considering-climate-change-environmental-assessment-process.

2017b Strategy for a Waste-Free Ontario: Building the Circular Economy. https://www.ontario.ca/page/strategy-waste-free-ontario-building-circular-economy

2017c Climate Change Action Plan. https://www.ontario.ca/page/climate-change-action-plan.

2018a Food and Organic Waste Policy Statement. https://www.ontario.ca/page/food-and-organic-waste-policy-statement.

2018b Preserving and Protecting our Environment for Future Generations: A Made-In-Ontario Environment Plan. https://ero.ontario.ca/notice/013-4208.

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A

Approved Terms of Reference

Terms of Reference

Twin Creeks Environmental Centre Landfill Optimization Project Environmental Assessment

Waste Management of Canada Corporation

Watford, Ontario

January 7, 2022 (Original)
March 30, 2022 (Amended)

Prepared by:

HDR Corporation
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Executive Summary

Waste Management of Canada Corporation (WM) is proposing to undertake an Environmental Assessment (EA) for the optimization of the design and operation of the Twin Creeks Environmental Centre (TCEC) landfill. The TCEC is located is located in the Township of Warwick near the Village of Watford, at the corner of Nauvoo Road and Zion Line, within the County of Lambton. The municipal street address for the facility is 5768 Nauvoo Road, Watford, Ontario. The site began operating as a landfill in 1972.

WM has owned and operated the TCEC since 1996. The landfill was approved under the *Environmental Assessment Act* (EAA) for expansion in 2007, and has total airspace capacity of 26,508,000 m³ over an area of 101.8 ha, within a total site area of 301 ha. The landfill provides safe and convenient disposal services for communities, businesses and industries serving the Province of Ontario. This landfill is approved to receive municipal, industrial, commercial, and institutional solid non-hazardous wastes, including non-hazardous contaminated soil. The TCEC is permitted to receive up to a maximum of 1,400,000 tonnes per year of waste including contaminated soil for disposal at the site.

WM has prepared these Terms of Reference (ToR) in accordance with subsection 6(2)(c) of the EAA which allows WM to set out in detail the requirements for preparation of the Environmental Assessment (EA). WM plans to proceed under subsection 6(2)(c) and 6.1(3) of the EAA, which allows proponents to focus the EA and consideration of alternatives to address their specific needs and circumstances. The ToR was prepared following consultation with Indigenous communities and stakeholders as required by Section 6(3) of the EAA. The proposed undertaking is designated under Regulation 101/07 of the EAA.

The purpose of the undertaking is to provide additional landfill airspace capacity for up to approximately 14,000,000 m³ of waste through the optimization of the approved landfill, which could extend the site life by approximately 12 years (from 2031 to 2043). There is approximately 13,200,000 m³ or 10 years of approved airspace capacity remaining at the TCEC (i.e., capacity will be reached in approximately 2031). There is a need for the continued development of the TCEC as it is a significant component of the provincial waste management network and infrastructure, which is lacking in sufficient and secure long-term disposal capacity. Optimizing the future development of the TCEC allows for on-going sustainable business operations and continued provision of essential financial support for community services and programs. This project will also provide longer-term certainty of service continuity to WM's customers beyond the remaining 10 years of capacity.

The rationale for the undertaking is twofold: first, there is a need for additional landfill capacity at the TCEC as it is a significant component of the provincial waste management network and infrastructure serving a broad area and customer base across Southern Ontario; and second, WM is providing waste management services and facilities that are well positioned to continue to support Ontario's transition to becoming waste-free and achieving a circular economy, while supporting a reduction in greenhouse gas (GHG) production and the amount of waste going to landfill, consistent with provincial legislation.

The proposed optimization may be achieved through alternative landfill configurations or alternative methods within the existing TCEC site area. WM has identified a preference for

a vertical alternative method although both vertical and horizontal alternative methods will be considered in the EA. The alternatives will be assessed using criteria related to the natural, built, cultural, and socio-economic environments within the on-site study area and the off-site study area (generally within approximately 1 km of the on-site study area). The off-site study area may be refined during the EA to suit the requirements of a specific environmental component or based on the spatial extent of predicted effects.

WM is committed to carrying out meaningful consultation and engagement on the project with a broad range of stakeholders. The ToR outlines a consultation and engagement program to be implemented during the preparation of the EA to engage the public, Indigenous communities, government agencies, and other interested parties in the EA process.

The EA will contain a list of commitments made by WM during the ToR process and indicate how such commitments have been addressed in the EA. A list of commitments made by WM during the preparation of the EA will also be included in the EA along with a framework for monitoring when and how all commitments will be fulfilled. In addition, a strategy and schedule for compliance and effects monitoring will be developed and included in the EA.

In addition to the approval under the EAA, certain other approvals may be required under provincial legislation. A complete list of the specific approvals required for the proposed undertaking will be provided in the EA. The proposed undertaking is not identified as a designated project under the *Impact Assessment Act*, and this has been confirmed with the Impact Assessment Agency of Canada.

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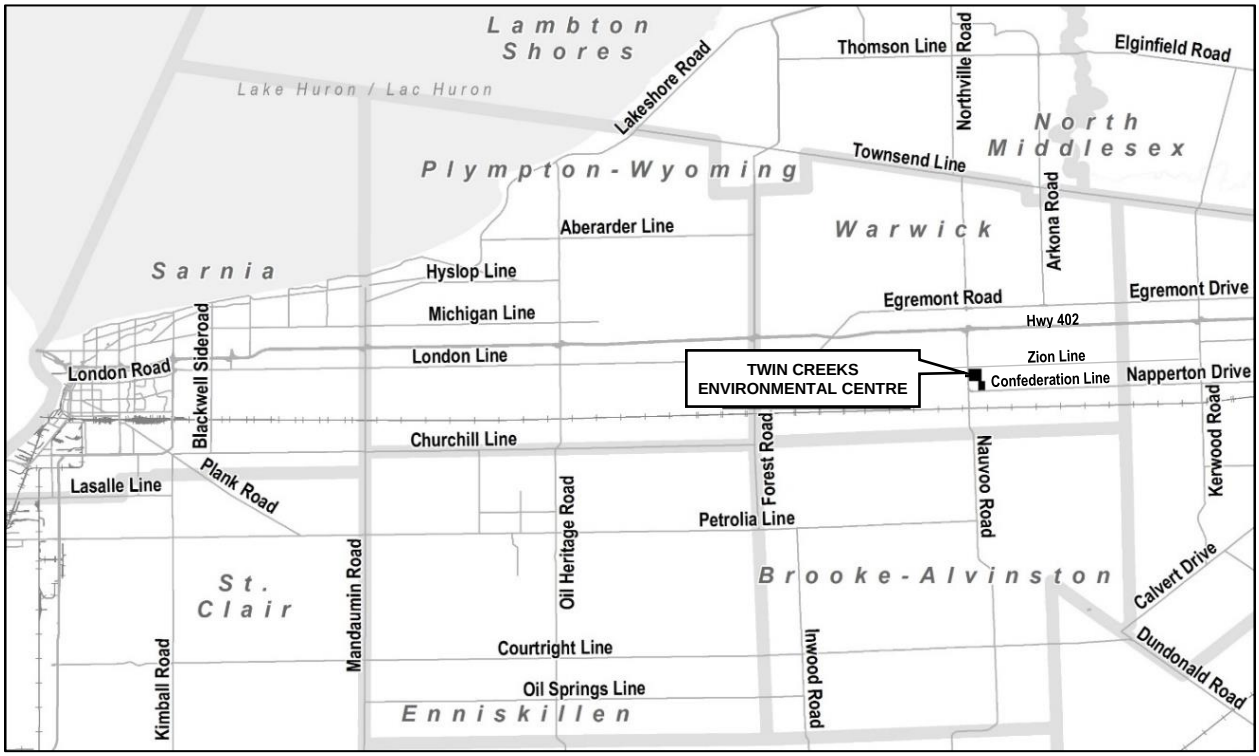
Supporting Document 1. Rationale for the Undertaking
Supporting Document 2. Alternatives to the Undertaking
Supporting Document 3. Geotechnical Feasibility Review
Supporting Document 4. Record of Consultation and Engagement

1 Introduction and Background

Waste Management of Canada Corporation (WM), the owner and operator of the Twin Creeks Environmental Centre (TCEC) in Watford, Ontario, has initiated an Environmental Assessment (EA) seeking approval for increasing the landfill airspace capacity including optimizing the existing landfill design and operation, maximizing the use of the constructed infrastructure and the significant investment made at the TCEC.

The TCEC is a regional landfill facility located in the Township of Warwick at the corner of Nauvoo Road and Zion Line (**Figure 1-1**), which originally began operation in 1972. WM acknowledges that the Twin Creeks Environmental Centre is situated within the traditional and Treaty lands of Walpole Island First Nation. The landfill provides safe and convenient disposal services for communities, businesses and industries serving the Province of Ontario. This landfill is approved to receive municipal, industrial, commercial, and institutional solid non-hazardous wastes, including non-hazardous contaminated soil.

Figure 1-1. Site Location



The landfill is engineered with environmental protection systems that meet or exceed regulatory requirements and is subject to highly regulated monitoring and reporting requirements. Systems include engineered liners and covers, leachate collection and management, landfill gas collection and control, and on-site leachate disposal through a phytoremediation system consisting of a 9.3 ha poplar system planted on the existing landfill cap in 2003. Surplus leachate is trucked off-site to approved wastewater treatment plants.

WM has owned and operated the TCEC since 1996. The landfill was approved under the *Environmental Assessment Act* (EAA) for expansion in 2007, and waste was first deposited into the expansion in November 2009. The pre-existing site was originally approved for a waste capacity of 3,072,000 m³ within an area of 32.4 ha. The approval of the expansion landfill increased the total airspace capacity to 26,508,000 m³ over an area of 101.8 ha, within a total site area of 301 ha.

The Environmental Compliance Approval (ECA) A032203 for the Twin Creeks Environmental Centre allows the landfill to receive up to a maximum of 1,400,000 tonnes per year of waste including contaminated soil for disposal at the site. The TCEC typically receives between 5,000 to 7,500 tonnes of residual waste, with an average of 200 waste hauling vehicles, per week day. There is approximately 10 years of approved airspace capacity remaining at the expansion landfill (i.e., capacity will be reached in approximately 2031). The remaining approved capacity was approximately 13,200,000 m³ at the end of September 2021.

The optimization of the TCEC could provide additional airspace of up to approximately 14,000,000 m³, which could extend the site life by about 12 years (from 2031 to 2043). There would be no change to the current 301 ha site area, the approved service area, or the annual fill rate.

There is a need for the continued development of the TCEC as it is a significant component of the provincial waste management network and infrastructure, which is lacking in sufficient and secure long-term disposal capacity. Optimizing the future development of the TCEC allows for on-going sustainable business operations and continued provision of essential financial support for community services and programs.

In accordance with Ontario Regulation 101/07 under the *Ontario Environmental Assessment Act* and the *Guide to Environmental Assessment Requirements for Waste Management Projects*, the proposed project is designated as an undertaking to which the Act applies. It is essential for WM to start the Environmental Assessment (EA) approvals process now so that the necessary approvals are in place to allow an efficient implementation of the landfill optimization project. This project will also provide longer-term certainty of service continuity to WM's customers beyond the remaining 10 years of capacity.

2 Proponent

The proponent for the proposed undertaking is Waste Management of Canada Corporation (WM). Waste Management, based in Houston, Texas, is the leading provider of comprehensive waste management services in North America. WM provides a broad range of comprehensive waste management related services across North America, including collection, transfer, recycling and resource recovery, and disposal services throughout Canada.

WM employs over 1,500 skilled workers and qualified professionals across six provinces and manages its Canadian operations from its head office, located in Kitchener, Ontario. Within Ontario, WM's operations include seven natural gas fueling stations, five materials recovery / baling facilities, 15 transfer stations, 16 hauling sites, and two active landfills.

Over the past 50 years, the company has provided services to over 250,000 residential, commercial, and industrial customers in Ontario alone.

WM is a local company and primary service provider for the collection and disposal of waste generated in the Township of Warwick, Lambton County and throughout Ontario. The company's mission is to maximize resource value while minimizing environmental impact to improve economic and environmental sustainability for its stakeholders, including municipal partners, and residential and commercial customers. To learn more, visit www.wm.com.

WM is proud to be an active supporter of community events and programs that make the Township of Warwick and surrounding areas a strong and healthy place to live, work, and play. Community benefits include host community fees, local sports club donations, downtown amenities, arena upgrades, a dog park addition, Watford and Warwick fire department donations, and various other charitable contributions and community events.

The WM contact for this project is:

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3 Preparation of the Environmental Assessment

The following sections describe how the Draft Terms of Reference (ToR) was prepared, the flexibility of the ToR and the preparation of the EA.

3.1 Preparation of the Terms of Reference

WM has complied with the Ministry of Environment, Conservation and Parks (MECP)'s Code of Practice for *Preparing and Reviewing Terms of Reference for Environmental Assessments in Ontario* (January 2014) when preparing this ToR. The consultation and engagement program has been undertaken in accordance with the MECP's Code of Practice, *Consultation in Ontario's Environmental Assessment Process* (January 2014). In addition, the requirements of the MECP's *Guide to Environmental Assessment Requirements for Waste Management Projects in Ontario* (March 2007) has also been addressed.

The Notice of Commencement for the ToR was published on November 17, 2020.

WM has prepared this ToR in accordance with subsection 6(2)(c) of the EAA, which allows WM to set out in detail the requirements for preparation of the EA. WM plans to proceed under subsection 6(2)(c) and 6.1(3) of the EAA, which allows proponents to focus the EA and consideration of alternatives to address their specific needs and circumstances. The ToR was prepared following consultation with Indigenous communities and stakeholders

as required by Section 6(3) of the EAA. The proposed undertaking is designated under Regulation 101/07 of the EAA.

WM has completed an assessment of the rationale and need for the optimization of the landfill at the TCEC. There is a need for the continued development of the TCEC – the TCEC is a significant component of the provincial waste management network and infrastructure, which is lacking in sufficient and secure long-term disposal capacity. There are three large private landfill sites in southern Ontario, including the TCEC, which are all operating at their approved annual limits, and the Ontario Waste Management Association has estimated that there are only 15.5 years of disposal capacity remaining in Ontario.

The continued operation of the TCEC aligns with the Province of Ontario's Strategy for a Waste Free Ontario, Climate Change Action Plan goal of reducing greenhouse gas (GHG) emissions, and the Made in Ontario Environment Plan to reduce litter and waste in communities. Approximately 2.5 million to over 3 million tonnes of post recycling and diversion residual waste generated in Ontario is disposed of in Michigan each year. The TCEC receives 1.4 million tonnes of post recycling and diversion residual waste, approximately 20% of which is managed directly by WM with the remainder controlled by third parties.

Optimizing the future development of the TCEC allows for on-going sustainable business operations and continued provision of essential financial support for community services and programs.

Additional details regarding the rationale for the project are provided in **Section 5** and **Supporting Document 1** (Rationale for the Undertaking). Information on the rationale and need for the landfill optimization was included in consultation and engagement with the public, interested stakeholders, Indigenous communities, and government agencies during the development of the ToR. The final description of the proposed undertaking and rationale for the project will be confirmed during the EA.

As noted, WM intends to proceed under subsections 6(2)(c) and 6.1(3) of the EAA, which allow the proponent to focus the EA. Specifically, WM intends to exclude the 'alternatives to' assessment during the EA studies because an evaluation of waste management alternatives was carried out separately. The assessment of the 'alternatives to', including consideration of the do nothing scenario, have been further assessed during the preparation of this ToR as presented in **Section 6.1** and **Supporting Document 2** (Alternatives to the Undertaking).

This ToR identifies a preferred 'Alternative To' and identifies the 'alternative methods' that will be examined during the preparation of the EA. This approach is consistent with the MECP *Code of Practice: Preparing and Reviewing Terms of Reference for Environmental Assessments in Ontario* (January 2014), which describes how a Proponent can proceed under subsection 6(2)(c) and 6.1(3) if the Proponent is further along in the defined planning process and additional detail is known regarding its proposal.

The consideration of 'alternatives to' the undertaking was included as part of consultation and engagement with the public, interested stakeholders, Indigenous communities, and government agencies and is documented in **Section 6.1** and in the Record of Consultation and Engagement (**Supporting Document 4**). No additional assessment of 'alternatives to' the undertaking will be included in the EA. The 'Do Nothing' alternative will be carried

into the EA and considered against the preferred undertaking for assessing potential effects.

The ToR further identifies the 'alternative methods' that will be considered in the EA. These 'alternative methods' will be reviewed during the EA and modified if appropriate. Additional alternatives may be identified if warranted. The alternative methods are outlined in **Section 6.2**.

This Terms of Reference was originally submitted on January 7, 2022 and was subsequently amended in March 2022 to include consideration of Policy 6.8 of the Food and Organic Waste Policy Statement as part of the EA (**Section 5.1.2**), outline how future leachate management requirements for the landfill will be considered in the EA (**Section 8.2**), and provide additional details on the consultation and engagement plan for the EA (**Section 9.2**).

3.2 Flexibility of the Terms of Reference

If approved by the Minister of Environment, Conservation and Parks, this ToR will provide the framework for preparing the EA Study Report. The ToR is not intended to present every detail of all the activities that will occur when preparing the EA. It is possible that, in carrying out the work described in this ToR, minor variations to methodologies may be necessary. These variations may include, but are not limited to:

- modifications to the local study area to suit the requirements of each environmental component;
- modifications to the alternatives, or identification of additional alternatives, considered;
- modifications to studies or additional/expanded studies due to variations in the degree of environmental impact assumed at the time of preparation of this ToR or due to content and quality of information available;
- modifications/refinements to the work plans for the technical studies;
- modifications to the consultation and engagement plan; and
- any other modifications required or available through changes to Acts or Regulations.

These examples are not intended to be exhaustive; rather, they are meant to set out the types of changes that may be considered minor and that could be accommodated within the framework of the ToR. The MECP will be consulted in the event of uncertainty as to whether a proposed change should be considered minor and accommodated within the approved ToR.

The flexibility to accommodate new circumstances is also described in **Section 11**.

3.3 Preparation of the Environmental Assessment

Following approval of the ToR by the Minister of Environment, Conservation and Parks (the Minister), WM will prepare the EA in accordance with the requirements of the approved ToR and EAA and submit to the Minister for review and approval. The EA will include:

- a description of the purpose of the undertaking, as described in **Section 4** of this ToR;

- the rationale for the undertaking, as described in **Section 5** of this ToR;
- a description of the undertaking based on the consideration of alternative methods, as described in **Section 6** of this ToR;
- a description of the environment potentially affected by the undertaking (the description in **Section 7** of the ToR will be expanded);
- an assessment of the alternative methods of carrying out the undertaking based on the method outlined in **Section 8** of this ToR. WM intends to consider the alternatives described in **Section 6** including:
    - a description of the effects that will be caused or that might reasonably be expected to be caused on the environment by the undertaking or the alternative methods;
    - a description of the mitigation measures that are necessary to prevent or reduce significant adverse effects on the environment;
    - an evaluation of the advantages and disadvantages to the environment as a result of the undertaking; and
- a description of the consultation and engagement process undertaken by WM for the EA following the plan described in **Section 9** of this ToR.

4 Purpose of the Undertaking

The purpose of the undertaking is to provide additional airspace for up to approximately 14,000,000 m³ of waste through the optimization of the TCEC, which could extend the site life by approximately 12 years (from 2031 to 2043).

There is approximately 10 years of approved airspace capacity remaining at the expansion landfill (i.e., capacity will be reached in approximately 2031). There is a need for the continued development of the TCEC as it is a significant component of the provincial waste management network and infrastructure, which is lacking in sufficient and secure long-term disposal capacity. Optimizing the future development of the TCEC allows for on-going sustainable business operations and continued provision of essential financial support for community services and programs. This project will also provide longer-term certainty of service continuity to WM's customers beyond the remaining 10 years of capacity.

The renewable bio-gas (landfill gas) produced by the landfill is provided to a neighbouring greenhouse to grow produce, which is sold throughout Ontario and Quebec, creating employment opportunities for the local community. WM's intent is for the landfill to continue to supply gas to the greenhouses for heating purposes for the next 25 years.

The purpose of the undertaking may be refined during the EA process and will be included in the EA Study Report.

5 Rationale for and Description of the Undertaking

The rationale for and description of the undertaking are presented below. The rationale for and description of the undertaking may evolve during the preparation of the EA and will be included in the EA Study Report.

5.1 Rationale for the Undertaking

A summary of the rationale for the undertaking is presented below. Additional details are provided in **Supporting Document 1**.

The rationale for the undertaking is twofold:

1. There is a need for additional landfill capacity at the TCEC as it is a significant component of the provincial waste management network and infrastructure, both now and in the future, serving a broad area and customer base across Southern Ontario; and
2. WM is providing waste management services and facilities that support Ontario's climate change strategy and the reduction of greenhouse gas emissions through management of landfill gas, supporting closure of smaller landfill sites and an overall reduction in vehicles travelling to waste management facilities, consistent with provincial legislation.

5.1.1 Need for the Undertaking

The TCEC landfill provides cost effective services to a broad customer base largely across Southern Ontario. This includes a range of municipalities and Indigenous communities without their own disposal capacity along with numerous industrial, commercial, and institutional businesses.

Approximately 28% of the waste received at the TCEC is post-recycling and post-diversion residential residual waste from municipalities. Most municipal customers have long term (e.g., 10 years or greater) waste disposal contracts with WM to provide certainty of disposal capacity at the TCEC. Many of these municipalities have been faced with the need to close their own landfill sites due to various factors including increased regulatory requirements and associated costs, the risks and costs associated with long term liabilities, and encroaching urban development. Faced with these uncertainties, WM provides these municipalities and communities with secure access to an essential service within Ontario and in a cost-effective manner into the future.

Since 2017 and the increase in the annual fill rate, TCEC has effectively been operating at the approved annual limit of 1,400,000 tonnes. In 2019, an additional quantity of waste was received at the landfill following an emergency request, approved by the MECP, to address increased waste generated by municipal customers due to population growth, issues in the recycling market, and the challenges encountered in directing waste to alternate disposal facilities in Michigan.

The majority of the waste received at the TCEC is from the IC&I sector within Ontario, including third-party waste management companies and haulers who do not typically own a landfill. These companies provide their customers with a range of waste management services including collection, business and industry specific recycling and diversion programs, and disposal. Provision of disposal capacity for post-recycling/post-diversion (i.e., residual) waste to these businesses in a cost-effective and secure manner ensures these companies can continue operating competitively. WM estimates that the TCEC manages approximately 25% of IC&I waste generated within Southern Ontario.

The projected significant growth in Ontario's population, projected to increase by approximately 31.5% or almost 4.6 million people by 2046, with its associated economic and business growth to support a larger work force, will result in a continued demand for WM to provide service to existing and new municipal and IC&I customers.

In January 2021, the Ontario Waste Management Association (OWMA) released their State of Waste in Ontario: Landfill Report (3rd Landfill Report) which provides an assessment of landfill disposal capacity in Ontario. It is estimated that there is only about 15.5 years of remaining capacity in the Province as a whole. The OWMA report also notes that the majority of the remaining capacity is held by private sector landfills (53%), and that the remaining municipal landfill capacity, which is effectively restricted by service area, has decreased to 47% from 64% in 2017.

The remaining disposal capacity in Ontario is becoming concentrated in a fewer number of large regional sites. The OWMA reports that the trend may be for smaller open landfills to continue to close, directing increased waste volumes to a fewer number of large regional sites in the future. Since 2017, there have only been two approvals for significant additional landfill capacity in Southern Ontario: the Essex-Windsor Solid Waste Authority municipal landfill received approval for additional capacity in 2017; and in 2020, Waste Connections received approval for the expansion of the Ridge Landfill, extending the operating life of the landfill for a further 20 years[1]. The City of London is currently pursuing approval to expand the capacity of their W12A Landfill. A new private landfill proposed for development in Oxford County was put on hold in July 2021 after nine years of study and assessment.

Most municipalities are now focused on conserving their landfill capacity for residential waste and limiting the amount of IC&I and/or construction and demolition (C&D) waste accepted. Siting new landfill capacity within municipal boundaries continues to be challenging as the population and density of municipalities in Southern Ontario increases.

Access to landfill disposal capacity in Ontario is restricted by daily and/or annual fill rates and service area. With a few exceptions, municipal landfill sites have service areas which restrict the landfill to serve only waste generators within the municipality. Private landfills typically have broader, but still restricted, service areas and fill rates. All three large private landfill sites in southern Ontario, including the TCEC, are operating at their approved annual limits.

In summary, it is evident that the TCEC landfill is a significant component of the provincial waste management network and infrastructure, serving a broad area and customer base

[1] It should be noted that as part of the recent EA approval to expand the Ridge Landfill, the landfill service area for residential waste was restricted to only the municipality of Chatham-Kent.

across Southern Ontario. With a lack of sufficient and secure long-term disposal capacity available in Ontario, there is an on-going requirement for the TCEC to continue to provide this landfill disposal service, supporting stable operation and growth for municipalities and businesses across Southern Ontario. The projected significant growth in population, with its associated economic and business growth to support a larger work force, will also result in a continued demand for WM to provide service to existing and new municipal and IC&I customers. The on-going development and operation of the TCEC will allow WM to provide these customers with secure access to an essential service within Ontario in a cost-effective manner for the long term.

5.1.2 Consistency with Provincial Legislation

In June 2016, the Ontario government passed the *Waste Free Ontario Act*, which enacted two Acts: the *Resource Recovery and Circular Economy Act*, 2016, and the *Waste Diversion Transition Act*, 2016. Under the new legislation, the province is moving toward a circular economy framework by establishing a producer responsibility regime. It is anticipated that extended producer responsibility for the Blue Box program will come into effect in 2023.

Subsequently in 2017, the MECP released the Strategy for a Waste-Free Ontario: Building the Circular Economy (the Strategy). The Strategy outlines a vision for Ontario where waste is considered a resource that can be recovered, reused, and reintegrated to achieve a circular economy. The ultimate goal of the Strategy is to achieve zero waste and zero greenhouse gas (GHG) emissions from the waste sector. The Strategy further identifies four overall objectives which include a total of 15 actions to be taken and implemented by 2050. A number of the actions relate to the need for landfill including increased resource recovery, disposal bans, reduction of food and organic wastes, and ensuring landfills are well planned and managed to minimize their need and reduce GHG emissions.

In November 2018, the MECP released Preserving and Protecting our Environment for Future Generations: A Made-in-Ontario Environment Plan which outlined various commitments to reduce litter and waste in Ontario communities. Subsequently in March 2019, the Ministry released the Reducing Litter and Waste in Our Communities: Discussion Paper identifying three waste management goals for Ontario, including:

1. Decrease the amount of waste going to landfill;
2. Increase the Province's overall diversion rate; and
3. Reduce GHGs from the waste sector.

The Province of Ontario is also beginning to shift its legislation and economics towards a Circular Economy through the Strategy for a Waste Free Ontario: Building a Circular Economy and Ontario's Food and Organic Waste Framework. The Framework lays out a broad-based approach to attempt to achieve a vision of a circular economy that moves towards zero food and organic waste and zero GHG emissions from the waste sector. The Food and Organic Waste Policy Statement provides further direction for increasing waste reduction and resource recovery of food and organic waste in Ontario. In consideration of Policy 6.8 of the Food and Organic Waste Policy Statement, which directs that "proponents of new or expanded waste management systems for disposal should consider resource

recovery opportunities for food and organic waste", WM will examine options for food and organic waste resource recovery and/or diversion opportunities as part of the EA.

Continued operation of the Twin Creeks landfill aligns with the Province of Ontario's Strategy for a Waste Free Ontario, Climate Change Action Plan goal of reducing GHG emissions, and the Made in Ontario Environment Plan to reduce litter and waste in communities. WM has invested in many initiatives to reduce GHG emissions and divert more materials, including:

- A recycling drop-off area is provided for local community (Township of Warwick) residents and businesses in an on-site area near the scale house. A series of bins are available for the collection of typical blue box materials (i.e., glass, plastic and metal containers, and fibre), cardboard, metal, white goods and yard waste. When a bin is full it is removed and transferred off-site for processing or directly to a market for the material. WM will continue to work with the Township of Warwick to address future diversion opportunities and their implementation if feasible.
- An on-site waste processing and diversion area is approved in the southeast corner of the approved landfill footprint. This 1 ha area supports waste screening and diversion activities for specific waste types that have been identified to have a beneficial use on site. Concrete, asphalt, tires and wood are approved to be separated from the waste stream and processed on-site for use. The TCEC is permitted for processing up to 36,000 tonnes/year of this material. Uses of these diverted materials include road base, daily cover or pipe bedding. This program removes diverted materials from the landfill and reduces the requirement to import granular material, while some materials can be beneficially reused for cover material and landscaping amongst other uses.
- The approvals are in place for WM to develop an on-site aerobic composting facility for leaf and yard waste, agricultural waste and wood. The TCEC is permitted to compost up to 7,500 tonnes/year. WM monitors the quantity of material received annually as part of its recycling drop-off area while planning for implementation of this facility.
- Installing a landfill gas (LFG) collection system at the landfill to collect methane gas (a major source of GHGs) which is converted to produce green energy. The TCEC is providing landfill gas to heat 40 acres of greenhouses located adjacent to the landfill site. Prior to the LFG being used by the greenhouses it was flared. The intent is for the landfill to supply LFG for heating to the greenhouses for 25 years.
- Providing long-term residential waste disposal capacity to Lambton County and other Ontario municipalities. Over time, this has allowed the County and other Ontario municipalities to close a number of smaller landfill sites which did not have control systems to manage GHG emissions associated with LFG.
- Providing a network of regional transfer stations across Southern Ontario to collect material from a larger number of small generators and consolidate the material for transport. This results in a significant reduction in the number of vehicles travelling long distances to appropriate processing and disposal facilities and supports a substantial decrease in the emission of GHGs associated with the transportation of waste. The TCEC landfill receives waste from these transfer stations.

5.2 Description of the Undertaking

The proposed undertaking will provide additional airspace for up to approximately 14,000,000 m³ of waste through the on-going development of the approved TCEC landfill, which could extend the site life by approximately 12 years (from 2031 to 2043). There would be no change to the current 301 ha total site area, the approved service area, or the annual fill rate. The proposed undertaking will occur within the TCEC site area shown on **Figure 5-1**.

Figure 5-1. Project Location



6 Rationale and Description of Alternatives

The EAA identifies two types of alternatives: 'alternatives to' an undertaking and 'alternative methods' of carrying out an undertaking. 'Alternatives to' an undertaking are the different ways of addressing a problem or opportunity, while 'alternative methods' are different ways of carrying out the same activity. The 'alternatives to' and 'alternative methods' for the TCEC landfill optimization are discussed below.

6.1 Alternatives to the Undertaking

"Alternatives to" the undertaking are functionally different ways of addressing the sustainable business opportunity and need for the TCEC landfill to continue to provide disposal capacity over the long term. WM has identified and considered specific "alternatives to" the proposed undertaking that address the opportunity and are within the company's business mandate and ability to implement.

Consistent with the MECP Code of Practice for *Preparing and Reviewing Terms of Reference for Environmental Assessments in Ontario* (January 2014), WM identified a range of 'alternatives to' for providing long-term disposal capacity that are appropriate and reasonable for them (a private sector company) to implement.

The following four alternatives were identified:

1. Do nothing;
2. Redirect waste to a disposal facility elsewhere;
3. Develop a new WM disposal facility; and
4. Develop additional disposal capacity within the TCEC site area.

WM does not own or operate any thermal treatment facilities. This type of alternative is not within the company's business mandate and ability to implement.

Each of the 'alternatives to' were considered in the context of their ability to meet the need for long term disposal capacity to serve Ontario municipalities and the IC&I sector, and the business opportunity identified by WM. A summary description of each 'alternative to' and an assessment of how each addresses the opportunity are presented below and detailed in **Supporting Document 2**.

Alternative 1 – Do Nothing

The "do nothing" alternative implies that WM would not undertake the development of new long term disposal capacity. WM would only be able to continue with their current business operations at the Twin Creeks Environmental Centre for approximately 10 years based on current landfilling rates (i.e., until approximately 2031). Landfill operations would have to cease once the existing landfill is at capacity.

The Twin Creeks landfill provides cost effective services to a broad customer base largely across Southern Ontario, which includes a range of municipalities and Indigenous communities without their own disposal capacity along with numerous industrial, commercial, and institutional businesses. Most municipal customers have long-term (e.g., 10 years or greater) waste disposal contracts with WM to provide certainty of disposal capacity at the TCEC. Many of these municipalities have been faced with the need to close their own landfill sites. WM provides these municipalities and communities with secure access to an essential service within Ontario and in a cost-effective manner.

The majority of the waste (approximately 72%) received at the TCEC is from the IC&I sector within Ontario, including third-party waste management companies and haulers who do not typically own a landfill. These companies provide their customers with a range of waste management services including collection, business and industry specific recycling and diversion programs, and disposal. Provision of disposal capacity for post-

recycling/post-diversion (i.e., residual) waste to these businesses in a cost-effective and secure manner ensures these companies can continue operating competitively. WM estimates that the TCEC manages approximately 25% of IC&I waste generated within Southern Ontario.

The TCEC landfill, like the other private landfills in the region, is operating at its annual limit. With a lack of sufficient and secure long-term disposal capacity available in Ontario, there is an on-going requirement for the TCEC to continue to provide this landfill disposal service, supporting stable operation and growth for municipalities and businesses across Southern Ontario.

The closure of the TCEC landfill would result in the loss of local employment and indirect employment, as well reduced municipal and third-party business revenues related to discontinued TCEC annual operating expenditures.

The “do nothing” alternative would not allow WM to continue to provide disposal services to its customers and fulfill long-term contractual commitments within Ontario. These customers, including a number of municipalities across Southern Ontario, would need to find alternate ways to manage their waste. The opportunity to optimize the investment in the facility infrastructure would be lost along with the economic contributions to the local economy. This alternative is not a viable option for WM’s on-going business, its customers, and the Province of Ontario. It has been included to provide a benchmark against which to measure the other alternatives and to assess the advantages and disadvantages of the preferred alternative.

Alternative 2 – Redirect Waste to a Disposal Facility Elsewhere

This alternative involves WM redirecting waste to a disposal facility elsewhere (transport material to other approved disposal facilities in Ontario and/or the U.S.). There would be no development of new long term disposal capacity at the TCEC. WM does not own or control any other landfills currently operating within Southern Ontario.

The TCEC landfill has an all Ontario service area and an annual fill rate of 1.4 million tonnes. The landfill is effectively operating at its approved annual limit. Access to landfill disposal capacity in Ontario is restricted by daily and/or annual fill rates and service area. With a few exceptions (e.g., City of Toronto’s Green Lane Landfill) municipal landfill sites have service areas which restrict the landfill to serve only waste generators within the municipality. Private landfills typically have broader, but still restricted, service areas and fill rates. The other large private landfills in Southern Ontario, including the Waste Connections Ridge Landfill and Walker South Landfill, are reported to operate at their annual capacity.

The Michigan Department of Environment, Great Lakes and Energy (EGLE) reports that historically the total quantity of waste exported from Ontario to that state has generally been in the order of 2.5 million to over 3 million tonnes annually. In 2020, the WM Pine Tree Acres Landfill in Michigan received approximately 1.54 million tonnes of waste from Ontario.

At a minimum, with virtually no excess landfill disposal capacity available within Southern Ontario for the 1.4 million tonnes managed at TCEC, WM would need to redirect the waste volume it controls (20-30% of the waste managed at the TCEC) to its landfill in Michigan.

The remaining 70-80% of waste from external sources would also need to be redirected to landfill sites largely located in the U.S.

This alternative would not allow WM to continue to provide disposal services to its customers and fulfill long-term contractual commitments within Ontario. These customers, including a number of municipalities across Southern Ontario, would need to find alternate ways to manage their waste. This will likely require export to the US since landfill capacity within Southern Ontario is both restricted and limited. The opportunity to optimize the investment in the TCEC facility infrastructure would be lost along with the economic contributions to the local economy. This alternative is not a viable option for WM's on-going business, its customers, and the Province of Ontario.

Alternative 3 – Develop a New Disposal Facility

This alternative requires WM to develop a new waste disposal facility at a location within Southern Ontario capable of continuing to service the customer base for the TCEC. The ability to develop a new disposal facility is limited to those properties owned by WM including the potential expansion of an existing landfill.

WM owns a number of closed landfill sites in Southern Ontario, and other properties such as transfer stations and hauling yard sites, which do not have the property area, site infrastructure and environmental controls to manage 1.4 million tonnes of waste annually over a period of approximately 12 years. In addition, significant financial investment would be required to enhance and upgrade off-site infrastructure including access roads and, in some cases, the site has been transitioned to alternative land uses.

This alternative would not allow WM to continue to provide disposal services to its customers and fulfill long term contractual commitments within Ontario; as such, these customers, including a number of municipalities across Southern Ontario, would need to find alternate ways to manage their waste. The opportunity to optimize the investment in the TCEC facility infrastructure would be lost along with the economic contributions to the local economy. This alternative is not a viable option for WM's on-going business, its customers, and the Province of Ontario.

Alternative 4 – Develop within the TCEC Site Area

This alternative would involve WM developing additional landfill capacity within the 301 ha TCEC site area. The additional capacity would be developed through either a vertical expansion of the currently approved 101.8 ha expansion landfill footprint or a horizontal expansion into other areas of the TCEC site. Within the TCEC site a range of existing land uses and development opportunities may potentially exist. This alternative would be able to optimize and utilize the extensive existing infrastructure constructed at the TCEC including site features for leachate and gas management, stormwater management, roads, administration and maintenance, etc.

A vertical expansion would involve redesigning the originally planned and approved final contours of the 101.8 ha expansion landfill including potential changes to the grade of the side slopes and the peak elevation.

A horizontal expansion within the overall 301 ha TCEC site area may require that development occur on the partially-lined existing closed landfill area at the east of the site. The southern portion of the TCEC site currently includes a 28.3 ha poplar plantation used

to dispose on-site treated leachate, and approximately 36 ha currently used for agriculture and recreation.

Development within the TCEC site area is the only practical, environmentally sound, and cost-effective option to address the identified business opportunity to allow WM to operate in the long-term. WM has been successfully operating the TCEC landfill since 1996 and it has become an important addition to the local community by creating employment opportunities, contributing financially to the Township of Warwick, and supporting local initiatives within the community. This alternative is the most financially and economically viable option to both WM and its customers; utilizing land already owned by WM and optimizing the significant investment that has been made in the supporting site infrastructure that has already been developed, including environmental controls.

Preferred Alternative to the Undertaking

WM has determined that development of additional landfill capacity within the TCEC site area (Alternative 4) is the only reasonable alternative for the company, its customers, and the Province of Ontario. The other alternatives do not address WM's business opportunity to meet long-term customer commitments, avoid business risks or maximize the financial investment in the facility, and limit the benefits provided to the local community. A summary of the advantages and disadvantages of the alternatives in addressing the opportunity identified by WM is provided in the following table.

Alternative To	Advantages	Disadvantages
Alternative 1 – Do Nothing	• Provides a benchmark against which to assess potential effects of the project.	• Does not allow WM to continue to provide disposal services and meet commitments. • No opportunity for WM to optimize the investment in the TCEC site infrastructure. • Economic contributions to the local economy end. • Lack of sufficient and long-term disposal capacity in Ontario.
Alternative 2 – Redirect Waste Elsewhere	• No advantages identified.	• Would require the potential export of an additional 1.4 million tonnes of waste to Michigan. • No opportunity for WM to optimize the investment in the TCEC site infrastructure. • Economic contributions to the local economy end. • Lack of sufficient and long-term disposal capacity in Ontario.
Alternative 3 – Develop a New Facility	• No advantages identified.	• WM does not own any other suitable properties in Southern Ontario. • Would require the potential export of an additional 1.4 million tonnes of waste to Michigan. • No opportunity for WM to optimize the investment in the TCEC site infrastructure. • Economic contributions to the local economy end.

Alternative To	Advantages	Disadvantages
		• Lack of sufficient and long-term disposal capacity in Ontario.
Alternative 4 – Develop within the TCEC Site Area	• Allows WM to continue to provide disposal services within Southern Ontario and meet their business commitments. • Allows WM to optimize the investment in the TCEC site infrastructure. • Economic contributions to the local economy will continue for an extended period of time. • Provides Ontario with additional long-term disposal capacity.	• No disadvantages identified.

These alternatives, and the identification of the preferred "alternative to", were presented to the public during the consultation and engagement on the development of the ToR. Based on the comments received the description of Alternative 4 was more broadly defined to include all development options within the TCEC site area and a summary of the advantages and disadvantages of the alternatives was included.

The "do nothing" alternative will be carried forward in the EA for comparison against the preferred undertaking to assess its potential effects on the existing environment.

6.2 Identification of Alternative Methods

'Alternative methods' of carrying out the undertaking are different ways of implementing the proposed undertaking. The development of additional landfill capacity within the TCEC site area can be achieved through a vertical expansion of the currently approved expansion landfill footprint of 101.8 ha or a horizontal expansion into other areas of the TCEC site based on the preferred alternative to the undertaking identified in **Section 6.1**. Through the consideration of "alternatives to" the undertaking, WM has determined that developing additional landfill capacity within the TCEC site area is the only reasonable alternative for the company, its customers, and the Province of Ontario.

The existing ground elevation in the area of the TCEC site is approximately 245 metres above sea level (masl). The approved expansion landfill utilizes 4:1 exterior sideslopes to an elevation of 265.7 masl, and then transitions to 20:1 sideslopes to the landfill peak elevation of 278 masl. A two-metre thick final cover results in a landfill peak at 280 masl. A vertical expansion would involve redesigning the originally planned and approved final contours of the 101.8 ha expansion landfill including potential changes to the grade of the side slopes and the peak elevation. A range of variations and combinations of potential changes, or alternative methods, to the side slopes and peak elevation exist. A horizontal expansion within the overall TCEC site area would likely require that development occur on the existing closed landfill area at the east of the site or within the southern portion of the site.

The existing closed landfill is situated east of the expansion landfill and covers an area of approximately 30.9 ha. The existing closed landfill is a partially lined landfill under final

cover. Poplar trees planted on 9.3 ha of the final cover, referred to as the Poplar System, are utilized for the on-site management of leachate. Horizontal expansion in this area may require that development occur over the existing partially-lined landfill area, or excavation of landfilled waste to line the landfill area, with limited buffer from the eastern site boundary and the neighbouring land use (i.e., greenhouse). This alternative would require significant cost associated with remediation and/or engineering of the area in order to comply with applicable landfill design standards.

Within the southern portion of the TCEC site are the excess soil stockpile, a 28.3 ha area to dispose on-site treated leachate referred to as the Poplar Plantation, and approximately 36 ha currently used for agriculture and recreation. The southern portion of the site area is in close proximity to the Village of Watford and sensitive land uses within the community. This alternative would require the development of extensive additional site infrastructure including perimeter screening berms, stormwater works, roads, and landfill liner. On-going consultation and engagement with the local community and the Township of Warwick has consistently identified concerns with respect to the landfill or landfill-related activities encroaching on the Village and associated built up areas.

Based on a qualitative consideration of the potential vertical and horizontal expansion methods available within the site area, in addition to potentially locating waste in close proximity to the Village, the horizontal alternatives result in significant additional costs and do not optimize the use of the available and constructed infrastructure at the site to the extent possible. Given the financial, technological, and community risks and concerns associated with the horizontal alternative methods, WM has identified a preference for a vertical alternative method. A screening of the vertical and horizontal alternative methods will be carried out in the EA to confirm this conclusion.

Based on the preference for a vertical alternative method, four preliminary vertical alternative methods have been identified which may be refined and confirmed, as appropriate, during the EA. The preliminary vertical alternative methods include the following modifications to the expansion landfill final contours:

- 4:1 side slopes to an elevation of 300 masl, then 20:1 slope to a peak elevation of 304 masl;
- 3:1 side slopes to an elevation of 300 masl, then 20:1 slope to a peak elevation of 307 masl;
- 4:1 side slopes to a peak elevation of 320 masl; and
- 3:1 side slopes to an elevation of 320 masl, then 20:1 slope to a peak elevation of 324 masl.

During consultation and engagement on the development of the ToR, WM received comments regarding the feasibility of increasing the height of the expansion landfill; specifically, the comments were focused on the strength of the underlying leachate collection system pipes and if they could withstand the weight of the additional landfilled waste. To address these comments, WM completed a geotechnical feasibility review of the vertical alternative methods focused on the following design aspects:

- Settlement/deformation of the landfill base due to the increased weight of waste and cover material;

- Stability of the exterior side slopes if they are increased from 4:1 to 3:1; and
- Effects of the added weight on the leachate drainage systems, specifically drainage pipe deformation/deflection in the primary drainage layer and geonet compression within the secondary drainage layer.

The feasibility assessment, including the detailed analyses completed, is provided as **Supporting Document 3** (Geotechnical Feasibility Review). The assessment focused on the potential alternatives with a proposed increase in the side slopes (i.e., steeper, at 3:1) and peak elevation. As outlined in **Supporting Document 3**, the feasibility assessment confirmed the range of vertical alternative methods are acceptable as follows:

- Post-settlement landfill base grades meet O.Reg. 232/98 requirements and maintain acceptable leachate collection in the primary leachate drainage layer;
- The combination of 3:1 final side slopes and proposed peak elevation are stable;
- The strength of the primary drainage layer collection pipes is acceptable for the landfill optimization alternatives; and
- The flow capacity of the geonet within the secondary drainage layer will meet the design requirements for the landfill optimization alternatives.

The requirement for a more detailed geotechnical assessment for the assessment of the preferred alternative will be determined once it is identified.

WM will qualitatively predict the effects for each alternative method on the environment. The assessment will be completed for each component based on the locations and conceptual designs for each alternative, including mitigation and the existing environmental conditions. Leachate management considerations for the EA are outlined in **Section 8.2**.

7 Description of Existing Environment and Potential Effects of the Undertaking

A brief description of the existing environmental conditions at the TCEC and surrounding areas is presented in this section. This description is based on previous environmental studies completed for the TCEC (e.g., annual monitoring reports, compliance monitoring, previous environmental assessments) and on the additional work and studies underway to support the EA for the TCEC landfill optimization. A more detailed description of the existing environmental conditions will be prepared as part of the EA. The existing conditions will be used to assess the potential effects of the alternatives on the environment. The actual determination of the anticipated potential environmental effects of the undertaking, potential mitigation/management measures, and net effects are not included in this ToR; however, these will be identified in the EA Study Report.

During the EA, existing conditions and potential effects will be considered in the context of two study areas: on-site and off-site. The proposed studies to support the EA are detailed in the discipline work plans presented in **Appendix C**.

The following sections describe the study areas and the existing environmental conditions within these study areas.

7.1 Study Areas

The proposed on-site and off-site study areas for the EA are as follows (**Figure 7-1**):

- **On-site study area**: the existing TCEC;
- **Off-site study area**: the lands within the vicinity of the TCEC extending approximately 1 km out from the On-site Study Area.

The off-site study area may be refined during the EA to suit the requirements of a specific environmental component or based on the spatial extent of predicted effects. Proposed refinements to the off-site study area are identified in the discipline work plans.

Figure 7-1. General On-Site and Off-Site Study Areas



7.2 Existing Conditions by Environmental Component

The EAA defines the environment in a broad, general sense that comprises physical, biological, and human considerations. In this EA the environment has been separated broadly into natural, socio-economic, cultural, and built components. The following

sections present preliminary descriptions of the existing environmental conditions by environmental component. The EA Study Report will include more detailed descriptions of existing environmental conditions. The characterization of the existing environment for the EA will incorporate the results of past studies, field reconnaissance, additional baseline studies, and information from the data sources outlined in **Appendix B**, as applicable.

7.2.1 Natural Environment

The natural environment, as defined for the EA, includes the atmospheric environment, geology and hydrogeology, the surface water environment, and the ecological environment.

7.2.1.1 Atmospheric Environment

The atmospheric environment includes air quality, odour, noise, and litter.

Air Quality

The area surrounding the TCEC comprises mostly agricultural lands as well as portions of Hwy 402, Nauvoo Road, and Confederation Line, and the village of Watford including a number of small businesses. Sources of air emissions include on-site operations and activities from the surrounding agricultural operations, as well as traffic on local roads.

On-site sources of dust at TCEC include vehicle traffic on paved and unpaved roadways, material handling of soil, wind erosion of exposed areas, construction activities, and combustion. Off-site sources of dust include agricultural activities and traffic on local roads. WM has implemented a dust management plan at the TCEC.

Since 2009, total suspended particulate (TSP) sampling has been completed at three MECP-approved locations around the landfill footprint. Between 2009 and 2020, only about 4% of samples exceeded the TSP Ambient Air Quality Criterion of 120 µg/m^3. Although some of these measured exceedances were found to be the result of off-site sources, the majority of these exceedance events were attributable in whole or in part to the landfill operations. Measured metal concentrations were consistently below the applicable criteria.

Only one dust complaint was received at the landfill between 2009 and 2020. This complaint was received in 2015 and was related to dirt tracked out on the road, rather than airborne dust.

Landfill gas is generated by the decomposition of waste within the landfill. This landfill gas consists mainly of methane and carbon dioxide; however, it also contains trace amounts of volatile organic compounds (VOCs) and reduced sulphur compounds (RS). The majority of the landfill gas generated by the existing TCEC is collected by the landfill gas collection system and sent for destruction or for utilization; however, a portion of the landfill gas is released through the landfill surface as fugitive emissions.

Combustion by-product impacts may result from on-site combustion equipment such as landfill gas flares and diesel-fired generators as well as tailpipe emissions from on-site traffic and mobile equipment. Common contaminants include combustion by-products such as nitrogen oxides (NO_X), carbon monoxide (CO), sulphur dioxide (SO_2), certain VOCs, benzo(a)pyrene, and dioxins and furans.

VOC sampling has been completed through the summer months (July, August, and September) since 2009. In general, the VOC concentrations measured since the onset of the monitoring program have been generally quite low. All concentrations measured have consistently been less than their respective air quality standards.

No ambient monitoring of combustion by-product contaminants resulting from traffic has been conducted in the vicinity of TCEC. The background concentration is expected to be similar to other locations throughout Southwestern Ontario. Overall, the landfill traffic represents a small proportion of the traffic along the external haul route.

No landfill gas-related complaints, other than those that may have been denoted as odour issues by the complainant, have been received at the landfill between 2009 and 2020. Similarly, no complaints related to combustion by-products have been received at the landfill between 2009 and 2020.

Odour

On-site sources of odour at TCEC include fugitive emissions from the landfill mound (final cover areas, interim cover areas, and working face), waste soil piles, and leachate collection and treatment systems. Off-site sources of odour in the area are predominantly agricultural. WM has implemented an odour management plan at the TCEC.

Ambient monitoring for odour is not completed at the facility; ambient monitoring of odour as a mixture of compounds is not possible. In 2019, odour surveys were completed in the community, around the landfill, and in response to odour events. Odour-related complaints received during the 2019 operating period were reviewed to identify any trends and to identify corrective actions. Overall, no trends were identified as a result of the surveys. Of the odours that were identified as being related to site operations, it was determined that the majority were related to a reduction in the efficiency of the landfill gas (LFG) collection system. The lower collection efficiency was related to uneven settling of waste that resulted in pinched collection lines, which were subsequently repaired within Cell 1 and Cell 2 between the third quarter of 2019 and the first quarter of 2020.

A total of 105 odour complaints were received at the landfill between 2009 and 2020. The greatest number of complaints were received in 2019 (51). During 2020 there was a reduction in odour complaints (30) compared to 2019. This reduction may be attributed to the previously-noted repair of the LFG collection system. Prior to 2019, odour complaints were generally low.

When a complaint is received, WM follows the documented complaint procedure, which includes notification to the MECP and stakeholders, logging and investigating the complaint, and implementing corrective action or mitigation to resolve the issue. WM has been working to obtain and enhance the review and documentation related to the odour complaints and follow-up activities.

Noise

The acoustic environment in the area of the TCEC is influenced by nearby businesses and agricultural operations, Highway 402, which runs roughly parallel to Zion Line and is located approximately 1.4 km from Zion Line to the north, and a major rail line that runs through the Village of Watford roughly parallel to Confederation Line and located approximately 1.1 km south of Confederation Line.

The TCEC operates from 07:00 to 17:00 during the week and from 08:00 to 11:00 on Saturdays. Normal operation includes typical landfilling and construction activity along with the gas flare system running. On-site equipment for landfilling includes bulldozers, haul trucks, excavators, compactors, compressors, and portable generators. The gas management system includes a flare site with a continuously operating flare and a fixed-in-place generator.

The TCEC has a Noise Monitoring Program that includes quarterly on-site monitoring, completed at four MECP-approved locations around the landfill, off-site confirmation at transition to subsequent landfill phase, and a complaints evaluation process. The on-site part of the program involves regular sound level measurements at the TCEC perimeter as a proxy for compliance at surrounding receptors, with reporting on a quarterly and annual basis. The use of a proxy has value when there are no other sources of noise in the area; however, this is not currently the case. The development of the industrial park to the southwest of the landfill has introduced a number of sources closer to the two southern perimeter monitoring receptors than certain stages of landfilling. Recreational activities in the area, specifically the trail adjacent to these two perimeter receptors, include walking, running, dog-walking, and snowmobiling. Sounds of nature are also prevalent due to the wooded area in which one of the perimeter receptors is located. The industrial park, recreational activities, and sounds of nature all cause exceedances at the monitors that are not related to landfilling – this is demonstrated by the prevalence of exceedance-level sound even during periods when the TCEC is closed. TCEC landfill operations are in compliance with landfilling sound level limits at all points of reception.

The TCEC documents complaints on-site. There have not been any noise complaints since 2012. An absence of noise complaints during construction and landfilling may be indicative of limited impact from noise levels in the study area.

Litter

Litter is considered a potential nuisance, which may be transported off-site during events with above average wind speeds. In 2005, a review of the wind conditions in the area was conducted, which concluded that the potential for light blowing litter events occurred less than 13% of the time and the potential for moderate and heavy blowing litter events combined is less than 2% of the time. Therefore, light blowing litter events will have the potential to occur on an occasional basis, and moderate and heavy blowing litter events will be very infrequent. The potential for off-site litter impacts are mitigated through the use of portable and permanent litter fencing – permanent litter fencing has been installed and portable litter fencing is in use at the working face.

Only eight litter complaints were received at the landfill between 2009 and 2020.

7.2.1.2 Geology and Hydrogeology

Geology and hydrogeology includes geology, hydrogeology, and groundwater quality and quantity.

Geology

The regional geologic stratigraphy consists of about 10 m to 45 m of dominantly clayey silt to silty clay soil overlying bedrock. This overburden is generally thinner within the western

portion of the area, near Bear Creek, and thicker in the east. The shallow soil varies within the regional area. The Seaforth Moraine extends across most of the regional area and is typified by shallow clayey silt textured till (Southern Till). Localized deposits of surficial sand and gravel, as well as modern alluvial aim occur over the till. Where sufficient surficial sand and gravel resources occur, sand and gravel pits have been developed.

Lacustrine deep-water deposits of sand, silt, and clay occur within the western portion of the regional area. Thin discontinuous deposits of clay, silt, and sand (interstadial deposits) occur between the Southern Till and the underlying Rannoch Till, which is a silt till, with discontinuous occurrences of silt and sand lenses. A discontinuous sand to gravel deposit underlies the Rannoch Till and overlies the shale bedrock of the Kettle Point Formation and the alternating grey shale and argillaceous limestone of the Widder Formation. The bedrock topography ranges between about 195 masl and 220 masl, with a general slope toward the southeast and the southwest.

The stratigraphy below and around the TCEC includes the clayey silt to silty clay till (Southern Till) and lacustrine deep-water deposits to depths of up to 12.5 m. The upper 2 m to 5 m is brown and weathered with soil fractures, and grades into the underlying soil, which is grey and unweathered with infrequent soil fractures. Shallow alluvial deposits also occur near Brown Creek. The stratigraphy below the TCEC is subdivided into the following main units:

- Southern Till, 1.6 m to 12.5 m thick;
- interstadial deposits, 4.0 m to 10.7 m thick;
- the Rannoch Till, approximately 21.4 m thick; and
- bedrock and the overlying basal sand.

The economic geology within the region relates to aggregate resources (i.e., sand and gravel), as well as oil and gas resources. Most sand and gravel pits were developed within localized features that were mined out and closed. Active licences exist for sand and gravel pit operations northeast of Wisbeach and north of the TCEC.

There are a number of oil well licences in the regional area that tend to show three groupings around the Village of Watford. One grouping is to the southwest, one to the southeast, and one to the northeast. Scattered oil wells also occur throughout the regional area, although none are documented within the TCEC or vicinity. Most of the oil wells are developed within the reef structures of the Guelph Formation, which is separated from the regional aquifer by low permeability formations. The upper fractured portion of the bedrock and the overlying basal sand form the local bedrock aquifer.

Hydrogeology

The regional groundwater aquifer occurs at the interface of the discontinuous sand and gravel deposits at the base of the Rannoch Till and within the underlying weathered and fractured portion of the bedrock, which as introduced below is termed the interface aquifer. Groundwater flow for the interface aquifer is toward the west, although historic domestic use of the interface aquifer likely influenced the direction of groundwater movement, especially in the vicinity of Watford to the southwest.

Groundwater movement at the TCEC and vicinity is generally controlled by the low permeability lacustrine deep-water deposits, Southern Till, and Rannoch Till, which represent aquitards within the regional area.

Within overburden, the groundwater flow velocities are slow and typically in a downward direction. Lateral shallow groundwater movement occurs within the upper weathered and fractured portion of the Southern Till, as well as within the surficial sand, gravel, and alluvial deposits. The local drains, ditches, and creeks influence the direction of this shallow groundwater movement within the Southern Till, and to a lesser extent within the interstadial deposits, depth dependent. Groundwater movement within the discontinuous interstadial sand is controlled by the surrounding low permeability soil.

The TCEC is not within a Wellhead Protection Zone or an Intake Protection Zone (1 through 3). The southwestern portion of the TCEC is within a low significance groundwater recharge area, approximating the Brown Creek surface watershed area (a Tier 1 Low Groundwater Sub-watershed); however, the landfill optimization project is not within the Brown Creek watershed. Overall, the TCEC is developed in a hydrogeologic setting that is a low significance groundwater resource.

To define the local groundwater setting below the TCEC, the stratigraphic sequence described above can be associated with hydrostratigraphic units, as follows:

- Active Aquitard: Southern Till (Brown Zone) at a depth of 0 to 1.6 m below ground;
- Upper Aquitard: Southern Till (Grey Zone) and Interstadial Deposits (Clay and Silt) at a depth of 1.6 to 7.9 m below ground;
- Interstadial Silt & Sand: Interstadial Deposits (Silt and Sand) at a depth of 4.0 to 10.7 m below ground;
- Lower Aquitard: Rannoch Till at a depth of 4.5 to 12.5 m below ground; and
- Interface Aquifer: Fractured Bedrock and Basal Sand at 22.8 to 29.3 m below ground.

The Active Aquitard represents the best shallow flow system for evaluating potential landfill leachate effects, such as lateral migration. The hydrostratigraphic units assessed for potential landfill leachate effects on groundwater quality are:

1. Active Aquitard;
2. Interstadial Silt and Sand; and
3. Interface Aquifer.

The groundwater within each of the aforementioned hydrostratigraphic units has shown acceptable quality at the TCEC since monitoring began.

Groundwater Quality and Quantity

Groundwater was historically used for domestic and agricultural purposes. Water was obtained from water supply wells typically developed within the interface aquifer. Shallower water supply wells are also developed within the interstadial sand and within the surficial sand and gravel deposits. A piped municipal water supply is provided by Lambton Area Water Supply System, which sources its water from a surface water source – Lake Huron. This same system services the Town of Watford and is available along

many of the rural roads in the vicinity of the Site. The increasing reliance on the municipal water supply has resulted in a reduction in the use of the groundwater resources.

Groundwater is mineralized owing to the slow movement through the aquitards. Chemical characteristics within the overburden elute to a hard and bicarbonate groundwater quality. Within the interface aquifer, the water quality is also bicarbonate with sodium as the dominant cation; however, the groundwater chemical characteristics naturally vary within the interface aquifer with the occurrence of natural gas and hydrocarbons at some locations.

There has not been any detected, or reported, impact on groundwater resources in the area as a result of the landfill. On-going groundwater quality monitoring at the Site has confirmed this since monitoring began. Groundwater is monitored semi-annually in the spring and fall as per the Environmental Monitoring Plan. Groundwater compliance is assessed based on criteria calculated with respect to the MECP's Guideline B-7 Reasonable Use Concept and evaluated at the Site boundaries. The groundwater within each hydrostratigraphic unit has shown acceptable quality since monitoring began.

7.2.1.3 Surface Water Environment

The surface water environment includes surface water quantity and quality.

Surface Water Quantity

The surficial drainage within the Brown Creek and Bear Creek watersheds has been enhanced with ditches and drains, which direct surface water toward Brown Creek and Bear Creek. Both creeks flow in a southerly direction toward the Sydenham River.

To the east of the site is an artificial open drain identified as the Kersey Drain. This drain forms the eastern boundary of the southern portion of the Site and flows in a southward direction where it connects with Brown Creek at County Road 39. Within historic documentation for the Existing Landfill, the Kersey Drain was identified as Brown Creek. Bear Creek, which is located about 8.7 km west of the site, has its natural headwaters north of the site's vicinity. Kersey Drain captures the eastern portion of the study area which includes a greenhouse property located east from the TCEC and beside the Existing Landfill footprint. Kersey Drain, near the site, receives flow from several tributaries draining agricultural lands on the east side of the property. Near Confederation Line, Kersey Drain merges into Brown Creek which runs easterly of Watford.

To the west of the TCEC the Gilliland-Geerts Drain, with several of its branches receiving runoff from the site, forms a tributary to Bear Creek. The Gilliland-Geerts Drain receives its headwater runoff from various portions of the Site.

Ditches and drains within the site and vicinity are typically intermittent. Surface water flow occurs during periods of snowmelt and after intense or prolonged periods of precipitation. Historic information indicates that Brown Creek and Bear Creek are perennial watercourses, although during prolonged dry periods the portions of Kersey Drain (Brown Creek) are dry, while the head portions of Gilliland-Geerts Drain are ephemeral in nature and only show flow after periods of snowmelt, prolonged and/or intense precipitation events.

Surface water runoff from the TCEC flows toward the Kersey Drain (Brown Creek) to the east and toward drains and ditches associated with Bear Creek to the west. Surface water flow on TCEC is entirely ephemeral by nature, with flow that typically occurs after snowmelt or prolonged and/or intense periods of precipitation. Runoff originating from waste disposal areas drains as sheet flow into the landfill perimeter ditching and is conveyed into one of four ponds through a strategically located network of manmade channels and culverts. Sedimentation Ponds 1 through 4 are four (4) on-site Sedimentation Ponds, fully constructed in 2009, to manage surface water for the TCEC. These ponds control flows such that they do not exceed pre-development conditions.

Sedimentation Pond 1 discharges water through twin culverts to an open drainage ditch on-site, which flows westward until it enters a municipal drainage tile at a catch basin situated 60 m east of the western site boundary. The municipal drainage tile subsequently drains into one of the headwater branches of the Gilliland-Geerts Drain on the east site Lambton County Road 79 (Nauvoo Road).

Sedimentation Pond 2 receives most of the stormwater runoff for the site and discharges through twin culverts and then to an open drainage ditch that flows to the western site boundary and into one of the headwater branches of the Gilliland-Geerts Drain on the east side of Lambton County Road 79 (Nauvoo Road).

Sedimentation Pond 3 receives stormwater runoff from the northwestern portion of the site, and discharges through one of three culverts that flow to the eastern roadside ditch of Nauvoo Road, which in-turn directs the runoff to two additional headwater branches of the Gilliland-Geerts Drain.

Sedimentation Pond 4 discharges stormwater through a culvert then into an open drainage ditch that flows westward until it enters a series of culverts that direct water under a screening berm and then under Zion Line to flow into one of the headwater branches of the Gilliland-Geerts Drain.

Surface Water Quality

Surface water flow patterns in the regional area are typically from northeast to southwest towards Lake St. Clair, which connects Lake Erie and Lake Huron at the Michigan-Ontario border. There were numerous low-grade historically produced wetlands in this area that were drained at the turn of the century to enhance agricultural practices.

The majority of the streams within Lambton County are impacted from land use practices such as, but not limited to, soil erosion effects. This, in combination with the loss of natural vegetation to buffer these watercourses, has led to generally unnaturally poor water quality that experience both nutrient enhancement and turbid water clarity.

Trace metals including aluminum (Al), iron (Fe), and zinc (Zn), are naturally bound to the suspended solids (dominantly clays and silts) entering the water courses. The trace metals are naturally present within the clayey soil minerology. Nutrients including phosphorus and nitrogen typically abound in waters receiving inputs from manure fertilizer effects to runoff quality, as well as suspended solids from erosion. Consequently, minerally and nutrient enriched waters are part of the environmental baseline of the area and any landfill influences are interpreted against these reference conditions. Runoff and groundwater inputs to surface drainage are minimal in the vicinity of the TCEC, leaving water quality in

the water courses stagnant. Interpretation of water quality results must factor in the intermittent and agricultural influenced nature of these waterways.

The TCEC is part of the Sydenham River drainage system whose headwaters are found within the Bear, Black, and Brown Creeks. Bear Creek flows southwesterly from north of the TCEC, for approximately 11 km to form the North Sydenham River at the confluence of Bear and Black Creek. The landfill area is drained by the more southerly headwaters of Bear Creek, from within the TCEC to County Road 79 (Nauvoo Rd.), which runs adjacent to the western limit of the TCEC.

Downstream of the TCEC, the channel size and definition of Bear Creek increases. Numerous small tributaries enter the creek along its 11 km path to the Sydenham River. The land use downstream consists mainly of agricultural lands used for crop harvesting and livestock.

Bear Creek, from upstream of and to approximately 3.5 km downstream of County Road 79, is ephemeral in nature, with visible flow only during the spring freshet and following intense storms. There are localized areas within the approximate 3.5 km downstream of Bear Creek that hold water as a result of unnatural dams or ponds being developed within the water course for what appears to be agricultural purposes.

Brown Creek's headwaters originate northeast of the TCEC. Brown Creek runs in a southerly direction along the eastern border of the southern half of the TCEC. Brown Creek runs for a distance of 37.5 km before joining the Sydenham River. Large portions of the first and second order tributaries connected to the creek appear to be channelized, which is attributable to drainage alterations from historical agricultural practices. The section of Brown Creek paralleling the eastern portion of the TCEC typically experiences continuous flow conditions.

The surface water is naturally turbid as a result of soil erosion, overland flow, and agricultural drainage from the surrounding land. Metal and nutrient concentrations within the surface water are naturally elevated as a result of the sediment load within the surface water. After intense or prolonged precipitation events the water turbidity as well as metal and nutrient concentrations generally increases. As a result, the quality of the surface water that flows off-site is generally similar to that of surface water observed from other areas in the vicinity of the TCEC.

Since the development of the expansion landfill, beginning in 2008, overall site improvements to protect the surface water were implemented to further protect downstream watercourses from runoff from the TCEC. These improvements include an extensive watercourse drainage network consisting of grasses, drainage ditches with rock-check dams, numerous straw bale check dams, drainage berms, as wells as four (4) stormwater management ponds. Additionally, temporary water storage areas are developed as part of landfill cell expansion/construction needs. During the drier months, in addition to water utilized from within temporary storage areas, WM is able to use the stormwater from the stormwater management ponds in compliance with the TCEC's Permit to Take Water (PTTW) to reduce the amount of stormwater discharge through on-site road watering activities for dust control. These activities would not alter the ephemeral nature of the receiving watercourses as they normally have a dry ditch base or areas with stagnant water during drier months. It is also noted that the TCEC's stormwater drainage network is similarly unnatural to much of the surrounding area.

Surface water runoff from the TCEC flows toward: 1) Kersey Drain (Brown Creek) to the east; and 2) to drains and ditches associated with Bear Creek to the west. Monitoring stations are situated at 10 locations surrounding the site.

The surface water monitoring program adheres to the relevant Waste ECA, the Sewage ECA, as well as conditions stipulated by the MECP. Surface water sampling is initiated and is dependent on precipitation events, with sampling completed quarterly when there is flowing conditions after a precipitation event. There are two (2) types of surface water monitoring stations at the TCEC. The first type of station consists of an open drainage ditch where surface water flowing conditions are precipitation duration/intensity dependent (ephemeral). The second type of station consists of Sedimentation Ponds, which typically have water available for sampling except during the late spring to early fall where water may not be available. An exceedance of a trigger concentration at one of the surface water monitoring compliance points would initiate verification monitoring.

Surface water quality monitoring has been completed at the TCEC since 2003. Since that time, monitoring has shown periodic site influences such as soil erosion effects on surface water quality; however, effects from landfill leachate have not been observed in the discharge from the site. The MECP-approved monitoring program of chemical and biological monitoring has shown that acceptable surface water quality has been discharging from the site since monitoring began.

7.2.1.4 Ecological Environment

The ecological environment includes both terrestrial and aquatic ecosystems.

Natural features are present within the On-site Study Area, and include woodlands identified by the County of Lambton Official Plan (2020) and Township of Warwick Official Plan (2010), and wetland and watercourse features regulated by the St. Clair River Conservation Authority (SCRCA).

The TCEC is located within two subwatersheds: the western portion of the on-site study area falls within a headwater area for Bear Creek, flowing west; and the eastern portion of the on-site study area forms part of a drainage catchment of Brown Creek, flowing to the south. Two watercourses, Brown Creek and a tributary to Bear Creek, are present along the southeastern property boundary and the extreme western portion of the on-site study area, respectively.

The study area falls within Ecoregion 7E. Much of the off-site study area comprises agricultural lands (row crops, dominated by corn and soy), with scattered residential houses. A portion of the Village of Watford is located in the southwestern portion of the off-site study area. The greatest area of natural cover is found in the central portion of the on-site and off-site study areas, comprised of a series of scattered deciduous woodlands.

The majority of the species documented within the on-site and off-site study areas are species that are common in southern Ontario and found in a mixture of agricultural landscapes interspersed with scattered deciduous woodlots, representative of the area.

Background review of the study area has identified Brown Creek and a tributary to Bear Creek, as well as some additional aquatic features that may be protected and/or have regulations associated with them as occurring within the on-site and off-site study areas.

The tributary to Bear Creek provides intermittent aquatic habitat that occurs during times of the year when water is flowing in response to the spring freshet (melting snow) and precipitation events. Brown Creek is a permanent feature that provides continuous aquatic habitat conditions throughout the year; however, water flow is strongly correlated to precipitation events. Species captured during past surveying include coolwater and warmwater species, which could indicate potential groundwater input to the aquatic features within the study area; however, previous studies did not identify areas of groundwater discharge or groundwater indicators (e.g., watercress or iron staining).

There are no Provincially or Locally Significant Wetlands identified within the study areas, as per Schedule 'A' to the Township of Warwick Official Plan (2010) and the Natural Heritage Information Centre (NHIC; MNRF 2021). A series of small unevaluated wetland units are located within the on-site study area, in proximity to the watercourses present. The tributary to Bear Creek and Brown Creek provides fish habitat, although the Bear Creek tributary may only provide seasonal habitat since background information indicates that it exhibits ephemeral/intermittent characteristics. A series of woodlands within the On-site and Off-site Study Areas are identified as significant under Lambton County's Official Plan (2020).

Based on a review of background material and air photos, a preliminary Significant Wildlife Habitat (SWH) screening was undertaken to identify what SWH may be present within the study area. A total of 15 candidate habitat types are potentially present within the on-site and off-site study areas. A review of existing reports, online resources, and wildlife atlases was undertaken to identify species that are reported from the study area. A total of 17 Species at Risk (SAR) and Species of Conservation Concern (SCC) have suitable habitat within the study area. Field work to be completed will confirm which species are present within the study area and may identify additional species. There are no provincially significant Areas of Natural and Scientific Interest within the study area.

7.2.2 Socio-Economic Environment

The socio-economic environment comprises the economic and social environments.

7.2.2.1 Economic Environment

The Township of Warwick (the Township) is a rural township located in the County of Lambton, midway between London and Sarnia on Hwy 402. The village of Watford is the main population centre of the Township, located south of Hwy 402 at the intersection of Nauvoo Road and Confederation Line. Based on the 2016 Census, approximately 34% of the Township's labour force (i.e., employable population) resides in Watford.

The top five employment sectors in the Township are: agriculture, forestry, fishing, and hunting; health care and social assistance; construction; retail trade; and manufacturing. The unemployment rate is low at 4.1% (2016), with the majority of individuals occupied in trades, transport and equipment operations, management, sales and service, business, finance, and administration.

The TCEC is not a significant source of employment in the off-site study area due to the scale of its operations and the proximity of the Township to the major urban centres of Strathroy, Sarnia, and London (approximately 20, 25, and 35 mins away, respectively). Based on 2016 Census results, approximately 66% of employed individuals within the

Township commute outside of the Township for work. The TCEC provides stable employment for 25 staff, the majority of which are operators.

The TCEC is a regional facility that provides safe and convenient disposal services for communities, businesses and industries serving the Province of Ontario. WM strives to be a good neighbour and a responsible partner in the community. Day-to-day operations, from the wages and benefits provided to the income taxes paid, boost economic growth in the community. The TCEC supports local businesses through the purchase of materials and services, and provides annual host community fees to the Township. Since 2009, when the TCEC expansion landfill began receiving waste, WM has contributed over $24 million in host community fees and municipal property taxes to the Township. These host community contributions are a key component of the Township's annual municipal budget and are placed into general funds to keep taxes low and provide for community projects. Over the past 10 years, WM has provided additional support for community projects such as walking trails, soccer fields, arena upgrades, dog park, yard waste and recycling depots, and local festivals and events.

7.2.2.2 Social Environment

The social environment includes the local community and visual aesthetics.

Local Community

The TCEC is located south of Hwy 402 in a predominantly rural area with few neighbours with the exception of the village of Watford, which is located approximately 1.5 km southwest of the expansion landfill area (this is the area of the site where the landfill optimization project is anticipated to occur). The area surrounding the landfill and Watford is predominantly used for agricultural activities. The two main roads in the area are Nauvoo Road, which runs north-south along the west side of the TCEC and is used as the primary haul route to the TCEC from Hwy 402, and Confederation Line, which runs east-west along the south end of the TCEC. The village of Watford is located at the intersection of Nauvoo Road and south of Confederation Line.

Watford has a population of approximately 1,536 (2016) and has experienced minimal population growth over the past 5 years (an increase of 3% since 2011). The Township of Warwick is home to approximately 3,692 residents (2016) and has experienced a minor decrease during the same time period (0.7%). Approximately 640 individual residences are located within Watford, and it is estimated that approximately 40 residences are located outside of Watford within the off-site study area. The Township's most recently approved Official Plan (2010) identifies future residential lands to the west and southeast of Watford, which may allow for future residential development and population growth.

Local businesses in the off-site study area are primarily in the industries of manufacturing, retail trade, and construction, and are predominantly located along Nauvoo Road, Confederation Line, or on the edges of the residential developments in Watford. The Township owns the Warwick Industrial Park, a fully serviced 16 ha site (with potential to expand to 64 ha) on Nauvoo Road, 3 km south of Hwy 402, that borders the TCEC to the southwest. The Township is actively working with the Sarnia-Lambton Economic Partnership to promote the industrial park and bring business to the area. The Official Plan identifies additional commercial lands at the corner of Nauvoo Road and Hwy 402,

along the west side of Nauvoo Road north of Confederation Line, and along Confederation Line at the east end of Watford.

Several recreational facilities are located in Watford including the Watford Community Arena (which includes ice surface, community hall, and meeting rooms) and Centennial Park (which houses softball diamonds with lights, playground equipment, splashpad, basketball nets, ball hockey court, outdoor pavilion, BMX Park, tennis courts, running track, and horseshoe pits). Watford Arena and Centennial Park are located south of Confederation Line, approximately 1.5 km from the expansion landfill area at the TCEC. In late 2020, Warwick Township Council approved a $10M expansion and renovation of the Watford Arena to include a fitness area, large multipurpose gym, kitchen, additional parking, and improved accessibility. Three other small greenspace parks are located in Watford: Memorial Park; Sunken Gardens; and Bluebird Parkette.

Watford has two elementary schools: East Lambton Elementary and St. Peter Canisius Catholic School, both located approximately 2 km south of the expansion landfill area at the TCEC. The closest secondary schools are located in Forest, Petrolia, and Strathroy. Four churches are located in Watford, the closest of which is located approximately 1.8 km south of the expansion landfill area at the TCEC. Three retirement homes are located in Watford, the closest of which is located on Confederation Line west of Nauvoo Road, approximately 1.6 km from the expansion landfill area at the TCEC.

Visual Aesthetics

The TCEC active landfilling area is located approximately 1.5 km northeast of the Village of Watford in the Township of Warwick. The facility is situated southeast of the intersection of Zion Line and Nauvoo Road and the main entrance to the facility is located approximately 300 m south of Zion Line on the east side of Nauvoo Road. The north and east perimeters of the site comprise high berms with established coniferous and deciduous trees that perform an effective visual screening function. The recently constructed Twin Creeks Greenhouses complex is effective in screening views from the receptors that are located northeast of the TCEC. The west side of the TCEC is screened from view by the existing woodlots that are located west of TCEC. To the south of the TCEC, a soil stockpile functions as an effective visual barrier for the receptors that are located along Confederation Line.

The TCEC site entrance is located approximately 1.6 km south of Highway 402. The site is visible from just south of the intersection of Hwy 402 and Nauvoo Road. Existing buildings do not afford a direct view of the TCEC from the Watford village centre. Land uses to the east of the site are primarily agricultural. Several residences and businesses are located along Confederation Line, to the south of the TCEC. Since the time that the TCEC was constructed, several new buildings/developments have been erected, including the Twin Creeks Greenhouses complex. These facilities function as visual screening elements. Significant public amenities in the vicinity of the TCEC include the Watford Arena, the Watford cemetery, Centennial Park and Confederation Park, which was constructed as a component of the development of the TCEC. Confederation Park includes a dogs-off-leash park and a trailhead.

The lands that are owned by WM include the TCEC, adjacent agricultural lands and a significant woodland. The existing visual/landscape conditions are described as follows:

- The existing TCEC is framed on its west and north sides by 7 m high berms that are vegetated with coniferous and deciduous trees, which effectively screen the landfill operation from Zion Line and Nauvoo Road, respectively. These vegetated berms are visually dominant within the local landscape but are aesthetically pleasing.
- From the southern view, the soil stockpile and the existing woodland are the dominant landscape features.
- The recently constructed Twin Creeks Greenhouses facility comprises a 16 ha campus of large buildings that dominate the landscape on the northeastern side of the TCEC.
- The property beyond the limit of the TCEC has relatively flat topography that supports agricultural uses, including croplands and poultry farms.

Nauvoo Road accommodates most of the traffic into the TCEC. Nauvoo Road has a rural cross-section with paved shoulders and ditches on both sides from Highway 402 to the site entrance. The road has gravel shoulders north of Highway 402 and south of the site entrance. Approaching the TCEC from the north, the existing vegetated berm is the dominant visual element. The entrance driveway represents a perforation in the continuous perimeter berm. However, view corridor that is afforded by the entrance driveway does not expose the landfill. The main entrance to the TCEC that was formerly located on the south side of Zion Line has been closed and Zion Line is no longer a major haul route.

7.2.3 Cultural Environment

The cultural environment comprises archaeological and cultural heritage resources.

7.2.3.1 Archaeological Resources

The archaeological potential of the entire TCEC was assessed as part of previous archaeological assessments. Between 1999 and 2008, 12 archaeological sites were identified within the TCEC, including one in the south half of the TCEC, which was protected within a tree plantation in association with the St. Clair Conservation Authority following a Stage 3 archaeological assessment in conjunction with Walpole Island First Nation. No further archaeological assessment is required at the one remaining identified archaeological site as long as the site continues to be protected and avoided. The remaining 11 sites in the north half of the TCEC no longer have cultural heritage value or interest and are cleared of archaeological concern.

One historic cemetery is located directly adjacent to the TCEC. This feature was not addressed in previous archaeological assessments. Due to the current expectations from the Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI), further research and an archaeological assessment report is required, including review of any burial plot maps and cemetery property plans, in order to determine whether there is archaeological potential for unmarked graves outside of the present property limits. Any impacts within approximately 10 m adjacent to a historic cemetery property may trigger Stage 3 Cemetery Investigation.

7.2.3.2 Cultural Heritage Resources

Based on the results of municipal and provincial consultation, background research and historical mapping review, two potential built heritage resources (BHRs) and 19 potential

cultural heritage landscapes (CHLs) were identified within 1 km of the TCEC. Only one CHL was identified within the TCEC – Lot 20-21, Concession 4, which are active agricultural lands suspected of being in continuous operation since the late nineteenth century. No known BHRs or CHLs that are listed by the Township of Warwick or designated under Part IV of the *Ontario Heritage Act* were identified.

7.2.4 Built Environment

The built environment includes transportation and land use.

7.2.4.1 Transportation

The TCEC site entrance is directly from Nauvoo Road, south of Zion Line. The primary haul route to and from the site extends from Highway 402 (inclusive of the interchange intersections) south along Nauvoo Road to the landfill site entrance. Waste is typically hauled to the site in waste transfer trailers with a smaller portion transported in small and medium trucks (i.e., front or rear compactors, roll off bins, etc.). Only minor amounts of waste arrive at the TCEC from the south.

Nauvoo Road (County Road 79) is under the jurisdiction of the County of Lambton and is a north-south rural road with a posted speed of 80 km/h. It has a two-lane rural cross-section with no sidewalk on either side. Nauvoo Road is free-flow within the study area at the Highway 402 interchange intersections, Zion Line, and Confederation Line. These intersections are under east-west stop control.

A previous Traffic Impact Study completed in March 2017 in support of the fill rate increase concluded that, under 2022 background conditions (i.e., without landfill generated traffic), the individual movements for intersections in the study area will operate with acceptable level of service and with reserve capacity (Level of Service (LOS) 'D' or better, and volume-to-capacity ratios of 0.50 or lower). The study further concluded that with the addition of landfill generated traffic under 2022 total traffic conditions, study intersections would continue to operate at these acceptable levels.

Two on-site weight scales (inbound and outbound) at the Twin Creeks Landfill are located approximately 330 m southeast of the site entrance/driveway. The roadway leading to the weight scales has two lanes in each direction, and has an available combined vehicle storage capacity of 660 m. All waste hauling trucks proceed across the weight scale before unloading. An on-site staging and queuing area is available on-site for vehicles waiting to access the landfill tipping area.

Road safety was assessed in 2017 along the length of the landfill haul route from the site entrance to Highway 402. This assessment considered the operation of the existing northbound acceleration lane from the site entrance to Zion Line, collision history along the haul route, and potential cyclist exposure to conflicts with landfill related traffic since Nauvoo Road is identified as a Linkage Trail Corridor (with on-road shared access) as part of the Lambton County Trails. The northbound acceleration lane was found to satisfy the design standards specified by the Ministry of Transportation. The acceleration lane was also found to operate satisfactorily and there is little opportunity for merge conflicts. Historical collision records along the length of the haul route indicated that the haul route is not a collision-prone location. The risk of collision with trucks or cyclists was considered to be minimal due to the low exposure and cyclist demands along the haul route.

7.2.4.2 Land Use

The on-site and off-site study areas are located within the County of Lambton, which utilizes a two-tier governance system for land-use planning. The County of Lambton Official Plan provides a general policy framework for land use, with the Township of Warwick Official Plan providing more detailed planning policies on a local level. These planning policies and objectives are implemented through the Township of Warwick Zoning By-law No. 121 of 2012, which provides exact direction on how land may be used within the municipality. The County of Lambton Official Plan ('County OP'), Township of Warwick Official Plan ('Local OP'), and the Township of Warwick Zoning By-law No. 121 of 2012 are the end products of the planning process under the *Planning Act.*

Off-Site Study Area

The existing land uses within the off-site study area are predominantly agricultural in nature, including but not limited to field crops, greenhouses, and livestock operations, with a small number of single-detached dwellings associated with agricultural operations. The entire settlement area of Watford is located within the southwest portion of the off-site study area, with a mix of low-density residential, indoor and outdoor recreation facilities, open space, commercial, institutional, and commercial industrial uses.

The lands within the off-site study area are predominantly designated as 'Agricultural Area' in the County OP, with the entire 'Urban Centre' of Watford located within the off-site study area to the southwest. 'Urban Centres' contain a wide variety of residential, institutional, commercial, and industrial land uses, with specific land use designations and policies for these areas provided in local official plans. A 'Hwy 402 Service Centre' designation exists south of Highway 402 and west of County Road 79, with the purpose to provide opportunities for strategically located highway service centres and tourist-oriented land uses adjacent to the Highway 402 corridor. There is also a 'Primary Corridor (Group 'C' Feature') within the southern portion of the off-site study area.

Similar to the County OP, the lands to the north, east, and west within the off-site study area are predominantly designated as 'Agriculture' in the Local OP, with a 'Highway Service Centre Commercial' designation to the north, as well as scattered 'Natural Heritage – Woodlot' lands and 'Natural Heritage – Hazard' lands adjacent to creeks and drains. The entire settlement area of Watford is located within the southwest portion of the off-site study area.

Agricultural uses, including the growing of crops, raising of livestock and other animals for food or fur, aquaculture, agro-forestry, and maple syrup production, are the primary permitted uses within the 'Agriculture' designation. New single-detached dwellings accessory to agriculture, existing single-detached non-farm dwellings, and new single-detached non-farm dwellings (subject to certain conditions) are also permitted within the 'Agriculture' designation. Development within 'Natural Heritage' designations is very limited, and generally restricted to agriculture and conservation.

Watford is considered a 'Rural Settlement Area' under the Local OP framework. All new development within Rural Settlement Areas is to be compatible with existing and future surrounding development. The development of non-compatible uses is discouraged, with incompatible uses separated by increased setbacks or buffering measures. Permitted

residential uses within Watford include single-detached dwellings, semi-detached and duplex dwellings, and multiple-unit dwellings.

As per the Township of Warwick Zoning By-law, the lands to the north, east, and west within the off-site study area are predominantly zoned 'Agriculture 1', with a 'Service Centre Commercial' zone to the northwest at the intersection of Highway 402 and County Road 79, as well as scattered 'Natural Heritage – Hazard' and 'Natural Heritage – Significant Woodlot' zoning associated with streams in the area. A property zoned 'Service Commercial 2-1' is located directly to the west of the on-site study area, across County Road 79. A wide range of commercial and industrial uses are permitted in this zone, including but not limited to light and general industrial uses, health clubs, motels, and places of entertainment. A former waste disposal site is located directly to the south of the on-site study area.

The lands north of Confederation Line fronting onto County Road 79 are zoned a mix of 'Industrial' and 'Mixed Commercial/Industrial'. The lands south of Confederation Line within Watford are primarily zoned 'Residential 1', with some properties zoned 'Residential 3' and '5', 'Institutional', 'Open Space 1' and '2', 'Mixed Commercial/ Industrial' with a holding provision, 'Central Commercial' and 'Highway Commercial', and 'Agricultural 2'.

On-Site Study Area

The TCEC is the predominant existing land use within the on-site study area, with 101.8 ha of the site currently licensed for landfilling. A poplar plantation is located to the south of the existing excess soil stockpile, and a mature grove of trees are located directly to the south of the previously-approved landfill expansion area. The southernmost portion of the on-site study area appears to be used for the growing of agricultural crops.

The on-site study area is designated as 'Agricultural Area' in the County OP. The southeastern corner of the on-site study area intersects with a 'Primary Corridor (Group 'C' Feature)' conceptually identified in the off-site study area. The primary permitted land uses in the 'Agricultural Area' designation are agricultural uses of all sizes, types, and intensities. 'Primary Corridor' features represent existing connections between natural heritage areas and tend to follow major watercourses. The County OP also indicates that private commercial waste management facilities (such as the existing landfill) "are to be located on lands designated and zoned for such purposes. An amendment to this Plan and the local official plan is required prior to the establishment of new waste management facilities or the expansion of existing facilities". The County OP policies do not differentiate between vertical and horizontal landfill expansions. Any expansion proposals must be consistent with the County OP and comply with the provisions of the *Environmental Protection Act* and relevant Provincial legislation. Before any *Planning Act* approvals for a proposed expansion are adopted or granted, approval from the Province must be obtained.

The on-site study area is predominantly designated as 'Landfill Site', with smaller areas designated as 'Natural Heritage – Hazard', 'Natural Heritage – Woodlot' and 'Agriculture', in the middle and southern portions of the property on Schedule 'A' of the Local OP. A 'Waste Management Policy Area' designation wraps around the entire TCEC, extending to County Road 39.

A special policy applies to the 'Landfill Site' lands in the on-site study area, which permits the disposal, depositing, and receipt of non-hazardous solid waste within the landfilling

area (also referred to as “the existing landfill” that is approved under the provisions of the *Environmental Protection Act*, including a Certificate of Approval for a Waste Disposal Site). Ancillary and accessory uses are also permitted within the ‘Landfill Site’, including but not limited to an administrative office building, weigh scales, storage buildings, forestry, accessory parking for the adjacent cemetery, an education and interpretative centre, and trails and walkways. Within the most southerly 500 m of the area designated ‘Landfill Site’, the only permitted use is the poplar forest used in conjunction with the approved leachate treatment facility. A limited range of agricultural uses are permitted within the designated ‘Agricultural’ area within the ‘Waste Management Policy Area’, notwithstanding the ‘Agricultural’ policies of the Local OP. Dwellings are not permitted in this area.

The on-site study area is zoned as ‘Industrial Waste Disposal’, with small portions of the property zoned ‘Natural Heritage – Significant Woodlot’ and ‘Natural Heritage – Hazard’, with the southernmost portion zoned ‘Agricultural 2-3’. A former waste disposal site is located within the boundary of the on-site study area.

Although the ‘Landfill Site’ comprises the entire area zoned ‘Industrial Waste Disposal’, the “landfilling area” is limited to the approved area. Waste disposal is only permitted in the “landfilling area”, or existing landfill.

Permitted uses in the ‘Natural Heritage – Significant Woodlot’ zone are limited to agricultural, passive recreation, and conservation uses (all exclusive of buildings and structures), as well as existing single-detached dwellings, new single-detached dwellings on existing lots with an area of 2 ha or less, and buildings, structures, and uses accessory to a single-detached dwelling on the same lot. The ‘Natural Heritage – Hazard’ zone primarily permits agricultural uses and passive recreation; however, no agricultural uses are permitted in a portion of this zone on the property. The ‘Agricultural 2-3’ zone permits the growing of crops, agro-forestry, conservation uses, commercial greenhouses, and accessory buildings and structures.

8 Environmental Assessment Method

The following sections provide an overview of the method that will be used to develop the EA for the proposed undertaking.

The proposed method to be followed in the EA will be a qualitative comparison of the ‘alternative methods’ using criteria, indicators and data sources to identify the preferred alternative.

An effects assessment will be carried out on the preferred alternative using the same criteria, indicators and data sources, and additional studies as required.

8.1 Description of the Existing Environment

The existing environment within the on-site and off-site study areas (**Section 7.1**) will be characterized in the EA Study Report. The characterization of the existing environment will address the five aspects of the environment as defined in the EAA, specifically:

- natural environment;
- built environment;

- cultural environment;
- social environment; and
- economic environment.

For the purposes of the EA, the social and economic environments have been combined into the socio-economic environment.

The characterization of the existing environment will incorporate the results of past studies, field reconnaissance, additional baseline studies, and information from the preliminary data sources outlined in **Appendix B**, as applicable.

The potential environmental effects of the alternative methods will be qualitatively compared against the existing environmental conditions.

8.2 Description and Screening of the Alternative Methods

As described in Section 6.2, potential vertical and horizontal expansion methods may be available within the TCEC site area. Given the financial, technological, and community risks and concerns associated with the horizontal alternative methods, WM has identified a preference for a vertical alternative method. Preliminary concepts for the potential vertical and horizontal expansion methods will be developed. A screening of the vertical and horizontal alternative methods will be carried out in the EA to confirm this conclusion.

Based on the preference for a vertical alternative method, WM has preliminarily identified four vertical expansion alternative methods for the future development of the landfill as described in **Section 6.2**. The alternative methods will be described in further detail in the EA Study Report. The description of the alternative methods will outline future leachate management requirements for the landfill. The long-term leachate management requirements will be described consistent with the approved Leachate Management Plan for the TCEC including a combination of on-site phytoremediation, trucking off-site to approved wastewater treatment plants and consideration of the future construction of an on-site treatment plant. The effects of climate change on the design approach and the effect of the conceptual design on climate change for the alternative methods will be included.

8.3 Prediction of Potential Environmental Effects for Each Alternative Method

The potential effects of each alternative method will be identified based upon application of the proposed evaluation criteria, indicators and data sources as outlined in **Appendix B**. The analysis of potential effects will be based on the maximum allowable waste receipt level for the landfill. Potential effects can be positive or negative, direct or indirect, and short or long-term. Actions necessary, or that may reasonably be expected to be necessary, to prevent or mitigate the potential effects will be identified, as appropriate.

8.4 Identification of the Preferred Alternative

The alternative methods will be assessed in a qualitative comparative process to determine the preferred alternative, using the criteria and indicators provided in **Appendix B**. These evaluation criteria and indicators will be finalized during the EA.

The differences in net effects (the potential effect remaining following implementation of mitigation and/or management measures) will be used to identify and compare the advantages and disadvantages for each alternative. The comparison of alternatives will include a clear rationale for the selection of the preferred alternative.

8.5 Effects Assessment of the Preferred Alternative

Following the identification of the preferred alternative, an effects assessment will be carried out on the preferred alternative considering the same criteria, indicators and data sources, and additional studies as required, considering possible mitigation and/or management measures and cumulative effects. A human health assessment review will be completed for the preferred alternative based on the criteria and indicators provided in **Appendix B** and the work plan included in **Appendix C**. The potential effects of the preferred alternative will be compared to the 'do nothing' alternative.

The EA will also include a description of the preferred alternative's contribution to reducing GHG emissions and climate change, and the potential effect of climate change on the preferred alternative.

9 Consultation and Engagement

An overview of the consultation and engagement process conducted during the preparation of the Draft ToR is presented below and detailed in **Supporting Document 4**. The proposed Consultation and Engagement Plan in support of developing the EA is presented in **Section 9.2** and the proposed plan for Indigenous engagement during the EA is presented in **Section 9.3**.

9.1 Summary of Consultation and Engagement Activities on the Draft ToR

WM consulted and engaged with a broad range of stakeholders including the public, agencies, and Indigenous communities during the preparation of this Draft ToR. The following consultation activities took place during preparation of the Draft ToR:

- Distribution of Notice of Commencement and Virtual Consultation and Engagement Event 1;
- Virtual Consultation and Engagement Event 1;
- Distribution of Notice of Review – Draft Terms of Reference and Virtual Consultation and Engagement Event 2;
- Virtual Consultation and Engagement Event 2;

- Draft Terms of Reference review;
- Project website, e-mail, and telephone number;
- Consultation with Agencies and organizations;
- Engagement with Indigenous communities and groups;
- Municipal Council meetings:
    - Township of Warwick Council and staff meetings on November 16, 2020, and March 1, April 6, May 4, June 10, July 6, August 10, and October 5, 2021;
- Warwick Public Liaison Committee (WPLC) meetings:
    - on November 26, 2020 after the publication of the Notice of Commencement; and
    - on February 18, May 6, and August 18, 2021;
- Facility tours and meetings;
- Phone calls; and
- Media publications regarding the Project.

A detailed chronology and description of the various consultation and engagement events and activities during the ToR development is included in **Supporting Document 4**.

Interested persons were identified at the outset of the project for the purpose of developing a contact or mailing list. A list of non-MECP government review agencies (GRT) was provided by the MECP and reviewed by WM to confirm the applicable agencies. The MECP also provided WM with a list of Indigenous communities with a potential interest in the project to be consulted. The Township of Warwick and County of Lambton provided a list of municipal contacts. WM utilized its own contact list developed through previous approval processes, notifications and with the Warwick Public Liaison Committee to identify members of the public, local residents and landowners and the broader community. Additions and changes to the mailing list were made based on requests received during the development of the ToR.

The Notice of Commencement for the ToR was developed, which included an overview of the Project, the EA process, and an invitation to Virtual Consultation and Engagement Event 1. The Notice of Commencement (the Notice, provided in **Supporting Document 4**) was published in three newspapers (one regional and two local): The Sarnia Observer on November 17 and 24, 2020; The Standard Lambton-Middlesex on November 19 and 26, 2020; and The Independent Serving Petrolia and Central Lambton on November 19 and 26, 2020.

The Notice was sent via email to agencies, municipalities, organizations, Indigenous communities, and neighbouring property owners on November 17, 2020. The Notice was also sent via regular mail to neighbouring property owners without available email addresses. A copy of the Notice was uploaded to the project website (www.wm.com/ca/en/twin-creeks-landfill/landfill-optimization-project) on November 17, 2020.

Virtual Consultation and Engagement Event 1 took place over 18 days from Tuesday, November 17 to Friday, December 4, 2020. Due to public gathering restrictions related to

the COVID-19 pandemic, the event was held online and a link to the event was provided on the project website. The virtual event was organized to allow attendees to click through and review the provided content at their own pace. Options to join the mailing list and submit comments were also provided as part of the event. Based on the data gathered during the event, Virtual Consultation and Engagement Event 1 was visited by 51 people in addition to WM and consulting staff. A detailed summary of Virtual Consultation and Engagement Event 1 was posted on the website and is provided in **Supporting Document 4**.

Virtual Consultation and Engagement Event 2 took place Tuesday, June 15 to July 13, 2021. Due to public gathering restrictions related to the COVID-19 pandemic, the event was held online and a link to the event was provided on the project website. The virtual event was organized to allow attendees to click through and review the provided content at their own pace. Options to join the mailing list and submit comments were also provided as part of the event. Based on the data gathered during the event, Virtual Consultation and Engagement Event 2 was visited by 16 people in addition to WM and consulting staff. A detailed summary of Virtual Consultation and Engagement Event 2 is provided in **Supporting Document 4**.

During the development of the Draft ToR, WM responded to comments received by telephone, email, and in writing. All comments received and responses provided by WM are included in **Supporting Document 4**. The company also met with anyone who requested including conducting tours of the TCEC.

A Draft ToR, supporting documents and Record of Consultation and Engagement were prepared and made available to the public, Indigenous communities, Township of Warwick, government review team, and all other stakeholders on the project mailing list for their review and comments. Review comments on the Draft ToR were requested between June 15 and July 13, 2021, which was extended to September 20, 2021. A PDF copy of the Notice of Draft Terms of Reference Review was provided to all project mailing list recipients on June 15, 2021. A copy of the Draft Terms of Reference and all supporting documentation was available to view and download from the project website and a link was provided in the Notice. The Notice, the Draft ToR, supporting documents and Record of Consultation and Engagement were all available from the project website on June 15, 2021. Hard copies of the documents were made available at the Township of Warwick municipal office and the Watford Library for public viewing. Copies of the materials are included in **Supporting Document 4**.

A range of comments were received on the draft ToR. Responses were prepared by WM for each comment, outlining how the comment was addressed in the ToR as appropriate. All comments received and responses provided by WM, including how the comments are addressed in the ToR, are included in Supporting Document 4. Due to the extent and details of the comments received, a summary of the comments received based on topic area or category is as follows:

- Current site operations
- Rationale for the undertaking including additional details on diversion
- Refinement of the “alternatives to” and “alternative methods” descriptions
- Detailed comments on the technical discipline Work Plans

- Off-site study area refinement for specific environmental components
- Inclusion of a human health assessment review for the preferred alternative

9.2 Proposed Consultation and Engagement Program for the EA

WM is committed to carrying out meaningful consultation and engagement on the future development with a broad range of stakeholders. The development of the proposed consultation and engagement program for the EA is based on the following principles:

- transparency, accountability, and accessibility;
- identification of stakeholder and Indigenous community concerns early in the process and addressing these concerns in the EA;
- multiple points of consultation and engagement throughout the EA using a variety of techniques (in-person, digital, print); and
- documentation of issues, concerns, and responses in the EA.

By consulting with interested people, WM will provide opportunities for input before decisions are made and then respond by making changes as appropriate. The input received through the EA consultation and engagement process will be considered in the preparation of the EA and studies, and how this input is incorporated into the EA will be documented.

Consultation and engagement will be undertaken at key points in the process, as well as on an on-going basis, through the following activities as conditions permit:

- **Notice of Commencement for the EA**: by mail, email, newspapers, and on the project website, including details on the project, the EA process and contact information, as a minimum.
- **Notification**: notification will be provided by direct mail, email, newspapers (digital and/or print), and via the project website at key milestones during the EA. Key milestones may include the Notice of Commencement of EA, Existing Conditions/Alternative Methods, Identification of the Preferred Alternative, Draft EA Study Report review, and submission of the Final EA Study Report to the MECP. WM will provide notification by direct mail to all addresses within the local postal code surrounding the TCEC (e.g., through Canada Post neighbourhood mail or similar).
- **Public Open House(s)**: likely in the form of Virtual Consultation and Engagement Event(s) due to the COVID-19 pandemic, to present the ‘alternative methods’, a description of the existing environmental conditions, the comparative evaluation criteria, the results of the assessment and comparative evaluation of the alternative methods, and the identification of the preferred alternative. The format of the Public Open House(s) will be determined based on social gathering restrictions due to the pandemic.
- **Meetings/Tours**: if possible, depending on social gathering restrictions due to the pandemic;

- **Consultation and Engagement Report**: summarizing the results of the open house(s) as well as comments received via fax, email, or post will be prepared, including a record of comments and responses.
- **Website**: established by WM during the development of the Draft ToR, the project website will be maintained during the EA to provide information, inform the public of consultation and engagement events, and provide a means for feedback.
- **Contact Person**: provided for a WM staff member to receive enquiries from interested parties for information and submit comments.
- **Draft EA Study Report**: provided to the public, agencies, and Indigenous communities who have submitted comments on the ToR and/or wish to receive a copy. Written comments on the draft report will be requested within 45 days of its submission to the MECP. Notice of the draft report availability will be provided by newspaper notice, mail, email, and on the project website.
- **Final EA Study Report**: provided to the public, agencies and Indigenous communities who have submitted comments on the Draft EA and/or wish to receive a copy. Notice of the final report availability will be provided by newspaper notice, mail, email, and on the project website.

Consultation and engagement will be conducted in accordance with MECP requirements, and with consideration given to the potential limitations caused by the COVID-19 pandemic. If requested, additional consultation and engagement activities may be undertaken. WM is prepared to discuss individual concerns and comments directly with potentially affected persons. Additional events may be held to address specific issues of concern, as warranted.

A Record of Consultation and Engagement will be prepared as part of the EA which will include information about the EA consultation program, including copies of correspondence from and to the Proponent, information about and received at the public open houses and copies of comments, questions, issues, and concerns from stakeholders and members of the public, and how those questions, issues, and concerns were addressed. Comments received during the preparation of the EA will be recorded and tabulated. A response will be provided to each comment indicating how it has been addressed in the EA, as appropriate.

In accordance with Section 6.1(2)(e) of the EAA, a description of the consultation and engagement program carried out by WM during the EA, along with the results of the consultation and engagement, will be documented in the EA Study Report.

9.3 Indigenous Engagement during the EA

The list of potentially-affected Indigenous communities was developed in consultation with the MECP. The MECP identified the following Indigenous communities for engagement:

- Aamjiwnaang First Nation;
- Walpole Island First Nation – Bkejwanong Territory;
- Caldwell First Nation;
- Chippewas of Kettle and Stony Point First Nation;

- Chippewas of the Thames First Nation;
- Delaware Nation at Moraviantown;
- Munsee Delaware Nation;
- Oneida Nation of the Thames;
- Métis Nation of Ontario – Windsor-Essex Métis Council; and
- Métis Nation of Ontario – Lands, Resources & Consultations Branch.

During the EA, WM will continue to engage with these Indigenous communities and organizations in a manner consistent with any requests that might be received from each community. WM is committed to working with these Indigenous communities and organizations to address any comments or concerns they may have. This includes providing any specific engagement activities, such as meetings, at the request of the community. Consultation and engagement will be conducted in accordance with MECP requirements, and with consideration given to the potential limitations caused by the COVID-19 pandemic. WM will provide written notification to the Indigenous communities and organizations consistent with the consultation and engagement program for the EA.

10 Commitments and Monitoring

The EA will contain a list of commitments made by WM during the ToR process and indicate how such commitments have been addressed in the EA. A list of commitments made by WM during the preparation of the EA will also be included in the EA along with a framework for monitoring when and how all commitments will be fulfilled.

A strategy and schedule for compliance and effects monitoring will be developed and included in the EA. The monitoring plan will consider all relevant project phases: planning, detailed design, tendering, construction, establishment, and post-establishment. Compliance monitoring is an assessment of whether an undertaking has been designed, constructed, implemented and/or operated in accordance with the commitments in the EA document and the conditions of approval. Effects monitoring consists of activities carried out by the proponent after the approval of the EA to determine the environmental effects of the undertaking. Monitoring requirements for effects related to the proposed undertaking are anticipated to be developed as a part of the *Environmental Protection Act* and *Ontario Water Resources Act* approval processes.

11 Flexibility to Accommodate New Circumstances

The proposed project detailed in this ToR is based upon a preliminary or conceptual design, and does not necessarily represent the final design, location, or scope of the project. The description of the project in this ToR should be viewed as a preliminary description, which is subject to change during the preparation of the EA based on the results of on-going studies and advancement of the project design, existing conditions studies and effects assessments, and consultation and engagement including input from

agencies and other regulatory authorities. Consequently, there may be changes to the feasible alternative methods for carrying out the project before the proposed undertaking is confirmed and presented in the EA Study Report.

Subsection 6.1(1) of the EAA states that the EA must be prepared in accordance with the approved ToR. WM is aware that unforeseen circumstances may arise that could prevent the commitments in the ToR from being met; as such, flexibility has been incorporated into this ToR, where appropriate, to accommodate new circumstances that may arise during the progression of the EA and/or project design. It is therefore understood that certain aspects of the ToR may be adjusted without the need to re-start the provincial EA process.

For the purposes of preparing this ToR, flexibility is defined to include a minor variation or modification to the ToR itself, such as a change in consultation and engagement methods, existing conditions study methods, effects assessment methods, and to allow for refinement to things such as study areas, environmental criteria, indicators, and data sources. Therefore, the ToR has not established detailed existing conditions or a full suite of potential effects of the undertaking, for example; these will be determined during the EA and presented in the EA Study Report.

It is noted that proposed minor modifications to the ToR will be discussed with the MECP prior to proceeding with the changes.

12 Other Approvals

In addition to EA approval, certain other approvals may be required, including but not limited to:

- *Environmental Protection Act*;
  - Environmental Compliance Approvals (Waste and Air);
- *Ontario Water Resources Act*;
  - Environmental Compliance Approval (Sewage Works);
- *Drainage Act*;
- *Fisheries Act*;
- *Conservation Authorities Act*; and
- *Planning Act*.

Official Plan and Zoning By-Law amendment approvals may also be required.

The proposed undertaking is not identified as a designated project under the *Impact Assessment Act* (*IAA*) and, based on correspondence received from the Impact Assessment Agency of Canada in November 2020, it has been confirmed that the future development will not be subject to review under *IAA*. A list of the specific approvals required for the proposed undertaking will be provided in the EA.

A

Acronyms and Glossary

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Acronyms

Acronym	Definition
BHR	Built Heritage Resource
C&D	Construction and Demolition
CHL	Cultural Heritage Landscape
COVID-19	Coronavirus Disease
EA	Environmental Assessment
EAA	Environmental Assessment Act
ECA	Environmental Compliance Approval
EGLE	Michigan Department of Environment, Great Lakes and Energy
GHG	Greenhouse Gas
IAA	Impact Assessment Act
IC&I	Industrial Commercial and Institutional
LOS	Level of Service
LFG	Landfill Gas
MECP	Ministry of Environment, Conservation and Parks
MHSTCI	Ministry of Heritage, Sport, Tourism and Culture Industries
MW	Megawatt
NOX	Nitrogen Oxides
OWMA	Ontario Waste Management Association
SAR	Species at Risk
SCC	Species of Conservation Concern
SWH	Significant Wildlife Habitat
TCEC	Twin Creeks Environmental Centre
TSP	Total Suspended Particulate
VOC	Volatile Organic Compounds
WM	Waste Management of Canada Corporation
WPLC	Warwick Public Liaison Committee

Glossary

Term	Definition
Approval	Permission granted by an authorized individual or organization for an undertaking to proceed. This may be in the form of program approval, environmental compliance approval, certificate of approval or provisional certificate of approval
Capacity (Disposal Volume)	The total volume of air space available for disposal of waste at a landfill site for a particular design (typically in m^3); includes both waste and daily cover materials, but excludes the final cover
Composting	The controlled microbial decomposition of organic matter, such as food and yard wastes, in the presence of oxygen, into finished compost (humus), a soil-like material. Humus can be used in vegetable and flower gardens, hedges, etc.

Glossary

Term	Definition
Composting facility	A facility designed to compost organic matter either in the presence of oxygen (aerobic) or absence of oxygen (anaerobic).
Construction and demolition (C&D) waste	Solid waste produced in the course of residential, commercial, industrial, or institutional building construction, demolition, or renovation (e.g., lumber, brick, concrete, plaster, glass, stone, drywall, etc.)
Environment	As defined by the Ontario *Environmental Assessment Act*, environment means: • air, land or water; • plant and animal life, including human life; • the social, economic and cultural conditions that influence the life of humans or a community; • any building, structure, machine or other device or thing made by humans; • any solid, liquid, gas, odour, heat, sound, vibration or radiation resulting directly or indirectly from human activities; or • any part or combination of the foregoing and the interrelationships between any two or more of them (ecosystem approach).
Environmental Assessment (EA)	A systematic planning process that is conducted in accordance with applicable laws or regulations aimed at assessing the effects of a proposed undertaking on the environment
Environmental Compliance Approval (ECA)	A licence or permit issued by the Ministry of the Environment for the operation of a waste management site/facility
Evaluation criteria	Evaluation criteria are considerations or factors taken into account in assessing the advantages and disadvantages of various alternatives being considered
Greenhouse gas (GHG)	Any of the gases whose absorption of solar radiation is responsible for the greenhouse effect, including carbon dioxide, methane, ozone, and the fluorocarbons.
Indicators	Indicators are specific characteristics of the evaluation criteria that can be measured or determined in some way, as opposed to the actual criteria, which are fairly general
Industrial, commercial and institutional (IC&I) wastes	Wastes originating from the industrial, commercial, and institutional sectors
Landfill gas (LFG)	The gases produced from the wastes disposed in a landfill; the main constituents are typically carbon dioxide and methane, with small amounts of other organic and odour-causing compounds
Landfill site	An approved engineered site/facility used for the final disposal of waste. Landfills are waste disposal sites where waste is spread in layers, compacted to the smallest practical volume, and typically covered by soil.
Leachate	Liquid that drains from solid waste in a landfill and which contains dissolved, suspended and/or microbial contaminants from the breakdown of this waste.
Mitigation	Measures taken to reduce adverse impacts on the environment.
Non-hazardous waste	Non-hazardous wastes include all solid waste that does not meet the definition of hazardous waste and includes designated wastes such as asbestos waste.
Proponent	A person who: • carries out or proposes to carry out an undertaking; or • is the owner or person having charge, management, or control of an undertaking.
Receptor	The person, plant or wildlife species that may be affected due to exposure to a contaminant.
Residual waste	Waste remaining after a technological process has taken place; e.g., unrecyclable/unprocessed materials remaining after being processed at a material recovery facility or non-compostable materials such as plastic from the composting facility.

Glossary

Term	Definition
Source separated organic material	Organics separated by a household or business that include food wastes and may include leaf and yard wastes.
Stakeholder	Any organization, governmental entity, or individual that has a stake in or may be impacted by a given approach to environmental regulation, pollution prevention, energy conservation, etc.
Terms of Reference (ToR)	A terms of reference is a document that sets out detailed requirements for the preparation of an Environmental Assessment.
Undertaking	Is defined in the Ontario *Environmental Assessment Act* as follows: • An enterprise or activity or a proposal, plan, or program in respect of an enterprise or activity by or on behalf of Her Majesty in right of Ontario, by a public body or public bodies or by a municipality or municipalities; • A major commercial or business enterprise or activity or a proposal, plan, or program in respect of a major commercial or business enterprise or activity of a person or persons other than a person or persons referred to in clause (1) that is designated by the regulations; or • An enterprise or activity or a proposal, plan or program in respect of an enterprise or activity of a person or persons, other than a person or persons referred to in clause (a), if an agreement is entered into under section 3.0.1 in respect of the enterprise, activity, proposal, plan or program ("enterprise").
Waste	Refuse from places of human or animal habitation; unwanted materials left over from a manufacturing process.
Waste electrical and electronic equipment	A term encompassing all electronic waste (typically anything with a cord) designated by the MECP for end-of-life management by Ontario Electronic Stewardship.

B

Proposed Evaluation Criteria, Indicators, and Data Sources

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Table B-1. Proposed Evaluation Criteria, Indicators and Data Sources for the Environmental Assessment

Evaluation Criteria	Rationale	Indicators	Data Sources
Natural Environment			
Atmospheric Environment			
Air Quality - Dust	Construction and operation activities at a waste disposal site can lead to increased levels of particulates (dust) in the air.	• Off-site point of impingement air concentrations of particulate matter (dust) compounds at identified receptors in the immediate vicinity of the site, and community • Frequency of any exceedance of applicable standards, limits, or guidelines at identified receptors • Number of off-site identified receptors potentially affected (e.g., residential properties, public facilities, businesses/farms, institutions) • Both operational and construction activities occurring in each of the future operational stages of the landfill considered in the assessment will be independently identified	• MECP-provided meteorological data • Applicable MECP guidelines, technical standards and accepted models • Aerial photographic mapping and field reconnaissance • Previously completed reports for the TCEC facility, including the 2016 Environmental Screening report, the 2005 EA, various ECA/ESDM reports, ambient monitoring reports, etc. • Off-site receptors identified in coordination with other disciplines • Available background ambient air data • Site specific ambient particulate monitoring data • Proposed facility characteristics • Landfill design and operation data • Published terrain data • Published air emission factors and predictive models • Published particle size fractionation data • Traffic data • Applicable air quality standards, guidelines, and criteria from the MECP and the CCME
Air Quality – Landfill Gas and Combustion By-Products	Waste disposal site and associated operations can emit gaseous contaminants that can degrade air quality.	• Off-site point of impingement air concentrations of indicator compounds at identified receptors in the immediate vicinity of the site, and community (within 5 km) • Frequency of any exceedance of applicable standards, limits, or guidelines at identified receptors • Number of off-site receptors potentially affected (e.g., residential properties, public facilities, businesses/farms, institutions)	• MECP-provided meteorological data • Applicable MECP guidelines, technical standards and accepted models • Aerial photographic mapping and field reconnaissance • Previously completed reports for the TCEC facility, including the 2016 Environmental Screening report, the 2005 EA, various ECA/ESDM reports, ambient monitoring reports, etc.

Table B-1. Proposed Evaluation Criteria, Indicators and Data Sources for the Environmental Assessment

Evaluation Criteria	Rationale	Indicators	Data Sources
			• Off-site receptors identified in coordination with other disciplines • Available background ambient air data • Site specific ambient monitoring data • Proposed facility characteristics • Landfill design and operation data • Published terrain data • Published air emission factors and predictive models • Established gas characteristics from the existing operation • Applicable air quality standards, guidelines, and criteria from the MECP and the CCME
Air Quality – Blowing Litter	Waste disposal site and associated operations can release litter, which may be blown to the surround areas.	• Extent of zones potentially impacted by blowing litter • Number of off-site receptors potentially affected (e.g., residential properties, public facilities, businesses/farms odour sensitive area(s), institutions)	• On-site meteorological data • MECP-provided meteorological data • MECP inspection records, WM inspection records, and complaint history • Published literature related to the factors affecting the generation and mitigation of blowing litter • Landfill design and operation data
Odour	Waste disposal site and associated operations can emit contaminants that generate odorous emissions.	• Off-site odour concentrations (odour units) at identified odour sensitive receptors in the immediate vicinity of the site • Frequency of any odour levels above defined odour benchmarks • Number of off-site receptors potentially affected (e.g., residential properties, public facilities, businesses/farms odour sensitive area(s), institutions)	• MECP-provided meteorological data • Applicable MECP guidelines, technical standards, and accepted models • Aerial photographic mapping and field reconnaissance • Previously completed reports for the TCEC facility, including the 2016 Environmental Screening report, the 2005 EA, various ECA/ESDM reports, ambient monitoring reports, etc. • Off-site odour-sensitive receptors defined as per the MECP Odour Technical Bulletin[1], identified in coordination with other disciplines • Proposed facility characteristics • Landfill design and operation data

Table B-1. Proposed Evaluation Criteria, Indicators and Data Sources for the Environmental Assessment

Evaluation Criteria	Rationale	Indicators	Data Sources
			• Published terrain data • Published air emission factors • Emission measurements from comparable landfills and/or on-site sampling • Applicable air quality standards, guidelines, and criteria from the MECP and the CCME
Noise	Activities related to construction/rehabilitation, operation of the landfill and ancillary sources, and the off-site haul route can result in an increase in off-site noise levels.	• Predicted site-related noise levels (measured in dBA or dBAI) • Change in sound levels (dB)	• Annual on-site noise monitoring data • Off-site noise monitoring • Manufacturer noise specifications • Noise measurement of on-site sources • Applicable MECP guidelines, technical standards and models • Aerial mapping and field reconnaissance to confirm off-site receptors • Topographic and land-use mapping • Land use zoning plans • Proposed facility characteristics • Landfill design and operations data • Traffic counting, characterization and modelling studies
Geology and Hydrogeology			
Groundwater Quality	Contaminants associated with waste disposal at the Site have the potential to enter the groundwater and impact on-Site groundwater. Acceptable groundwater quality, which is 80% of the Guideline B-7 criteria for the PLIL parameters, must be shown at the Site boundaries.	• Predicted effects on groundwater quality on-Site from increased waste quantities disposed within the expansion landfill • Predicted contaminating lifespan	• Applicable regulatory documentation (i.e., Amended Site ECAs, MECP guidelines, technical standards, etc.). • Landfill Environmental Monitoring Plan (Jagger Hims Limited, 2007) (EMP), and as amended per MECP approval. • Historical Hydrogeological studies. • Liquid level monitoring data for on-Site groundwater monitoring wells and leachate monitoring stations. • Liquid level monitoring data for surface water. • Groundwater quality monitoring data at on-Site monitoring wells as outlined in the EMP.

Table B-1. Proposed Evaluation Criteria, Indicators and Data Sources for the Environmental Assessment

Evaluation Criteria	Rationale	Indicators	Data Sources
			• Quarterly and Annual Site compliance monitoring reports. • Leachate generation and management assessments, as outlined in the Leachate Management Plan, (March 2020) (HDR, 2019). • Proposed facility characteristics, including service life estimates. • Water well survey within the off-Site study area.
Groundwater Quantity	The landfill optimization has the potential to affect the established hydraulic trap design for the expansion landfill and understood groundwater flow patterns on-Site and Off-Site	• Predicted effect of landfill optimization on groundwater flow and quantity both on-Site and off-Site.	• Applicable regulatory documentation (i.e., Amended Site ECAs, MECP guidelines, technical standards, etc.) • Liquid level monitoring data for on-Site groundwater monitoring wells and leachate monitoring stations. • Historical Hydrogeological studies. • Water well records to be reviewed to understand the effect on groundwater quantity on-Site and off-Site as result of off-Site water well use in the area. • Quarterly and Annual Site compliance monitoring reports. • Water taking tracking from the Secondary Drainage Layer. • Proposed facility characteristics. • Water well survey within the off-Site study area.
Surface Water Environment			
Surface Water Quality	The landfill optimization has the potential to affect surface water quality through either possible leachate seepage through the landfill cap, increased erosion of the landfill clayey soil cap, or track-out of Automobile	• Predicted effects on surface water quality on-Site prior to off-Site discharge. • Predicted effects from polyaromatic hydrocarbons (PAHs) on surface water quality within the roadside ditch of the northbound lane of Nauvoo Road from the Site to Hwy 402 in the off-Site study area	• Applicable regulatory documentation (i.e., Amended Site ECAs, MECP guidelines, technical standards, etc.). • Landfill Environmental Monitoring Plan (Jagger Hims Limited, 2007) (EMP), and as amended per MECP approval.

Table B-1. Proposed Evaluation Criteria, Indicators and Data Sources for the Environmental Assessment

Evaluation Criteria	Rationale	Indicators	Data Sources
	Shredder Residue (ASR) wastes off-Site.		• Surface water quality monitoring data at each on-Site background, internal, and discharge (compliance) monitoring stations. • Provincial Water Quality Monitoring Network (PWQMN). • Topographic maps and aerial photos. • On-Site stormwater management system design for the Site. • Quarterly and Annual Site compliance monitoring reports. • Leachate generation and management assessments, as outlined in the Leachate Management Plan, (March 2020) (HDR, 2019). • Proposed facility characteristics. • Testing for PAHs related to potential effects of ASR on surface water within the roadside ditch of the northbound lane of Nauvoo Road from the Site to Hwy 402 in the off-Site study area
Surface Water Quantity	Construction of physical works may disrupt natural surface drainage patterns and may alter runoff and peak flows. The presence of the expanded landfill may also affect base flow to surface water.	• Change in runoff volumes and peak flows resulting from steeper and longer side slopes. • Changes to drainage areas on-site and off-site. • Predicted occurrence and degree of off-site effects to surface water flows.	• On-site stormwater management system design for expanded landfill. • Landfill design and operations data. • Hydrologic modelling. • Annual monitoring reports. • Published flow information and hydrology design standards from MECP, MNRF, Environment Canada and SCRCA. • Site reconnaissance. • Topographic surveys. • Air photos. • Drainage maps. • Watershed mapping areas including municipal water supply sources within the off-site study area from St. Clair Conservation Area. • Typical stream channel geometry within the off-site study area, to the extent accessible.

Table B-1. Proposed Evaluation Criteria, Indicators and Data Sources for the Environmental Assessment

Evaluation Criteria	Rationale	Indicators	Data Sources
			• Water well survey within the off-site study area. • PTTW records. • Liaison with MECP, SCRCA, downstream riparian landowners along Gilliland-Geerts Drain between Nauvoo Road and Underpass Road, Township of Warwick.
Ecological Environment			
Terrestrial Ecosystems	Continued or expanded operation of the waste disposal facility may disturb the functioning of natural terrestrial habitats, including rare, threatened or endangered species.	• Predicted effects on vegetation communities and species including rare, threatened or endangered species • Predicted effects on wildlife and wildlife habitat including rare, threatened or endangered species	• Vegetation and wildlife data, including SAR data from previous studies • Terrestrial field studies • Aerial imagery • Local and Indigenous sources of information on the ecological functions of features within the On-site and Off-site study areas. • Natural Heritage Reference Manual for Natural Heritage Policies of the Provincial Policy Statement (Ontario Ministry of Natural Resources 2010) • Significant Wildlife Habitat Technical Guide (Ontario Ministry of Natural Resources 2000) • Significant Wildlife Habitat (Schedule Criteria for Ecoregion 7E (Ontario Ministry of Natural Resources and Forestry 2015) • MECP background data • MNRF background data • SCRCA background data • Natural Heritage Information Centre background data • Ontario Breeding Bird Atlas • Ontario Butterfly Atlas • Ontario Reptile and Amphibian Atlas • Ontario Odonata Atlas • Ontario Mammal Atlas • eBird

Table B-1. Proposed Evaluation Criteria, Indicators and Data Sources for the Environmental Assessment

Evaluation Criteria	Rationale	Indicators	Data Sources
			• iNaturalist • Proposed facility characteristics • Landfill design and operations data • Annual monitoring report data • Results of other discipline assessments • Survey protocol for Ontario's Species at Risk Snakes (MNRF 2016a) • Survey Protocol for Blanding's Turtle in Ontario (MNRF 2015c) • Blanding's Turtle Nest and Nesting Survey Guidelines (MNRF 2016b) • Ontario Wetland Evaluation System: Southern Manual (MNRF 2014)
Aquatic Ecosystems	Continued or expanded operation of the waste disposal facility may disturb the functioning of natural aquatic habitats and species, including rare, threatened or endangered species.	• Predicted effects on aquatic habitat, including fish habitat • Predicted effects on aquatic biota including rare, threatened or endangered species	• Fish and fish habitat survey data from previous studies • Aquatic field studies • Local and Indigenous sources of information on the ecological functions of features within the On-Site and Off-Site study areas • MNRF review letters of previous existing conditions reports • MNRF aquatic resource data • Fisheries and Oceans Canada (DFO) Aquatic Species at Risk mapping • Annual monitoring report data • Proposed facility characteristics • Landfill design and operations data • Annual monitoring report data • Results of other discipline assessments • Observations obtained as part of interviews with riparian landowners

Table B-1. Proposed Evaluation Criteria, Indicators and Data Sources for the Environmental Assessment

Evaluation Criteria	Rationale	Indicators	Data Sources
Socio-Economic Environment			
Economic			
Economic effects on local community	The continued operation of the landfill could have economic effects on and/or provide economic benefits to the local community	• Employment at site (number, type, and duration) • Contributions to the host community • Opportunities for the provision and procurement of products and/or services	• Census and municipal data for Village of Watford and Township of Warwick • Municipal tax information / sources of municipal revenues • WM data on host community fee contributions • WM site employment data • WM data on types and values of goods and services procured • WM data on types and values of goods and services provided • Proposed facility characteristics • Results of other discipline assessments
Social			
Effects on local community	Waste disposal facilities can potentially affect local residents and businesses in the vicinity of the site.	• Number of residents and residences (e.g., receptors) • Number and type of local businesses • Nuisance effects (litter, dust, noise, odour, traffic) • Predicted changes to use and enjoyment of property • Level of satisfaction with living/working in the community • Confidence in TCEC operations	• Mapping and field reconnaissance • Census information and municipal data for Village of Watford and Township of Warwick • Number and nature of nuisance complaints received related to the TCEC (e.g., odour, litter, noise) • Community survey(s) • Proposed facility characteristics • Results of other discipline assessments
Visual Impact of Facility	The contours of the waste disposal facility may affect the visual appeal of a landscape.	• Predicted changes in perceptions of landscapes and views.	• Site grading plans • Aerial mapping and field reconnaissance • Proposed facility characteristics • Existing landfill design and operations data • Regional topographic mapping • Results of other discipline assessments

Table B-1. Proposed Evaluation Criteria, Indicators and Data Sources for the Environmental Assessment

Evaluation Criteria	Rationale	Indicators	Data Sources
Cultural Environment			

Cultural Heritage Resources	Activities related to construction and operation of the landfill may result in direct or indirect effects on identified built heritage resources and cultural heritage landscapes.	• Proximity of known or potential cultural heritage resources to the landfill (known/potential built heritage resources and cultural heritage landscapes will be assessed for potential direct or indirect effects).
		  ○ Direct impacts may include: the destruction of any, or part of any, significant heritage attributes or features; and alteration that is not sympathetic, or is incompatible, with the historic fabric and appearance.
		  ○ Indirect impacts may include: shadows created that alter the appearance of a heritage attribute or change the viability of a natural feature or plantings, such as a garden; and isolation of a heritage attribute from its surrounding environment, context or a significant relationship; direct or indirect obstruction of significant views or vistas within, from, or of built and natural features; a change in land use such as rezoning a battlefield from open space to residential use, allowing new development or site alteration to fill in the formerly open spaces; and land disturbances such as a change in grade that alters soils, and drainage patterns that adversely affect an archaeological resource.
			• Published data sources
			• Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes (MTCS 2016)
			• Ontario Heritage Tool Kit (MTCS 2006)
			• Commemorative statements
			• Proposed facility characteristics
			• Landfill design and operations data
			• Viewshed analysis
			• Previous EA reports
			• Municipal Heritage Inventories and Staff Reports
			• Provincial and Federal Heritage Registers and Inventories
			• Township of Warwick, MHSTCI, Ontario Heritage Trust, and engagement with Indigenous communities
			• Field survey results
			• Historical mapping, historical topographical maps and aerial photographs

Archaeological Resources	Archaeological resources are non-renewable cultural resources that can be destroyed by the construction and operation of a waste disposal facility.	• Archaeological resources on-site and predicted impacts on them • Cemetery properties within approximately 10 metres of the proposed impacts	• Published data sources • Standards and Guidelines for Consultant Archaeologists • Ontario Archaeological Sites Database (OASD) • MHTSCI register of archaeological reports

Table B-1. Proposed Evaluation Criteria, Indicators and Data Sources for the Environmental Assessment

Evaluation Criteria	Rationale	Indicators	Data Sources
	Activities related to construction and operation of the landfill may cause negative effects on archaeological sites or areas with archaeological potential.		• Existing Stage 1, 2, 3 Archaeological Assessments for the landfill site • Stage 1 property inspection results • Bereavement Authority of Ontario (BAO) • Cemetery records, plans and plot maps • Historical mapping, topographical maps and aerial photographs and imagery • Proposed facility characteristics • Landfill design and operations data
Built Environment			
Transportation			
Traffic Operations	Truck traffic associated with continued operations of the landfill may adversely affect residents, businesses, institutions and movement of farm vehicles in the site vicinity.	• Change in daily truck traffic volume and AADT along all study area road segments • Intersection performance – capacity, delay, queues (based on HCM 2010 and generated by Synchro 9) – for all study area intersections • Collisions per million vehicles at all study area intersections (severity, involving pedestrians, cyclists, autos, trucks, school buses, and agricultural vehicles) • Collisions per million vehicle-km along all study area road segments (severity, involving pedestrians, cyclists, autos, trucks, school buses, and agricultural vehicles) • Collisions by environmental conditions for segments and intersections • Sight distance at the primary access	• Turning Movement Count • Traffic Model • Collision History • Aerials • Land Survey • Stopping and Turning Sight Distance Review • Field inventory/investigation: Clear Zone, Conflicts, Visual Obstructions, Signage, Pavement Condition, Linework Condition

Table B-1. Proposed Evaluation Criteria, Indicators and Data Sources for the Environmental Assessment

Evaluation Criteria	Rationale	Indicators	Data Sources
Current and Planned Future Land Use			
Effects on Current and Future Land Uses	The continued operation of the landfill may not be fully compatible with certain current and/or planned future land uses in the Off-Site Study Area. Waste disposal facilities can potentially have a negative impact on sensitive land uses, in the vicinity of the site.	• Current land use • Planned land use • Type(s) and proximity of off-site recreational resources within 1 km of a landfill footprint potentially affected • Type(s) and proximity of off-site sensitive land uses as defined by the Provincial Policy Statement and the MECP D-1 Guidelines (e.g., dwellings, churches, parks) within 1 km of a landfill footprint potentially affected • Type(s) and proximity of agricultural land use/operations (e.g., organic, cash crop, livestock)	• Planning Act • Provincial Policy Statement • D-1 Land Use and Compatibility • D-4 Land Use On or Near Landfills and Dumps • Lambton County Official Plan • Township of Warwick Official Plan • Township of Warwick Zoning By-law 121 of 2012 • Aerial photographic mapping, utilizing the following sources: Lambton County GIS, St. Clair Region Conservation Authority, OMAFRA Agricultural Information Atlas, Google Maps, and Bing Maps • Canadian Lands Inventory mapping • Field reconnaissance • Published data on public recreational facilities/activities • Proposed facility characteristics • Landfill design and operations data
Human Health	Construction and operation activities at a waste disposal site can lead to increase to increased levels of particulates (dust) and related metals in the air.	• Predicted acute and chronic health-based concentration ratios arising from air concentrations of particulate matter (dust) and related metals at identified sensitive receptor locations within the Study Area. Refer to Table 2 for complete list of assessed contaminants. • Frequency of any exceedance of applicable standards, limits, or guidelines at identified receptors.	• Data used in previous 2005 risk assessment. • Available background ambient air data • Ground-level air concentrations modelled by Air Quality team for proposed preferred alternative and associated frequency data • Off-site receptors identified in coordination with other disciplines • Published health-based regulatory benchmarks or toxicity reference values (TRVs) for each contaminant of concern
	Waste disposal site and associated operations can emit gaseous contaminants that can degrade air quality.	• Predicted acute and chronic health-based concentration ratios arising from air concentrations of gaseous contaminants at identified sensitive receptor locations within the Study Area.	

Table B-1. Proposed Evaluation Criteria, Indicators and Data Sources for the Environmental Assessment

Evaluation Criteria	Rationale	Indicators	Data Sources
		Refer to Table 2 for complete list of assessed contaminants. • Frequency of any exceedance of applicable standards, limits, or guidelines at identified receptors	

Notes:
[1] MECP, 2016: Technical Bulletin – Methodology for Modelling Assessments of Contaminants with 10-Minute Average Standards and Guidelines under O. Reg. 419/05, September 2016.

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Discipline Work Plans

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Air Quality Work Plan

Twin Creeks Environmental Centre Landfill Optimization Project

Waste Management of Canada Corporation

Watford, Ontario

March 30, 2022

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Acronyms

Acronym	Definition
AAQC	Ambient Air Quality Criteria
BMPP	Best Management Practices Plan
CAAQS	Canadian Ambient Air Quality Standards
CCME	Canadian Council of Ministers of Environment
CO2e	Carbon Dioxide Equivalent
EA	Environmental Assessment
ECA	Environmental Compliance Approval
ESDM	Emission Summary and Dispersion Modelling
EST	Eastern Standard Time
GHG	Green House Gas
H_2S	Hydrogen Sulphide
IWA	Interim Waste Authority
LandGEM	Landfill Gas Emission Model
MECP	Ministry of Environment, Conservation and Parks
MOVES	Motor Vehicle Emission Simulator
NAPS	National Air Pollution Surveillance
NO_x	Nitrogen Oxides
NO_2	Nitrogen Dioxide
OLM	Ozone Limiting Method
O.Reg	Ontario Regulation
OU	Odour Unit
PAH	Polycyclic Aromatic Hydrocarbon
PM10	Particulate Matter less than 10 micron in Diameter
PM2.5	Particulate Matter less than 2.5 micron in Diameter
SO_2	Sulphur Dioxide
SOP	Standard Operation Procedure
TCEC	Twin Creeks Environmental Centre
ToR	Terms of Reference
TRS	Total Reduced Sulphur
TSP	Total Suspended Particulate
U.S EPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
WM	Waste Management of Canada Corporation

1 Introduction

This Air Quality work plan has been prepared to support the environmental assessment (EA) for the Twin Creeks Environmental Centre Landfill Optimization Project (the Project) and will be appended to the Terms of Reference (ToR) for the EA to be submitted to the Ministry of Environment, Conservation and Parks (MECP) for approval.

The Air Quality discipline evaluates the releases to air from the Project and assesses their potential impacts on surrounding areas by comparing to standards and guidelines published by government agencies. The Air Quality discipline assesses releases of air quality compounds of interest, particulate matter (dust), odours, blowing litter, and greenhouse gases.

Waste Management of Canada Corporation (WM), the owner and operator of the Twin Creeks Environmental Centre (TCEC) in Watford, Ontario, has initiated an EA seeking approval to increase the landfill airspace capacity at the TCEC. The TCEC has approximately 13.2M m^3 of remaining approved landfill airspace, which corresponds to about 10 years of operating life (2021 to 2031). This optimization project could provide additional airspace capacity of up to approximately 14M m^3, which could extend the site life by about 12 years (from 2031 to 2043). There would be no change to the current 301 ha site area, the approved service area, or the annual fill rate.

The TCEC is a regional facility that provides safe and convenient disposal services for communities, businesses and industries serving the Province of Ontario. The landfill is approved to receive municipal, industrial, commercial, and institutional solid non-hazardous wastes generated, including non-hazardous contaminated soil.

The TCEC is engineered with environmental protection systems that meet or exceed regulatory requirements and are subject to highly regulated monitoring and reporting requirements. Systems include engineered liners and covers, leachate collection and removal, landfill gas collection and control, and on-site leachate disposal through phytoremediation. The TCEC provides landfill gas, for heating, to the 40-acre greenhouse facility adjacent to the landfill property. Prior to this, all landfill gas was flared. The intent is for the landfill to supply gas for heating to the greenhouses for 25 years.

Leachate that is generated in the waste is conveyed toward a perimeter leachate collection system. WM received approval to treat leachate through a phytoremediation system consisting of a 9.3 ha poplar system planted on the existing landfill cap in 2003. Surplus leachate is trucked off-site to approved wastewater treatment plants.

WM pays host community fees annually to the Township of Warwick. Since 2009, when the TCEC Expansion Landfill began receiving waste, WM has contributed over $24M in host community fees to the Township.

There is a need for the continued development of the TCEC as it is a significant component of the provincial waste management network and infrastructure, which is lacking in sufficient and secure long-term disposal capacity. Optimizing the future development of the TCEC allows for on-going sustainable business operations and continued provision of essential financial support for community services and programs.

The purpose of the EA is to assess the potential effects of the proposed landfill optimization on the environment. The EA will be carried out in accordance with the requirements of the *Ontario Environmental Assessment Act*.

2 Study Purpose and Objectives

This air quality work plan outlines the tasks required to support the EA through the characterization of existing conditions and assessment of potential environmental effects of the project on the air quality environment, including the evaluation of the various alternative methods and the identification and assessment of a preferred alternative. This work plan outlines the scope of the air quality work, including protocols and/or standards to be adhered to while the work is undertaken. The specific evaluation criteria, indicators, and data sources to be used and the study areas to be considered are provided below. These items may be adjusted during the EA process.

In accordance with the *Ontario Environmental Assessment Act*, the objectives of the EA are as follows:

1. Describe the environment potentially affected by the proposed undertaking, including both the existing environment as well as the environment that would otherwise be likely to exist in the future without the proposed undertaking;
2. Carry out an evaluation of the environmental effects of the proposed undertaking, using the environmental assessment criteria and studies that have been established through the development of the ToR;
3. Undertake an evaluation of any additional actions that may be necessary to prevent, change or mitigate environmental effects;
4. Provide a description and evaluation of the environmental advantages and disadvantages of the proposed undertaking, based on the net environmental effects that will result following mitigation; and
5. Prepare monitoring, contingency and impact management plans to mitigate the environmental effects of the proposed undertaking.

3 Study Areas

During the EA, existing conditions and potential effects will be considered in the context of two study areas: on-site and off-site. The general study areas proposed for the purposes of the EA are (**Error! Reference source not found.**):

- On-site Study Area: the existing TCEC.
- Off-site Study Area: the lands within the vicinity of the TCEC extending approximately 1 km out from the On-site Study Area.

For air quality, the general Off-site Study Area has been extended to include lands within approximately 5 kilometres (km) from the TCEC, as shown in **Figure 3**. This 5 km study area is consistent with MECP modelling guidelines and is based on the maximum extent of air quality effects that can be anticipated.

For the purposes of this EA, a number of receptor locations will be identified to assist with the consideration of the effects that may result from the project. Some of these receptor locations will be common with other disciplines. The number and locations of these common receptors will be determined in a collaborative fashion with other disciplines, as appropriate. Of the identified common receptors, only those designated as relevant to air quality will be included in the air quality assessments.

Receptors under consideration for the air quality assessment are shown in **Figure 2**. These receptors represent the initial assessment of receptor locations and are based on previous studies conducted at the TCEC and may be adjusted.

The cemetery located to the west of the landfill will be included in the air quality assessment as an odour-sensitive receptor, subject to reasonable adjustments related to time-of-day when human activities regularly occur. Usage of this area is expected to be short-term and transient in nature. As such, evaluation of this location for air quality (any compound identified with a standard or guideline with an averaging period greater than 10 minutes) is not appropriate.

4 Scope of Work

The scope of work for air quality includes the development of evaluation criteria, indicators, and data sources, characterization of existing air quality conditions, assessment of the potential environmental effects of the alternative methods and the preferred alternative, development of mitigation measures and monitoring programs, and reporting as outlined below.

The air quality assessment will consist of the following sub-assessments:

- Dust;
- Landfill gas and combustion by-product emissions;
- Odour;
- Blowing Litter; and
- Climate Change.

Each of the primary criteria to be addressed in this study will be assessed during the operational period of the proposed landfill, as this is when the maximum potential air quality effects can occur. The operational period is defined as time during which the waste disposal facility is constructed, filled with waste, and capped. These activities are combined since they occur progressively (i.e., overlap) on a cell-by-cell basis, and they have a similar range of potential effects (e.g., there is heavy equipment active on the site). Within each sub-assessment, the worst-case operational period will be selected, which may vary between sub-assessments.

4.1 Evaluation Criteria, Indicators, and Data Sources

The environmental assessment criteria, indicators, and data sources for the air quality environment are provided in Table 1. The assessment criteria, indicators, and data sources will be used to assess the effects of the alternatives and the preferred alternative on the air quality environment. These evaluation criteria and indicators will be finalized during the EA.

Table 1. Evaluation Criteria, Indicators, and Data Sources for Air Quality

Evaluation Criteria	Rationale	Indicators	Data Sources
Natural Environment			
Atmospheric Environment			
Air Quality - Dust	Construction and operation activities at a waste disposal site can lead to increased levels of particulates (dust) in the air.	• Off-site point of impingement air concentrations of particulate matter (dust) compounds at identified receptors in the immediate vicinity of the site, and community • Frequency of any exceedance of applicable standards, limits, or guidelines at identified receptors • Number of off-site identified receptors potentially affected (e.g., residential properties, public facilities, businesses/farms, institutions) • Both operational and construction activities occurring in each of the future operational stages of the landfill considered in the assessment will be independently identified, described, and assessed.	• MECP-provided meteorological data • Applicable MECP guidelines, technical standards and accepted models • Aerial photographic mapping and field reconnaissance • Previously completed reports for the TCEC facility, including the 2016 Environmental Screening report, the 2005 EA, various ECA/ESDM reports, ambient monitoring reports, etc. • Off-site receptors identified in coordination with other disciplines • Available background ambient air data • Site specific ambient particulate monitoring data • Proposed facility characteristics • Landfill design and operation data • Published terrain data • Published air emission factors and predictive models • Published particle size fractionation data • Traffic data • Applicable air quality standards, guidelines, and criteria from the MECP and the CCME

Evaluation Criteria	Rationale	Indicators	Data Sources
Air Quality – Landfill Gas and Combustion By-Products	Waste disposal site and associated operations can emit gaseous contaminants that can degrade air quality.	• Off-site point of impingement air concentrations of indicator compounds at identified receptors in the immediate vicinity of the site, and community (within 5 km) • Frequency of any exceedance of applicable standards, limits, or guidelines at identified receptors • Number of off-site receptors potentially affected (e.g., residential properties, public facilities, businesses/farms, institutions)	• MECP-provided meteorological data • Applicable MECP guidelines, technical standards and accepted models • Aerial photographic mapping and field reconnaissance • Previously completed reports for the TCEC facility, including the 2016 Environmental Screening report, the 2005 EA, various ECA/ESDM reports, ambient monitoring reports, etc. • Off-site receptors identified in coordination with other disciplines • Available background ambient air data • Site specific ambient monitoring data • Proposed facility characteristics • Landfill design and operation data • Published terrain data • Published air emission factors and predictive models • Established gas characteristics from the existing operation • Applicable air quality standards, guidelines, and criteria from the MECP and the CCME
Air Quality - Odour	Waste disposal site and associated operations can emit contaminants that generate odorous emissions.	• Off-site odour concentrations (odour units) at identified odour sensitive receptors in the immediate vicinity of the site • Frequency of any odour levels above defined odour benchmarks • Number of off-site receptors potentially affected (e.g., residential properties, public facilities, businesses/farms odour sensitive area(s), institutions)	• MECP-provided meteorological data • Applicable MECP guidelines, technical standards, and accepted models • Aerial photographic mapping and field reconnaissance • Previously completed reports for the TCEC facility, including the 2016 Environmental Screening report, the 2005 EA, various ECA/ESDM reports, ambient monitoring reports, etc. • Off-site odour-sensitive receptors defined as per the MECP Odour Technical Bulletin [1], identified in coordination with other disciplines • Proposed facility characteristics • Landfill design and operation data • Published terrain data • Published air emission factors • Emission measurements from comparable landfills and/or on-site sampling • Applicable air quality standards, guidelines, and criteria from the MECP and the CCME

Evaluation Criteria	Rationale	Indicators	Data Sources
Air Quality - Blowing Litter	Waste disposal site and associated operations can release litter, which may be blown to the surround areas.	• Extent of zones potentially impacted by blowing litter • Number of off-site receptors potentially affected (e.g., residential properties, public facilities, businesses/farms odour sensitive area(s), institutions)	• On-site meteorological data • MECP-provided meteorological data • MECP inspection records, WM inspection records, and complaint history • Published literature related to the factors affecting the generation and mitigation of blowing litter • Landfill design and operation data

[1] MECP, 2016: Technical Bulletin – Methodology for Modelling Assessments of Contaminants with 10-Minute Average Standards and Guidelines under O. Reg. 419/05, September 2016.

The potential effects of the proposed landfill optimization will be assessed based on key indicator contaminants. Since the existing TCEC has been well characterized through studies such as the 2005 EA, the 2016 Environmental Screening Report, and various ECA applications, it has been determined which contaminants are of particular interest. The key indicator contaminants were developed based on a review of previous studies completed for the existing TCEC facility, as well as an understanding of the contaminants typically emitted by landfill operations. In general, the contaminants with predicted concentrations greater than 15% of their current criteria in the previously completed 2016 Twin Creeks Environmental Screening report were determined to be the key indicator contaminants.

The key indicator contaminants consist of:

- Total suspended particulate (TSP);
- Particulate matter less than 10 µm in diameter (PM_{10});
- Particulate matter less than 2.5 µm in diameter ($PM_{2.5}$);
- Vinyl Chloride;
- Benzene;
- 1,2-Dichloroethane;
- Ammonia;
- Hydrogen Sulphide (H_2S);
- Total Reduced Sulphur (TRS);
- Odour (as a mixture of compounds);
- Dioxins and Furans;
- Nitrogen Oxides (NO_X) / Nitrogen Dioxide (NO_2)
- Sulphur dioxide (SO_2); and
- Greenhouse Gases (carbon dioxide, methane, and nitrous oxide)

Key sources of these contaminants at the TCEC include the working face, interim cover area, and final cover area of the landfill; flares, generators, and other on-site combustion equipment; on-site traffic, equipment, soil handling, and wind erosion; and leachate treatment operations.

The applicable air quality standards, guidelines and criteria, are included in the following sources:

- MECP Regulation 419/05 standards, guidelines, and screening-level criteria (Reg. 419);
- MECP Ambient Air Quality Criteria (AAQC); and
- Canadian Council of Ministers of Environment (CCME) Canadian Ambient Air Quality Standards (CAAQS).

For any standards, criteria or guidelines with limits to be implemented in the future, these future limits will be presented for comparison to predicted concentrations. As the MECP or CCME update their air quality standards, guidelines, and criteria, the measure of predicted concentrations will be compared to the most stringent limits available at the time of the assessment.

The following table summarizes the applicable Air Quality Criteria to be used to assess potential effects from the TCEC. For contaminants with more than one limit that applies to the same averaging period, only the most stringent criteria will be used in the assessment.

Table 2. Assessment Criteria for Key Indicator Compounds

Contaminant	Applicable Sub-Assessment	Averaging Period	Air Quality Criteria (ug/m^3)	Source
TSP	Dust;	24-hour	120	AAQC and O.Reg 419/05
		Annual	60	AAQC
PM10	Dust;	24-Hour	50	AAQC
PM2.5	Dust;	24-Hour	25	AAQC
		24-Hour	27	CAAQs
		Annual	8.8	CAAQs
Vinyl chloride	Landfill Gas	24-hour	1.0	AAQC & O.Reg 419/05
		Annual	0.2	AAQC
Benzene	Landfill Gas	24-hour	2.3	AAQC
		Annual	0.45	AAQC & O.Reg 419/05
1,2-Dichloroethane	Landfill Gas	24-hour	2	AAQC & O.Reg 419/05
		Annual	0.4	AAQC
Ammonia	Landfill Gas	24-hour	100	AAQC
Hydrogen Sulphide	Landfill Gas	10-minute	13	AAQC & O.Reg 419/05
		24-hour	7	AAQC & O.Reg 419/05
Total Reduced Sulphurs (TRS)	Landfill Gas	10-minute	13	AAQC & O.Reg 419/05
		24-hour	7	AAQC & O.Reg 419/05
Odour	Odour	10-minute	1 OU/m^3	MECP Guidance
Dioxins and Furans	Combustion	24-hour	0.1 pg TEQ/m^3	AAQC

Table 2. Assessment Criteria for Key Indicator Compounds

Contaminant	Applicable Sub-Assessment	Averaging Period	Air Quality Criteria (ug/m^3)	Source
Nitrogen Dioxide	Combustion	1-hour	400	AAQC
		24-hour	200	AAQC
Nitrogen Oxides	Combustion	1-hour	400	O.Reg 419/05
		24-hour	200	O.Reg 419/05
Sulphur Dioxide	Combustion	1-hour	690	AAQC
		1-hour	100	O.Reg 419/05 (future 2023)
		24-hour	275	AAQC
		Annual	10	O.Reg 419/05 (future 2023)
		Annual	55	AAQC

There are no Reg. 419, AAQC, or CAAQS criteria for odour as a mixture of compounds. Historically, the MECP suggests that an upper limit for off-site concentrations of 1 odour unit (OU) per cubic metre, at an averaging time less than or equal to 10 minutes, be applied as a criterion. Odour results will be compared to 1, 3 and 5 OU; these levels are typically associated with odour detection, recognition, and annoyance thresholds, respectively. The MECP's "Methodology for Modelling Assessments of Contaminants with 10-Minute Average Standards and Guidelines for Odour under O. Reg. 419/05" outlines the procedure for evaluating compounds with 10-minute odour-based standards and the assessment for frequency of occurrences. Although this document does not explicitly consider it, the MECP typically also accepts this approach for the assessment of odour as a mixture of compounds, therefore; this document will be followed for the evaluation of odour and the frequency of odour events, as well as for assessing the 10-minute standards for H_2S and TRS.

Total releases of greenhouse gases are converted to carbon dioxide equivalents (CO_{2e}) based on Global Warming Potentials (GWP), as published by the MECP and/or ECCC.

4.2 Characterization of Existing Conditions

As part of the environmental assessment process, there is a requirement to evaluate the existing conditions in an area where the Project will occur. This is to develop a general background level so that the cumulative effects from the Project can be assessed and/or to determine what the effects would be with no Project in place. For the air quality assessment, baseline conditions will be defined using a combination of ambient monitoring and dispersion modelling.

4.2.1 Ambient Monitoring

Ambient monitoring has been conducted at the TCEC since 2009. The existing ambient monitoring program will be enhanced in order to fully characterize the existing conditions in the immediate vicinity of the TCEC. The results of the ambient monitoring will be compared to the applicable standards for each key indicator contaminant, as listed in **Table 2**. Ambient monitoring reports will be prepared quarterly.

An assessment of the wind conditions will be completed for each sampling period, in order to determine which of the monitoring locations were upwind and downwind of the landfill on each given day. The upwind samples will be used to develop background concentrations to be added to the dispersion modelling results. The downwind samples will be used for comparison with the dispersion modelling results.

When developing ambient background concentrations, the 90th percentile of the upwind 24-hour monitoring results will be used for assessing contaminants with 24-hour averaging periods and the average concentration of the upwind monitoring data will be used when assessing annual averaging periods. For compounds with averaging periods less than 24 hours (i.e., 1-hour and 10-minute), the 90th percentile 24-hour monitoring result will be converted to the shorter-term averaging period using the method described in MECP Guideline A-10 *Procedure for Preparing an Emission Summary and Dispersion Modelling Report*, version 4.1, March 2018.

Specifics regarding the ambient monitoring for each of the sub-assessments is provided in the following sections.

Dust Assessment

Ambient monitoring of TSP is well established at the existing site. TSP sampling is completed at three fixed locations around the landfill footprint, which were approved by the MECP. Each sample is conducted for a 24-hour period. The sampling commenced in 2009, at the onset of the construction at the site, and has continued to date. As of December 1, 2019, the sampling schedule for particulate was switched to a 6-day schedule from January 1 to May 31 and October 1 to December 31 of each year and a 3-day cycle from June 1 to September 30. Prior to this date, the samples were collected on six- or twelve-day intervals, depending on time of year, in concurrence with the U.S. EPA National Air Pollutant Surveillance monitoring schedule.

In order to develop a robust assessment of the existing conditions at the TCEC, the monitoring campaign will be enhanced to include monitoring of PM_{10}, and $PM_{2.5}$, co-located with the existing TSP samplers. Twenty-four (24) hour PM_{10} and $PM_{2.5}$ samples will be collected on the same schedule as the current TSP samples. All samples will be 24-hours in duration (midnight to midnight, Eastern Standard Time). This enhanced monitoring program will be conducted for a period of one year. The ambient monitoring results for PM_{10} and $PM_{2.5}$ will be used to develop a distribution factor, relative to TSP. This distribution factor will be applied to historical TSP measurements to estimate historical concentrations of PM_{10} and $PM_{2.5}$.

The samples will be collected on glass fibre filters (or other filters specified by the MECP) using General Metal Works standard High-Volume air samplers outfitted with PM_{10} and $PM_{2.5}$ inlet heads. The filters will be supplied, conditioned, and pre- and post-weighed by

an accredited laboratory. The filters will be stored and analyzed in monthly batches during the sampling program. The sampling will be completed according to the Operations Manual (as amended) published by the MECP. Any operational changes made to the MECP Operations Manual (as amended) during the study period will be implemented.

Landfill Gas and Combustion By-Product

Landfill gas is primarily composed of methane and carbon dioxide with trace amounts of VOCs and RS. VOC sampling has been completed through the summer months (July, August, and September) since 2009. A set of concurrent upwind and downwind samples are collected for 30-minutes in duration during TCEC operating hours for each sampling date. No more than two sets of samples are collected in any calendar month. The sample results are compared to the relevant MECP standards or guidelines. There is currently no ambient monitoring of RS compounds at TCEC.

In order to develop a robust assessment of the existing conditions at the TCEC, the monitoring campaign will be enhanced to include ambient monitoring of VOC and RS compounds collected over 24-hour durations (midnight to midnight, EST), co-located and on the same sampling schedule as the particulate monitoring, described in the preceding section. This sampling program will be conducted for four months, from June to September.

The samples will be collected and analyzed using methods defined in U.S. EPA Method TO-14/15 using evacuated canisters. Sampling methodologies will follow the Standard Operating Procedures (SOPs) as noted in the current version of the MECP Operations Manual, as amended.

No ambient monitoring will be conducted for nitrogen dioxide or sulphur dioxide, as these contaminants can be obtained from publicly available ambient monitoring data published by the MECP or from the National Air Pollution Surveillance (NAPS) database. In addition, ambient background ozone concentrations, used for converting NO_X to NO_2, will also be obtained from publicly available MECP or NAPS monitoring data.

Odour

No ambient monitoring is proposed for the odour assessment. Instead, the TCEC complaint log will be reviewed to determine the current level of odour impacts in the vicinity of the landfill. Other odours within the immediate community exist, including agricultural. Although agricultural odours can be related to landfill type odours, the two odour sources are generally distinct and the study will not include farming activities as local background sources.

For on-site odour concentrations, it is proposed to complete a series of on-site odour measurements to confirm the odour levels from the working face, interim cover area, waste soil materials, freshly uncovered waste, leachate collection manholes, and final cover areas. This set of data will be used to update the odour data from other landfills used in the previous TCEC odour assessments as well as confirm current odour conditions at the site. Odour sampling will follow approved Flux Chamber methodology and laboratory based olfactometry as outlined in the Ontario Source Testing Code Method 6. The odour samples would be taken during the summer conditions and would include: 9 samples from

the final cover area, 9 samples from the interim cover area, 3 samples from the working face, and 3 samples from the waste soil piles.

Blowing Litter

No ambient monitoring is proposed for the blowing litter assessment. Instead, the current TCEC complaint log will be reviewed to determine the current level of blowing litter impacts in the vicinity of the landfill.

4.2.2 Dispersion Modelling

Ambient monitoring will provide insight into existing conditions nearest to the property line, however conditions beyond the property line will be established using dispersion modelling. The focus of the modelling will be on predicted effects at identified residential receptors in the immediate vicinity (within ~ 1 kilometer) of the existing site. Modelling will be conducted using the current regulatory version of the US EPA AERMOD dispersion model (version 19191, or whichever version is currently approved by the MECP at the start of the modelling assessment).

The landfill will increase in height over its lifetime and in many cases, the sources of emissions may be located above grade. In past experience, modelling all activity at grade level results in a conservative assessment of predicted off-site effects. Sensitivity modelling will be conducted to confirm whether grade-level sources remain representative of worst-case conditions and, if so, landfill sources will be modelled at grade for a conservative approach.

Site-specific meteorological data will be requested from the MECP for use in the AERMOD dispersion modelling. To ensure that a broad range of dispersion conditions are addressed in the model, the meteorological data set will consist of five years' worth of historical weather data, processed by the MECP for use with AERMOD.

Contaminant concentrations will be predicted for a range of averaging periods for comparison with applicable air quality standards and criteria, as outlined in **Table 2**. Concentrations will be modelled at each of the identified air quality receptors (see **Figure 2**). In addition, concentrations will be modelled over a grid of receptors surrounding the landfill site and extending over the 5 km off-site study area.

The results from the predictive modelling for existing operations will be presented in both tabular form for the identified receptors as well as contour plots for the entire off-site study area for all contaminants. The contours will extend to a maximum distance of 5 km from the site; however, the study area (and associated contours) will be extended further if elevated concentrations occur beyond the 5 km radius. Predicted impacts will be presented both with and without measured upwind background concentrations to show landfill impact relative to the contribution from other sources in the area.

4.2.3 Source Quantification

The methods used for quantifying existing conditions for each of the air quality sub assessments are summarized below.

Dust Assessment

For the characterization of existing conditions, the dust sources will be identified based on previous EA and ECA (ESDM) reports for the facility, current operating conditions, and review of the dust complaint history. Typical dust sources include material handling, on-site equipment, landfill gas flares, wind erosion of exposed surfaces, and tailpipe emissions and re-entrained road dust from traffic on on-site haul routes. Emissions from both landfilling and on-site construction activities will be considered.

Reasonable maximum fugitive dust emission rates will be estimated based on emission factors published by the U.S. EPA for all processes. Roadway parameters such as silt loading, silt content, and moisture content will be based on site specific soil and road surface testing.

Tailpipe emissions for on-road and off-road vehicles will be determined using the U.S. EPA's MOVES 2014b emission program (or equivalent as agreed to by the MECP).

Dust emission rates will be adjusted based on the current mitigation measures in place at TCEC, as described in their Best Management Practices Plan (BMPP) for dust.

When dust particles travel downwind in a plume, larger particles fall out of the air through gravitational settling and other factors and are not replaced. Using the deposition routine within AERMOD provides a simulation of this process. By doing so, a more realistic prediction of dust impacts is produced. In the dispersion model, the dry particle deposition and dry plume depletion will be included as part of the dust assessment. As this is a non-regulatory option within AERMOD, consultation with the MECP will be conducted prior to using this feature. Provided the MECP is in agreement, AERMOD will be run using dry particle deposition and dry plume depletion, with deposition parameters derived from site-specific soil and road surface testing. These parameters will be circulated to the MECP and the Peer Review Team.

Landfill Gas and Combustion By-Product Assessment

For the characterization of existing conditions, the landfill gas compounds (VOC and RS) sources will be identified based on previous EA and ECA (ESDM) reports for the facility and current operating conditions. Typical sources of VOC and RS compounds include fugitive emissions from the landfill mound, the flare(s) or other landfill gas utilization equipment, waste soil stockpiles, and leachate treatment.

Landfill gas generation rates, consisting of emission rates VOCs and sulfur compounds, will be estimated using the U.S. EPA's Landfill Gas Emission Model (LandGEM). For this assessment U.S. EPA default values for landfill gas constituents will be used to determine landfill gas composition. Site specific measurement of landfill gas from TCEC may be used to further refine the emission estimates. The TCEC is equipped with a landfill gas collection system, which operates with a collection efficiency of 70%, as assumed in the 2016 Environmental Screening Report. Therefore, of the total landfill gas predicted by the LandGEM model, 70% will be collected and directed to the flares/other utilization equipment, with the remaining 30% escaping through the surface of the mound as fugitive emissions. The active cell of the landfill, where waste filling would be occurring, would be assumed to have a lower collection efficiency of 50%, since this area would not be under final cover.

The landfill gas emissions from the landfill flare(s) and other on-site utilization equipment will also be assessed. The on-site utilization equipment may include landfill gas-fired generators, a renewable natural gas facility, or other operations. The emissions will be based on the flow rates processed through the flare, the composition of the landfill gas, and typical flare destruction efficiencies for the landfill gas constituents, as published by the US EPA.

Emissions from the waste soil stockpile(s) will be based on testing previously conducted on waste soil at other landfills in Ontario. For the characterization of existing conditions, the combustion by-product emission sources will be identified based on previous EA and ECA (ESDM) reports for the facility and current operating conditions. Typical sources of combustion by-products include the landfill gas flare(s) and other on-site utilization equipment, on-site vehicles, off-road equipment, and other stationary combustion equipment.

Emissions of combustion by-products from the flare(s) and other stationary combustion will be developed based on published emission factors from the US EPA AP-42 documents.

The U.S. EPA's MOVES 2014b emission model (or equivalent as agreed to by the MECP) will be used to determine emission rates for all parameters related to tailpipe emissions from the on-site traffic and mobile equipment. Daily and peak hourly traffic volumes and hourly traffic variations will be obtained from the transportation work plan.

For the assessment of NO_2 impacts, the majority of the emission factors are provided as total nitrogen oxides (NO_X). The predicted NO_X concentration will be converted to NO_2 concentrations using the ozone limiting method (OLM), which limits the conversion of NO_X to NO_2 based on the amount of ozone available.

Odour Assessment

For the characterization of existing conditions, the odour sources will be identified based on previous EA and ECA (ESDM) reports for the facility and current operating conditions as noted above for updated odour measurements. Typical sources of odours include fugitive emissions from the landfill mound (final and interim cover area), the landfill working face, and waste soil stockpiles. Leachate treatment odours will be evaluated based on proposed alternative treatment options or approved systems.

The predicted odour levels from the current waste disposal site will evaluate the potential for odour impacts based on the MECP's 1 OU target levels and frequency of occurrence for odour events above 1 OU, 3 OU and 5 OU at sensitive receptors locations. Odour associated with landfill gas will be based on the MECP emission factor of 10,000 OU/m^3 of gas produced. The site-specific odour measurements, outlined in Section 4.2.1, will be used to characterize odour sources more accurately.

Blowing Litter Assessment

The potential for wind-blown litter to cause a nuisance at nearby residences has been investigated in studies conducted at other landfills in Ontario. The Interim Waste Authority (IWA) conducted a literature review and interviewed landfill operators to get an indication of the potential for nuisance impacts based on distance from the landfill perimeter. In

addition, RWDI has previously conducted wind-tunnel tests to develop threshold wind speeds for wind-blown litter.

Meteorological data, provided by the MECP, and the current operations at the landfill will be used as the primary tools to evaluate the potential for blowing litter events. Wind direction during these events will be used to determine the zones for litter. In addition, changes in windspeed at higher elevations will be considered.

The TCEC complaint record, MECP inspection record, and WM inspection record for blowing litter will be reviewed as part of the blowing litter assessment.

No dispersion modelling will be conducted for the blowing litter assessment.

Climate Change Assessment

The climate change assessment will be conducted for the preferred alternative only; see section 4.3.3.

4.3 Assessment of Potential Environmental Effects

Using the evaluation criteria, indicators, rationale, and data sources from Section 4.1 and the characterization of existing conditions as described in Section 4.2, the assessment of potential environmental effects will be carried out as follows:

- predict the potential environmental effects for each alternative method (Section 4.3.1);
- identify the preferred alternative based on a comparative evaluation of the potential environmental effects of each alternative method (Section 4.3.2); and
- conduct an effects assessment on the preferred alternative, including the identification of mitigation measures and monitoring programs (Section 4.3.3).

4.3.1 Evaluation of Alternative Methods

The potential effects will be identified based upon application of the proposed evaluation criteria, indicators and data sources as outlined in Section 4.1. Potential effects can be positive or negative, direct or indirect, and short or long-term. Alternatives will be assessed with consideration of typical mitigation measures in place.

The proposed facility characteristics of each alternative method will be reviewed to determine potential interactions with Air Quality. The criteria and indicators listed in Table 1 will be applied to each alternative method to determine potential effects. Evaluation of alternative methods will initially be assessed using a qualitative comparison; if this qualitative comparison suggests the alternative methods could result in differing air quality impacts, then a quantitative modelling comparison with be conducted.

If a quantitative comparison of the alternative methods is warranted, for the assessment of dust, landfill gas, combustion by-products, and odour the sources and methodology used for the potential effects assessment are expected to be similar to those considered for the assessment of existing conditions as outlined in Section 4.2. The dispersion modelling methodologies outlined in Section 4.2.2 will also be applied to the qualitative comparison of alternative methods.

One worst-case scenario will be assessed for each alternative method with the potential to have differing air quality impacts. Rationale for selection of the worst-case stages will be outlined in the report. The alternatives will be assessed at the identified receptors only. The alternatives will be assessed for a subset of contaminants, as follows:

- vinyl chloride (as an indicator for VOC contaminants),
- hydrogen sulphide (as an indicator for RS contaminants),
- total particulate matter (as an indicator for dust contaminants),
- nitrogen dioxide (as an indicator for combustion by-products), and,
- odour.

Dispersion modelling will be conducted for the contaminants listed above. The alternative methods will be compared with respect to the following:

- Predicted off-site points of impingement air concentrations of indicator compounds at all identified receptors within 5 kilometers will be presented as concentration isopleths;
- Predicted off-site points of impingement air concentrations for indicator compounds at identified sensitive receptors will be presented as tabular results;
- Change in predicted specific compound concentrations at key receptors from baseline conditions to predicted future operational stages;
- Frequency of any exceedance of applicable standards, limits, or guidelines at identified receptors;
- Number of off-site receptors potentially affected (residential properties, public facilities, businesses/farms, institutions); and
- Contribution from landfill compared to baseline (or existing conditions).

No dispersion modelling will be conducted for the blowing litter assessment. Instead, a comparison of the predicted litter zones between alternatives will be made. Climate change will not be assessed for the alternatives.

4.3.2 Identification of the Preferred Alternative

The alternative methods will be comparatively assessed and evaluated using the proposed evaluation criteria, indicators, and data sources to determine the preferred alternative. The differences in the potential environmental effects remaining following the implementation of mitigation/management measures (i.e., net effects) will be used to identify and compare the advantages and disadvantages of each alternative method. The comparison of alternative methods will include a clear rationale for the selection of the preferred alternative.

4.3.3 Effects Assessment of the Preferred Alternative

Following the identification of the preferred alternative, an effects assessment will be carried out on the preferred alternative considering the same evaluation criteria, indicators, and data sources, and additional studies as required, considering possible mitigation

and/or management measures and cumulative effects. The potential effects of the preferred alternative will be compared to the 'do nothing' alternative.

Details regarding the operations and design of the preferred alternative will be based on data provided by WM as to planned operations. In general, the sources and methodology used for the effects assessment of the preferred alternative are expected to be similar to those considered for the assessment of existing conditions. Therefore, the dispersion modelling methodologies, outlined in Section 4.2.2 will also be applied to the preferred alternative as well as the "do nothing" alternative (future baseline scenarios).

The preferred alternative will be assessed for all contaminants listed in Section 4.1.

Separate predicted particulate (dust) impacts will be presented for operations activities and construction activities in the assessment of the preferred alternative. Combined impacts of these two activities will also be presented.

As operations will move around the landfill site over the life of the landfill, the effects assessment of the preferred alternative will consider up to three future operational stages. Rationale for selection of the future stages will be outlined in the report.

The TCEC currently has approval to build an on-site leachate treatment plant, however, at the time of this workplan, this plant has not yet been installed. Therefore, the presence of this leachate plant does not form part of the existing conditions. If this leachate plant is part of the preferred alternative, emissions from this leachate plant will be based on emissions presented in the 2016 Environmental Screening Report.

After the assessment is completed, if predicted impacts are outside of acceptable ranges, additional mitigation measures will be proposed and incorporated into the assessment. The resulting net effects will be presented.

Based on the modelling results of the preferred alternative, future monitoring requirements will be developed with the goal of optimizing the monitoring program to cover both operational and construction activities.

A review of existing best management practices (BMPs) will be carried out to develop a framework for improvements to existing BMPs to be carried forward into the Environmental Compliance Approval (ECA) process, where specific details will be developed. This assessment will consider conceptual mitigation options for various on-site activities as well as off-site dust track out as necessary.

For the climate change assessment for the preferred alternative, GHG emission sources will be identified based on previous EA and ECA (ESDM) reports for the facility and current operating conditions. Typical sources of GHG include stationary sources, such as fugitive emissions from the landfill mound, the landfill gas flares, and other stationary combustion equipment, as well as mobile sources, such as on-road vehicles and off-road equipment. Potential credits for beneficial use of landfill gas and/or carbon sequestration will also be considered.

Methane, carbon dioxide, and nitrous oxide releases from the landfill will be quantified using the LANDGEM emission model, Individual GHG emissions will be converted to carbon dioxide equivalents (CO_2e) by applying the appropriate conversion factor (as provided by MECP) to determine the annual CO_2e emissions from the sources. GHG emissions from the on-road vehicles and off-road equipment will be determined through

the use of MOVES emission factors. The total site-wide annual GHG releases will be used to characterize the potential effects.

4.4 Reporting

Two separate reports will be prepared for air quality in support of the EA:

1. A report providing a characterization of Existing Conditions; and
2. A report providing the Effects Assessment.

These reports will be appended to the EA Study Report and will be available for review during the EA. A summary of the existing conditions and effects assessment will be included in the EA Study Report.

The characterization of existing conditions will include details of completed ambient monitoring and dispersion modelling.

5 References

Canadian Council of Ministers of the Environment
2021 Canadian Ambient Air Quality Standards.

Government of Ontario
1990 Environmental Assessment Act R.S.O. 1990, c. E.18

Technical Assessment and Standards Development Branch Ontario Ministry of the Environment, Conservation and Parks: Human Toxicology and Air Standards Section
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1992 Interim Guide to Estimate and Assess Landfill Air Impacts.

Ontario Ministry of the Environment and Climate Change
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2018 Air Contaminants Benchmarks List: standards, guidelines and screening levels for assessing point of impingement concentrations of air contaminants.

United States Environmental Protection Agency (EPA)
2005 Landfill Gas Emissions Model (LandGem) version 3.02.

United States Environmental Protection Agency (EPA)
2019 AERMOD Dispersion Model.

United States Environmental Protection Agency (EPA)
2014 Motor Vehicle Emission Simulator (MOVES), version 2014b.

Waste Management of Canada Corporation
2019 Twin Creeks Landfill Site Air Quality, Odour, and Dust: Evaluation Proposed Increase to Waste Tonnage.

Figures

Figure 1. General On-Site and Off-Site Study Areas

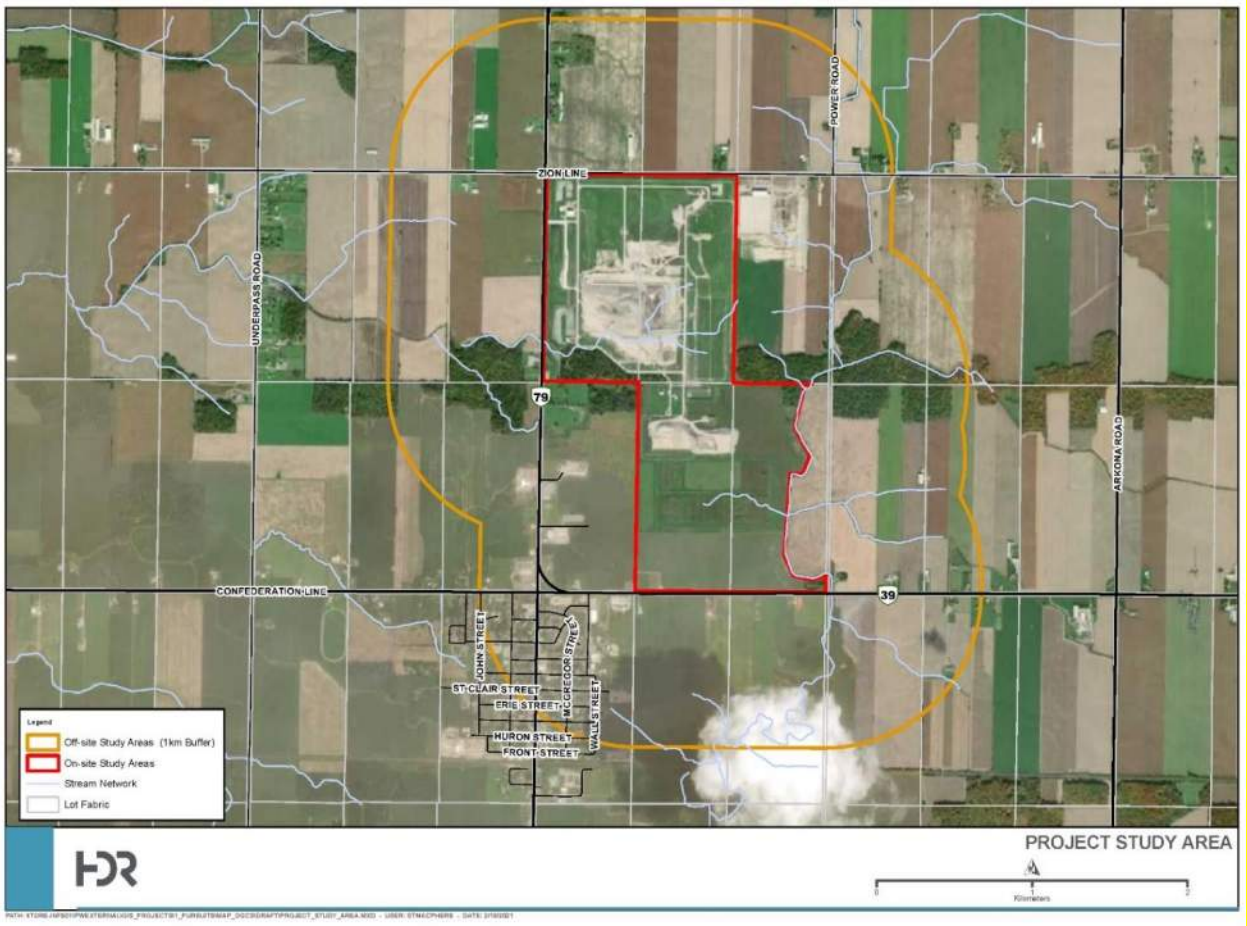
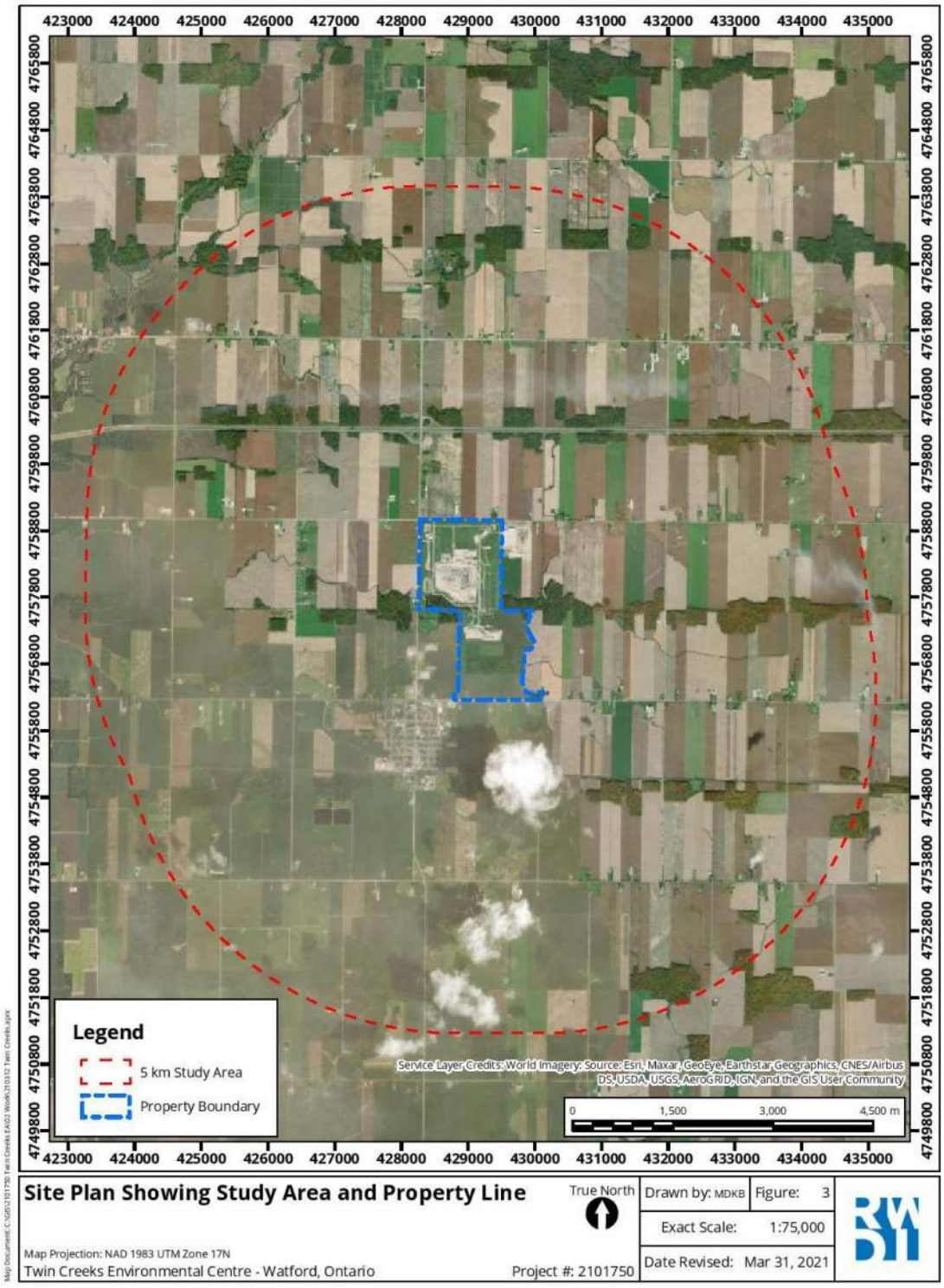


Figure 2. Site Plan Showing Property Boundary, Sensitive Receptors, and TSP Sampling Locations



Figure 3. Site Plan Showing Study Area and Property Line



Archaeology Work Plan

Twin Creeks Environmental Centre Landfill Optimization Project

Waste Management of Canada Corporation

Watford, Ontario

March 30, 2022

Prepared by:

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Acronyms

Acronym	Definition
ASI	Archaeological Services Inc.
BAO	Bereavement Authority of Ontario
EA	Environmental Assessment
GIS	Geographic Information System
MECP	Ministry of Environment, Conservation and Parks
MHSTCI	Ministry of Heritage, Sport, Tourism, and Culture Industries
TCEC	Twin Creeks Environmental Centre
S&G	Standards and Guidelines for Consultant Archaeologists
ToR	Terms of Reference
WM	Waste Management of Canada Corporation

1 Introduction

This Archaeology work plan has been prepared to support the environmental assessment (EA) for the Twin Creeks Environmental Centre Landfill Optimization Project (the Project) and will be appended to the Terms of Reference (ToR) for the EA to be submitted to the Ministry of Environment, Conservation and Parks (MECP) for approval.

Waste Management of Canada Corporation (WM), the owner and operator of the Twin Creeks Environmental Centre (TCEC) in Watford, Ontario, has initiated an EA seeking approval to increase the landfill airspace capacity at the TCEC. The TCEC has approximately 13.2M m³ of remaining approved landfill airspace, which corresponds to about 10 years of operating life (2021 to 2031). This optimization project could provide additional airspace capacity of up to approximately 14M m³, which could extend the site life by about 12 years (from 2031 to 2043). There would be no change to the current 301 ha site area, the approved service area, or the annual fill rate.

The TCEC is a regional facility that provides safe and convenient disposal services for communities, businesses and industries serving the Province of Ontario. The landfill is approved to receive municipal, industrial, commercial, and institutional solid non-hazardous wastes generated, including non-hazardous contaminated soil.

The TCEC is engineered with environmental protection systems that meet or exceed regulatory requirements and are subject to highly regulated monitoring and reporting requirements. Systems include engineered liners and covers, leachate collection and removal, landfill gas collection and control, and on-site leachate disposal through phytoremediation. The TCEC provides landfill gas, for heating, to the 40-acre greenhouse facility adjacent to the landfill property. Prior to this, all landfill gas was flared. The intent is for the landfill to supply gas for heating to the greenhouses for 25 years.

Leachate that is generated in the waste is conveyed toward a perimeter leachate collection system. WM received approval to treat leachate through a phytoremediation system consisting of a 9.3 ha poplar system planted on the existing landfill cap in 2003. Surplus leachate is trucked off-site to approved wastewater treatment plants.

WM pays host community fees annually to the Township of Warwick. Since 2009, when the TCEC Expansion Landfill began receiving waste, WM has contributed over $23M in host community fees to the Township.

There is a need for the continued development of the TCEC as it is a significant component of the provincial waste management network and infrastructure, which is lacking in sufficient and secure long-term disposal capacity. Optimizing the future development of the TCEC allows for on-going sustainable business operations and continued provision of essential financial support for community services and programs.

The purpose of the EA is to assess the potential effects of the proposed landfill optimization on the environment. The EA will be carried out in accordance with the requirements of the *Ontario Environmental Assessment Act* (Ministry of the Environment, 2016). Part of the EA requires assessment of potential impacts to any archaeological resources within the study area.

The Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI) defines archaeology as the study of past human cultures through the investigation of archaeological sites. In Ontario, these sites can include:

- Indigenous hunting camps and villages
- Battlefields
- Pioneer homes
- Burial grounds and cemeteries
- Shipwrecks
- Other evidence of past human activity

Before approving a land development project regulated by legislation, the approval authority for the project requires an archaeological assessment of all lands that are part of the project. Assessments are required when the land is known to have an archaeological site on it or has the potential to have archaeological resources.

The Standards and Guidelines for Consultant Archaeologists (S & G) (MHSTCI, 2011) lists the objectives of a Stage 1 archaeological assessment as follows:

- To provide information about the geography, history, previous archaeological fieldwork of the development property and its current land condition;
- To provide a detailed evaluation of the archaeological potential of the study area which will support recommendations for Stage 2 survey for all or parts of the study area; and
- To recommend appropriate strategies for Stage 2 survey, if necessary.

Indigenous community consultation and engagement activities carried out as part of the EA are separate from the Archaeology work plan.

Cultural heritage assessments are addressed under a separate work plan.

2 Study Purpose and Objectives

This Archaeology work plan outlines the tasks required to support the EA through the characterization of existing conditions and assessment of potential environmental effects of the project on the archaeological environment, including the evaluation of the various alternative methods and the identification and assessment of a preferred alternative. This work plan outlines the scope of the archaeological work, including protocols and/or standards to be adhered to while the work is undertaken. The specific evaluation criteria, indicators, and data sources to be used and the study areas to be considered are provided below. These items may be adjusted during the EA process.

In accordance with the *Ontario Environmental Assessment Act*, the objectives of the EA are as follows:

1. Describe the environment potentially affected by the proposed undertaking, including both the existing environment as well as the environment that would otherwise be likely to exist in the future without the proposed undertaking;

2. Carry out an evaluation of the environmental effects of the proposed undertaking, using the environmental assessment criteria and studies that have been established through the development of the ToR;
3. Undertake an evaluation of any additional actions that may be necessary to prevent, change or mitigate environmental effects;
4. Provide a description and evaluation of the environmental advantages and disadvantages of the proposed undertaking, based on the net environmental effects that will result following mitigation; and
5. Prepare monitoring, contingency and impact management plans to mitigate the environmental effects of the proposed undertaking.

3 Study Areas

During the EA, existing conditions and potential effects will be considered in the context of two study areas: on-site and off-site. The general study areas proposed for the purposes of the EA are (Figure 1):

- On-site Study Area: the existing TCEC.
- Off-site Study Area: the lands within the vicinity of the TCEC extending approximately 1 km out from the On-site Study Area.

During the EA all developments (direct impacts) are proposed within the On-Site Study Area. As archaeology is only concerned with area of direct impact, or within 50 metres of a known archaeological resource, the Off-Site Study Area does not require inclusion in the archaeological assessment. If any impacts are proposed in the Off-Site Study Area, those areas will require Stage 1 archaeological assessment. For the Archaeological Environment, the work will be limited to the On-Site Study Area, historically located in the Township of Warwick, County of Lambton in the following lots and concessions:

- Lots 19-20, Concession 3 South of Egremont Road; and
- Lots 20-21, Concession 4 South of Egremont Road.

4 Scope of Work

The scope of work for Archaeology includes the development of evaluation criteria, indicators, and data sources, characterization of existing archaeological conditions, assessment of the potential environmental effects of the alternative methods and the preferred alternative, development of mitigation measures and monitoring programs, and reporting as outlined below.

4.1 Evaluation Criteria, Indicators, and Data Sources

The environmental assessment criteria, indicators, and data sources for the archaeological environment are provided in Table 1. The assessment criteria, indicators, and data sources will be used to assess the effects of the alternatives and the preferred alternative on the

archaeological environment. These evaluation criteria and indicators will be finalized during the EA.

Table 1. Evaluation Criteria, Indicators, and Data Sources for Archaeology

Evaluation Criteria	Rationale	Indicators	Data Sources
Archaeological Environment			
Archaeological Resources	Archaeological resources are non-renewable cultural resources that can be destroyed by the construction and operation of a waste disposal facility. Activities related to construction and operation of the landfill may cause negative effects on archaeological sites or areas with archaeological potential.	• Archaeological resources on-site and predicted impacts on them • Cemetery properties within approximately 10 metres of the proposed impacts	• Published data sources • Standards and Guidelines for Consultant Archaeologists • Ontario Archaeological Sites Database (OASD) • MHTSCI register of archaeological reports • Existing Stage 1, 2, 3 Archaeological Assessments for the landfill site • Stage 1 property inspection results • Bereavement Authority of Ontario (BAO) • Cemetery records, plans and plot maps • Historical mapping, topographical maps and aerial photographs and imagery • Proposed facility characteristics • Landfill design and operations data

4.2 Characterization of Existing Conditions

The entire On-Site Study Area has been subject to past Stage 1-2 and Stage 3 archaeological assessments as part of previous landfill expansion projects (ASI, 2001, 2005, 2007, 2008). The Stage 1 report will be conducted to characterize the existing archaeological conditions of the On-Site Study Area; synthesize the findings of the previous assessments; and provide current recommendations in accordance with the 2011 S & Gs and best practices.

The Stage 1 Archaeological assessment report will require the following tasks: provincial inventory and database review; geographic and land use information review; agency and stakeholder consultation; Indigenous community engagement; background historical research; and property inspection to document existing conditions.

Consultation with interested Indigenous groups will be conducted by WM on behalf of ASI to determine if the study area contains any lands known to hold special significance or any features of known Indigenous interest.

The Stage 1 archaeological assessment proposed herein will address the requirements of the Ontario Environmental Assessment Act and the Ontario Heritage Act (R.S.O. 1990,

amended 2005), and will meet the 2011 S&Gs and archaeological license requirements set by MHSTCI. As such, it will also be subject to Ministry of Tourism and Culture review.

The purpose of Stage 1 archaeological assessment is to identify known archaeological sites that may be affected by the undertaking, and to describe the potential for the presence of archaeological resources throughout the EA study area (On-Site and Off-Site). The Stage 1 archaeological assessment will be designed to provide an inventory of known or potentially existing archaeological resources within the study area (Existing Conditions) for the purposes of assessing alternative methods, development of mitigation measures and monitoring programs of the undertaking. The Stage 1 archaeological assessment will involve the following tasks:

Task 1: Project Initiation, Background Research and Review of Existing Archaeological and Historical Data

Update ASI's existing database of known archaeological sites within the study area and identify data gaps that may need to be addressed through subsequent field investigations by:

- Reviewing pertinent provincial government files (OASD)
- Reviewing and compiling the results of a literature search (published and unpublished), including but not limited to archival material held at the Archives of Ontario, and the reports generated by previous archaeological assessment activities within the vicinity of the study area.

Task 2: Determine Archaeological Potential of the Study Area

Determine the archaeological potential of the study area by:

- Reviewing the former geomorphological and hydrological character of the study area, and the reconstructed locations of former settlement and industrial features on the basis of available project mapping, to delimit zones of archaeological potential.
- Should one or more cemeteries be identified, municipal and/or regional cemetery officials and/or heritage planners will be notified to obtain relevant information if necessary.
- Conducting a field review of the study area to confirm the research-based characterization of archaeological potential and to determine the degree to which recent construction disturbances may have affected archaeological potential.

Task 3: Archaeological Inventory and Management Strategy

On the basis of the results of the preceding research, an inventory of known and potential archaeological resources within the study area will be compiled. For each resource that may be impacted by the proposed undertaking, a series of mitigation measures will be recommended for incorporation within the overall development framework plan.

Task 4: Stage 1 Archaeological Assessment Report Preparation

The Stage 1 archaeological assessment report will describe the results of the Stage 1 archaeological assessment and will contain all necessary photographic and cartographic documentation. Available and derived spatial data will be compiled within a geographical information system (GIS) to produce a mapped inventory of known archaeological

resources as well as a zone of archaeological potential for the study area. The report will fulfill the project requirements, while at the same time addressing all of the archaeological and licensing concerns outlined in the Ontario Heritage Act and the Environmental Assessment Act.

The report is sent to MHSTCI as a condition of licensing in accordance with Part VI of the Ontario Heritage Act, R.S.O. 1990, c 0.18. The report is reviewed to ensure that it complies with the S & Gs that are issued by the Minister, and that the archaeological fieldwork and Report recommendations ensure the conservation, protection and preservation of the cultural heritage of Ontario. When all matters relating to archaeological sites within the project area of a development proposal have been addressed to the satisfaction of the MHSTCI, a letter will be issued by the Ministry stating that there are no further concerns with regard to alterations to archaeological sites by the proposed development. A copy of this letter will be provided to WM. The report will then be entered into the Ontario Public Registry of Archaeological Reports.

4.3 Assessment of Potential Environmental Effects

Using the evaluation criteria, indicators, rationale, and data sources from Section 4.1 and the characterization of existing conditions as described in Section 4.2, the assessment of potential environmental effects will be carried out as follows:

- predict the potential archaeological effects for each alternative method (Section 4.3.1);
- identify the preferred alternative based on a comparative evaluation of the potential archaeological effects of each alternative method (Section 4.3.2); and
- conduct an effects assessment on the preferred alternative, including the identification of mitigation measures and monitoring programs (Sections 4.3.3).

4.3.1 Evaluation of Alternative Methods

The potential effects of each alternative method will be identified based upon application of the proposed evaluation criteria, indicators and data sources as outlined in Section 4.1. Potential effects can be positive or negative, direct or indirect, and short or long-term. Mitigation measures will be identified to minimize or mitigate the potential effects and then the net effects are evaluated taking into consideration the application of mitigation measures.

Potential effects will be identified and evaluated against existing information gathered in the Stage 1 Archaeological Assessment report outlined in Section 4.2, including information provided by the field investigations and the assessment of archaeological potential of any lands that have not adequately been subject to previous archaeological assessment or have additional archaeological conditions/requirements.

4.3.2 Identification of the Preferred Alternative

The alternative methods will be comparatively assessed and evaluated using the proposed evaluation criteria, indicators, and data sources to determine the preferred alternative. The differences in the potential environmental effects remaining following the implementation of mitigation/management measures (i.e., net effects) will be used to identify and compare

the advantages and disadvantages of each alternative method. The comparison of alternative methods will include a clear rationale for the selection of the preferred alternative.

4.3.3 Effects Assessment of the Preferred Alternative

Following the identification of the preferred alternative, an effects assessment will be carried out on the preferred alternative considering the same evaluation criteria, indicators, and data sources, and additional studies as required, considering possible mitigation and/or management measures and cumulative effects. The potential effects of the preferred alternative will be compared to the 'do nothing' alternative.

If all proposed impacts are within the existing footprint of the landfill, the Stage 1 report will demonstrate that these areas have been cleared of further archaeological concern from previous archaeological assessments.

A site visit will be required to document the existing conditions of the On-Site Study Area and adjacent cemetery property.

4.4 Reporting

One report will be prepared for Archaeology in support of the EA:

1. A report providing a characterization of Existing Conditions and the Effects Assessment (Stage 1 Archaeological Assessment report).

The Stage 1 report will be appended to the EA Study Report and will be available for review during the EA. A summary of the existing conditions and effects assessment will be included in the EA Study Report.

The characterization of Existing Conditions Stage 1 AA will include a summary of historical developments within the study area, historical mapping review, details of completed field investigations, technical analyses, methods, results, maps of sensitive features within the On-site and Off-site Study Areas, mitigation measures (lands requiring further study by Stage 2, 3 or 4 AA), conclusions, and recommendations, as well as a record of Indigenous consultation.

Stage 3 Cemetery Investigation report may also be required if the preferred alternative is anticipated to impact areas found to retain archaeological potential associated with unmarked burials within the On-Site Study area adjacent to the Watford Cemetery, 5606 Nauvoo Road.

5 References

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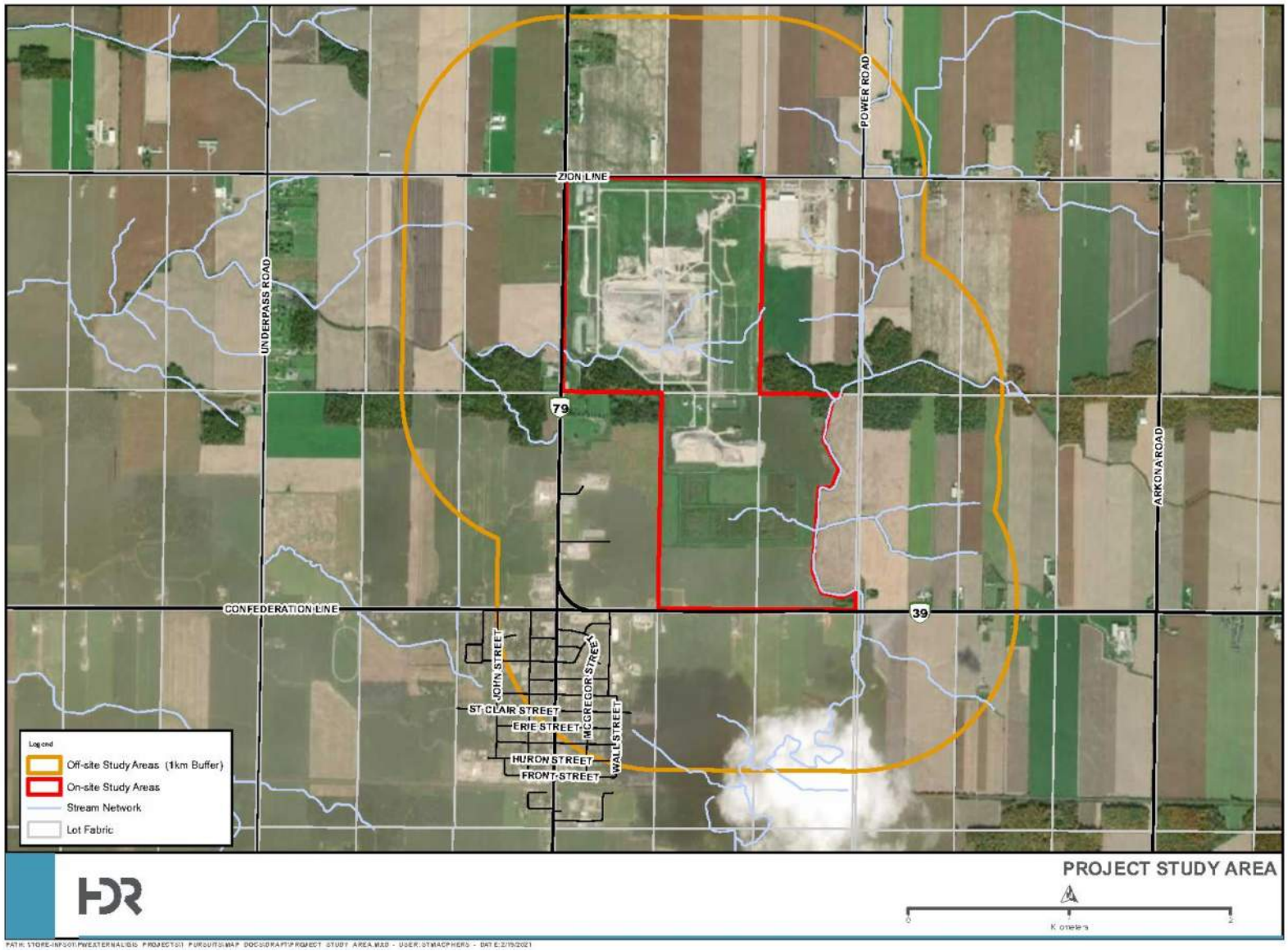
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Figures

Figure 1. General On-Site and Off-site Study Areas



Cultural Heritage Work Plan

Twin Creeks Environmental Centre Landfill Optimization Project

Waste Management of Canada Corporation

Watford, Ontario

March 30, 2022

Prepared by:

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Acronyms

Acronym	Definition
ASI	Archaeological Services Inc.
BHR	Built Heritage Resource
CHL	Cultural Heritage Landscape
CHER	Cultural Heritage Evaluation Report
EA	Environmental Assessment
HIA	Heritage Impact Assessment
MECP	Ministry of Environment, Conservation and Parks
MHSTCI	Ministry of Heritage, Sport, Tourism, and Culture Industries
TCEC	Twin Creeks Environmental Centre
ToR	Terms of Reference
WM	Waste Management of Canada Corporation

1 Introduction

This Cultural Heritage work plan has been prepared to support the environmental assessment (EA) for the Twin Creeks Environmental Centre Landfill Optimization Project (the Project) and will be appended to the Terms of Reference (ToR) for the EA to be submitted to the Ministry of Environment, Conservation and Parks (MECP) for approval.

Cultural heritage assessments in this context consider the above-ground cultural heritage resources that are valued for the important contribution they make to our understanding and appreciation of the history of a place, an event, or people (Ministry of Culture 2006). Cultural heritage resources considered in this assessment include: Built Heritage Resources (BHRs) such as built structures or features with identified design, historical, or contextual value; and Cultural Heritage Landscapes (CHLs) may consist of a geographical area that has been modified by human activity and which has design, historical, or contextual value. Assessment of archaeological site potential for the Project is included in a separate work plan. Similarly, consultation and engagement with Indigenous communities is being carried out during the ToR and the EA and are separate from this work plan.

Waste Management of Canada Corporation (WM), the owner and operator of the Twin Creeks Environmental Centre (TCEC) in Watford, Ontario, has initiated an EA seeking approval to increase the landfill airspace capacity at the TCEC. The TCEC has approximately 13.2M m^3 of remaining approved landfill airspace, which corresponds to about 10 years of operating life (2021 to 2031). This optimization project could provide additional airspace capacity of up to approximately 14M m^3, which could extend the site life by about 12 years (from 2031 to 2043). There would be no change to the current 301 ha site area, the approved service area, or the annual fill rate.

The TCEC is a regional facility that provides safe and convenient disposal services for communities, businesses and industries serving the Province of Ontario. The landfill is approved to receive municipal, industrial, commercial, and institutional solid non-hazardous wastes generated, including non-hazardous contaminated soil.

The TCEC is engineered with environmental protection systems that meet or exceed regulatory requirements and are subject to highly regulated monitoring and reporting requirements. Systems include engineered liners and covers, leachate collection and removal, landfill gas collection and control, and on-site leachate disposal through phytoremediation. The TCEC provides landfill gas, for heating, to the 40-acre greenhouse facility adjacent to the landfill property. Prior to this, all landfill gas was flared. The intent is for the landfill to supply gas for heating to the greenhouses for 25 years.

Leachate that is generated in the waste is conveyed toward a perimeter leachate collection system. WM received approval to treat leachate through a phytoremediation system consisting of a 9.3 ha poplar system planted on the existing landfill cap in 2003. Surplus leachate is trucked off-site to approved wastewater treatment plants.

WM pays host community fees annually to the Township of Warwick. Since 2009, when the TCEC Expansion Landfill began receiving waste, WM has contributed over $23M in host community fees to the Township.

There is a need for the continued development of the TCEC as it is a significant component of the provincial waste management network and infrastructure, which is lacking in sufficient and secure long-term disposal capacity. Optimizing the future development of the TCEC allows for on-going sustainable business operations and continued provision of essential financial support for community services and programs.

The purpose of the EA is to assess the potential effects of the proposed landfill optimization on the environment. The EA will be carried out in accordance with the requirements of the *Ontario Environmental Assessment Act*.

2 Study Purpose and Objectives

This Cultural Heritage work plan outlines the tasks required to support the EA through the characterization of existing conditions and assessment of potential environmental effects of the project on the Cultural Heritage environment, including the evaluation of the various alternative methods and the identification and assessment of a preferred alternative. This work plan outlines the scope of the Cultural Heritage work, including protocols and/or standards to be adhered to while the work is undertaken. The specific evaluation criteria, indicators, and data sources to be used and the study areas to be considered are provided below. These items may be adjusted during the EA process.

In accordance with the *Ontario Environmental Assessment Act*, the objectives of the EA are as follows:

1. Describe the environment potentially affected by the proposed undertaking, including both the existing environment as well as the environment that would otherwise be likely to exist in the future without the proposed undertaking;
2. Carry out an evaluation of the environmental effects of the proposed undertaking, using the environmental assessment criteria and studies that have been established through the development of the ToR;
3. Undertake an evaluation of any additional actions that may be necessary to prevent, change or mitigate environmental effects;
4. Provide a description and evaluation of the environmental advantages and disadvantages of the proposed undertaking, based on the net environmental effects that will result following mitigation; and
5. Prepare monitoring, contingency and impact management plans to mitigate the environmental effects of the proposed undertaking.

3 Study Areas

During the EA, existing conditions and potential effects will be considered in the context of two study areas: on-site and off-site. The general study areas proposed for the purposes of the EA are (**Figure 1**):

- On-site Study Area: the existing TCEC.

- Off-site Study Area: the lands within the vicinity of the TCEC extending approximately 1 km out from the On-site Study Area.

These study areas have been adopted for Cultural Heritage.

4 Scope of Work

The scope of work for Cultural Heritage includes the development of evaluation criteria, indicators, and data sources, characterization of existing Cultural Heritage conditions, assessment of the potential environmental effects of the alternative methods and the preferred alternative, development of mitigation measures and monitoring programs, and reporting as outlined below.

4.1 Evaluation Criteria, Indicators, and Data Sources

The environmental assessment criteria, indicators, and data sources for Cultural Heritage are provided in **Table 1**. The assessment criteria, indicators, and data sources will be used to assess the effects of the alternatives and the preferred alternative on Cultural Heritage. These evaluation criteria and indicators will be finalized during the EA.

Table 1. Evaluation Criteria, Indicators, and Data Sources for Cultural Heritage

Evaluation Criteria	Rationale	Indicators	Data Sources
Cultural Environment			
Cultural Heritage Resources (Built Heritage Resources and Cultural Heritage Landscapes)	Activities related to construction and operation of the landfill may result in direct or indirect effects on identified built heritage resources and cultural heritage landscapes.	• Proximity of known or potential cultural heritage resources to the landfill (known/potential built heritage resources and cultural heritage landscapes will be assessed for potential direct or indirect effects). ○ Direct impacts may include: the destruction of any, or part of any, significant heritage attributes or features; and alteration that is not sympathetic, or is incompatible, with the historic fabric and appearance. ○ Indirect impacts may include: shadows created that alter the appearance of a heritage attribute or change the viability of a natural feature or plantings, such as a garden; and isolation of a heritage attribute from its surrounding environment, context or a significant relationship; direct or indirect obstruction of significant views or vistas within, from, or of built and natural features; a change in land use such as rezoning a battlefield from open space to residential use, allowing new development or site alteration to fill in the formerly open spaces; and land disturbances such as a change in grade that alters soils, and drainage patterns that adversely affect an archaeological resource.	• Published data sources • Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes (MTCS 2016) • Ontario Heritage Tool Kit (MTCS 2006) • Commemorative statements • Proposed facility characteristics • Landfill design and operations data • Viewshed analysis • Previous EA reports • Municipal Heritage Inventories and Staff Reports • Provincial and Federal Heritage Registers and Inventories • Township of Warwick, MHSTCI, Ontario Heritage Trust, and engagement with Indigenous communities • Field survey results • Historical mapping, historical topographical maps and aerial photographs

4.2 Characterization of Existing Conditions

The characterization of the existing cultural heritage conditions of the On-Site and Off-Site Study Areas will require the following tasks:

1. Municipal, provincial and federal heritage inventory and database review. This task will involve review of available municipal, provincial, and federal registers and databases that identify known cultural heritage resources, and previously completed cultural heritage studies completed during the EA (ASI 2005).
2. Agency and stakeholder consultation. Agency and stakeholder consultation and engagement will be carried out as part of the preparation of the Terms of Reference and EA. Municipal and provincial heritage staff will be consulted to determine if any previously identified BHRs and CHLs, including those listed by the municipality, designated under Part IV or Part V of the Ontario Heritage Act, and those subject to any Federal recognition are located within the On-Site or Off-Site Study Areas. Consultation with interested Indigenous groups will be conducted by WM on behalf of ASI to determine if the project area contains any lands known to hold special significance or any features of known Indigenous interest.
3. Background historical research. This task includes conducting historical research for the project area and surrounding historical settlements to establish the Indigenous land use and settlement and the historical Euro-Canadian Township survey and settlement. Historical documents including local historical records, census records, and land ownership records, historical mapping, and aerial photographs will be consulted to establish the historical development and settlement history of the project area. Background historical document review will aid in the determination of approximate construction dates of structures, transportation features, and other landscape features within the project area. As part of the historical map review, project-specific mapping will be produced to illustrate the On-Site and Off-Site Study Area overlaid on historical mapping and aerial photography to demonstrate the development and evolution of the area over time.
4. Field review to document existing conditions. This task will be completed following consultation and background historical research to locate known cultural heritage resources and to identify any potential cultural heritage resources identified during background research. New potential cultural heritage resources will also be identified in field review by following the Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes (Ministry of Tourism, Culture and Sport 2016).
5. Preparation of an inventory of known and potential BHRs and CHLs within the project area. This task includes compiling the results of the heritage inventory and database review, stakeholder consultation, background historical research, and field review to produce an inventory of known and potential BHRs and CHLs within the project area. This inventory will include photographic documentation and description of general features and characteristics, and the rationale for identifying such features.

Outputs of the Characterization of Existing Conditions, including the identification of known and potential BHRs and CHLs within the On-Site and Off-Site Study Area, will allow the

project team to avoid and/or minimize potential effects to identified BHRs and CHLs during the preparation of the preferred alternative through avoidance or by establishing suitable mitigation measures. This cultural heritage assessment will be completed following the guidance presented in, and ensuring compliance with Ontario Heritage Tool Kit (Ministry of Culture 2006), the Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes (Ministry of Tourism, Culture and Sport 2016), and the Guide to Environmental Assessment Requirements for Waste Management Projects (Ministry of the Environment 2016).

4.3 Assessment of Potential Environmental Effects

Using the evaluation criteria, indicators, rationale, and data sources from Section 4.1 and the characterization of existing conditions as described in Section 4.2, the assessment of potential environmental effects will be carried out as follows:

- predict the potential environmental effects for each alternative method (Section 4.3.1);
- identify the preferred alternative based on a comparative evaluation of the potential environmental effects of each alternative method (Section 4.3.2); and
- conduct an effects assessment on the preferred alternative, including the identification of mitigation measures and monitoring programs (Sections 4.3.3).

4.3.1 Evaluation of Alternative Methods

The potential effects of each alternative method will be identified based upon application of the proposed evaluation criteria, indicators and data sources as outlined in Section 4.1. Potential effects can be positive or negative, direct or indirect, and short or long-term. Mitigation measures will be identified to minimize or mitigate the potential effects and then the net effects are evaluated taking into consideration the application of mitigation measures.

The potential effects of the undertaking on BHRs and CHLs identified in the existing conditions will be considered based on the Ontario Heritage Tool Kit InfoSheet #5: Heritage Impact Assessments and Conservation Plans (Ministry of Tourism and Culture 2006). Potential direct effects that will be considered include: the destruction of any, or part of any, significant heritage attributes or features; and alteration that is not sympathetic, or is incompatible, with the historic fabric and appearance (Ministry of Tourism and Culture 2006). Indirect effects that will be considered include: creation or alteration of shadows; isolation of a heritage attribute from its surroundings; obstruction of significant views to or from the resource; a change in land use; and land disturbance such as grading.

Indirect effects from construction-related vibration have the potential to negatively affect BHRs or CHLs depending on the type of construction methods and machinery selected for the project and proximity and composition of the identified resources. Potential vibration effects are defined as having potential to affect identified BHRs and CHLs where work is taking place within 50 m of features on the property. A 50 m buffer is applied in the absence of a project-specific defined vibration zone of influence based on existing secondary source literature and direction provided from the MHSTCI (Wiss 1981; Rainer 1982; Ellis 1987; Crispino and D'Apuzzo 2001; Carman et al. 2012). This buffer accommodates any additional or potential threat from collisions with heavy machinery or subsidence (Randl

2001). The Off-Site Study Area that extends 1 km from the limits of the TCEC is considered to be an ample buffer to account for any indirect effects to identified cultural heritage resources due to construction or operational vibration effects.

Potential effects on identified BHRs and CHLs will also be considered in terms of their magnitude, severity, duration, frequency, range, and diversity. These are outlined in a document set out by the Ministry of Culture and Communications (now MHSTCI) and the Ministry of the Environment entitled Guideline for Preparing the Cultural Heritage Resource Component of Environmental Assessments (1992).

4.3.2 Identification of the Preferred Alternative

The alternative methods will be comparatively assessed and evaluated using the proposed evaluation criteria, indicators, and data sources to determine the preferred alternative. The differences in the potential environmental effects remaining following the implementation of mitigation/management measures (i.e., net effects) will be used to identify and compare the advantages and disadvantages of each alternative method. The comparison of alternative methods will include a clear rationale for the selection of the preferred alternative.

4.3.3 Effects Assessment of the Preferred Alternative

Following the identification of the preferred alternative, an effects assessment will be carried out on the preferred alternative considering the same evaluation criteria, indicators, and data sources, and additional studies as required, considering possible mitigation and/or management measures and cumulative effects. The potential effects of the preferred alternative will be compared to the 'do nothing' alternative.

Where potential effects to known and potential BHRs or CHLs are unavoidable, the completion of a resource-specific Cultural Heritage Evaluation Report (CHER) will be required in order to evaluate the specific BHR or CHL for cultural heritage value or interest and confirm its specific heritage attributes that may be subject to effects and require conservation and/or mitigation.

The purpose of the CHER is to examine a property as whole, its relationship to surrounding landscapes, and its individual elements. Conducting archival research and site visits inform such an examination. Background information is gathered from heritage stakeholders where available, local archives, land registry offices, local history collections at public libraries, and the MHSTCI when appropriate. Once background data collection is complete, a site visit (in addition to any site visit completed during the preparation of earlier deliverables) is carried out to conduct photographic documentation and site analysis. These components provide a means to soundly establish the resource's cultural heritage value.

The scope of a CHER is guided by the Ministry of Tourism, Culture and Sport's (now administered by the Ministry of Heritage, Tourism, Sport and Culture Industries) Ontario Heritage Tool Kit (2006). Generally, CHERs include the following components:

A general description of the history of a study area as well as a detailed historical summary of property ownership and building(s) development:

- A description of the cultural heritage landscape and built heritage resources;

- Representative photographs of the structure, and character-defining details;
- A cultural heritage resource evaluation guided by the Ontario Heritage Act criteria;
- A summary of heritage attributes;
- Historical mapping and photographs; and
- A location plan.

Using background information and data collected during the site visit, the property is evaluated using criteria contained within Ontario Regulation 9/06 of the Ontario Heritage Act. The criteria are grouped into the following categories which determine the cultural heritage value or interest of a potential heritage resource in a municipality:

- Design/Physical Value;
- Historical/Associative Value; and
- Contextual Value.

Should a CHER determine that a known or potential BHR or CHL that retains cultural heritage value or interest will be impacted by the preferred alternative, a Heritage Impact Assessment (HIA) should be completed to determine the extent of impacts and to propose suitable mitigation measures.

To assess the potential effects of the preferred alternative for the proposed undertaking on the specific heritage attributes of a BHR or CHL with cultural heritage value or interest confirmed in a CHER, a detailed review of the preliminary design for the preferred alternative is required. Potential effects to identified BHRs and CHLs are considered against a range of possible negative impacts, based on the Ontario Heritage Tool Kit InfoSheet #5: Heritage Impact Assessments and Conservation Plans (Ministry of Tourism and Culture 2006). The preferred alternative will be examined in detail, and the specific effects to individual properties will be assessed for:

Direct impacts:

- Destruction of any, or part of any, significant heritage attributes or features; and
- Alteration that is not sympathetic, or is incompatible, with the historic fabric and appearance.

Indirect impacts

- Shadows created that alter the appearance of a heritage attribute or change the viability of a natural feature or plantings, such as a garden;
- Isolation of a heritage attribute from its surrounding environment, context or a significant relationship;
- Direct or indirect obstruction of significant views or vistas within, from, or of built and natural features;
- A change in land use such as rezoning a battlefield from open space to residential use, allowing new development or site alteration to fill in the formerly open spaces; and
- Land disturbances such as a change in grade that alters soils, and drainage patterns that adversely affect an archaeological resource.

Several additional factors are also considered when evaluating potential effects on identified BHRs and CHLs. These are outlined in a document set out by the Ministry of Culture and Communications (now MHSTCI) and the Ministry of the Environment entitled Guideline for Preparing the Cultural Heritage Resource Component of Environmental Assessments (1992) and include:

- Magnitude: the amount of physical alteration or destruction which can be expected;
- Severity: the irreversibility or reversibility of an impact;
- Duration: the length of time an adverse impact persists;
- Frequency: the number of times an impact can be expected;
- Range: the spatial distribution, widespread or site specific, of an adverse impact; and
- Diversity: the number of different kinds of activities to affect a heritage resource.

The proposed undertaking should endeavor to avoid adversely affecting known and potential BHRs and CHLs and interventions should be managed in such a way that identified significant cultural heritage resources are conserved. When the nature of the undertaking is such that adverse effects are unavoidable, it may be necessary to implement alternative approaches or mitigation strategies that alleviate the negative effects on identified BHRs and CHLs. Mitigation is the process of lessening or negating anticipated adverse effects to cultural heritage resources and may include, but are not limited to, such actions as avoidance, monitoring, protection, relocation, remedial landscaping, and documentation of the BHR or CHL if to be demolished or relocated.

4.4 Reporting

Two separate reports will be prepared for Cultural Heritage in support of the EA:

1. A report providing a characterization of Existing Conditions (Cultural Heritage Report: Existing Conditions); and
2. A report providing the Effects Assessment (Cultural Heritage Report: Preliminary Impact Assessment with resource-specific CHERs and HIAs included as appendices as required where potential effects are predicted).

These reports will be appended to the EA Study Report and will be available for review during the EA. A summary of the existing conditions and effects assessment will be included in the EA Study Report.

The characterization of existing conditions will include a methodology, summary of historical developments within the study area, historical mapping review, field review, inventory of known and potential BHRs and CHLs, record of municipal and Provincial and stakeholder or Indigenous consultation, technical analysis, maps of sensitive features within the On-site and Off-site Study Areas, mitigation measures, conclusions, and recommendations.

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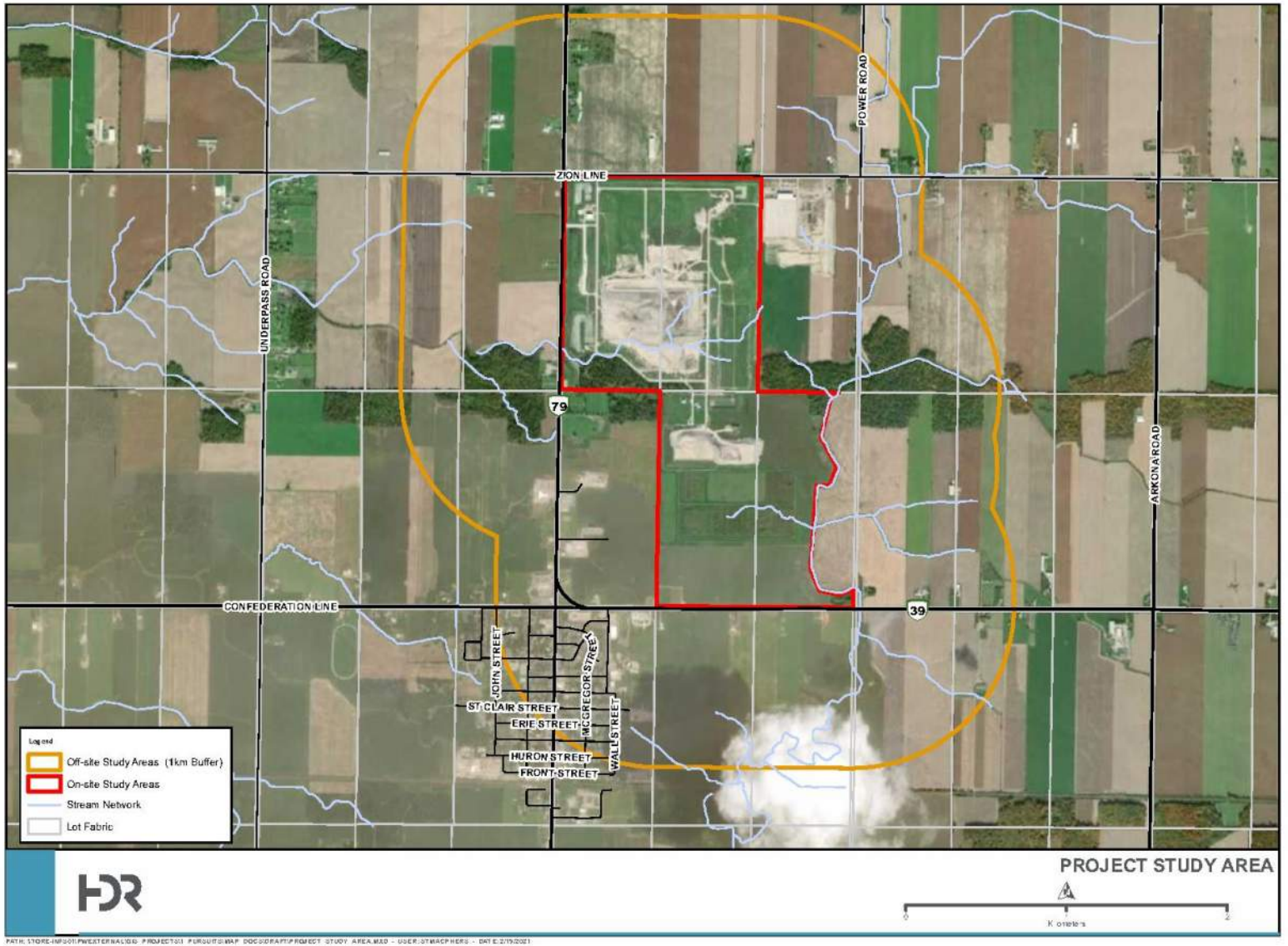
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Figures

Figure 1. General On-Site and Off-site Study Areas



Ecological Environment Work Plan

Twin Creeks Environmental Centre Landfill Optimization Project

Waste Management of Canada Corporation

Watford, Ontario

March 30, 2022

Prepared by:

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Appendix A Species at Risk / Species of Conservation Concern Screening Assessment

Appendix B Significant Wildlife Habitat Screening Assessment

Acronyms

Acronym	Definition
EA	Environmental Assessment
ELC	Ecological Land Classification
MECP	Ministry of Environment, Conservation and Parks
MNRF	Ministry of Natural Resources and Forestry
NRSI	Natural Resource Solutions Inc.
SAR	Species at Risk
SCC	Species of Conservation Concern
SCRCA	St. Clair River Conservation Authority
SWH	Significant Wildlife Habitat
TCEC	Twin Creeks Environmental Centre
ToR	Terms of Reference
WM	Waste Management of Canada Corporation

1 Introduction

This Ecological Environment (Terrestrial and Aquatic) work plan has been prepared to support the environmental assessment (EA) for the Twin Creeks Environmental Centre Landfill Optimization Project (the Project) and will be appended to the Terms of Reference (ToR) for the EA to be submitted to the Ministry of Environment, Conservation and Parks (MECP) for approval.

The Ecological Environment considers both the terrestrial and aquatic ecosystems and includes vegetation communities and species, wildlife and wildlife habitat, aquatic organisms such as fish and aquatic habitat. Studying the Ecological Environment affords an opportunity to assess the species and communities present, as well as the abundance of these organisms.

Waste Management of Canada Corporation (WM), the owner and operator of the Twin Creeks Environmental Centre (TCEC) in Watford, Ontario, has initiated an EA seeking approval to increase the landfill airspace capacity at the TCEC. The TCEC has approximately 13.2M m³ of remaining approved landfill airspace, which corresponds to about 10 years of operating life (2021 to 2031). This optimization project could provide additional airspace capacity of up to approximately 14M m³, which could extend the site life by about 12 years (from 2031 to 2043). There would be no change to the current 301 ha site area, the approved service area, or the annual fill rate.

The TCEC is a regional facility that provides safe and convenient disposal services for communities, businesses and industries serving the Province of Ontario. The landfill is approved to receive municipal, industrial, commercial, and institutional solid non-hazardous wastes generated, including non-hazardous contaminated soil.

The TCEC is engineered with environmental protection systems that meet or exceed regulatory requirements and are subject to highly regulated monitoring and reporting requirements. Systems include engineered liners and covers, leachate collection and removal, landfill gas collection and control, and on-site leachate disposal through phytoremediation. The TCEC provides landfill gas, for heating, to the 40-acre greenhouse facility adjacent to the landfill property. Prior to this, all landfill gas was flared. The intent is for the landfill to supply gas for heating to the greenhouses for 25 years.

Leachate that is generated in the waste is conveyed toward a perimeter leachate collection system. WM received approval to treat leachate through a phytoremediation system consisting of a 9.3 ha poplar system planted on the existing landfill cap in 2003. Surplus leachate is trucked off-site to approved wastewater treatment plants.

WM pays host community fees annually to the Township of Warwick. Since 2009, when the TCEC Expansion Landfill began receiving waste, WM has contributed over $24M in host community fees to the Township.

There is a need for the continued development of the TCEC as it is a significant component of the provincial waste management network and infrastructure, which is lacking in sufficient and secure long-term disposal capacity. Optimizing the future development of the TCEC allows for on-going sustainable business operations and continued provision of essential financial support for community services and programs.

The purpose of the EA is to assess the potential effects of the proposed landfill optimization on the environment. The EA will be carried out in accordance with the requirements of the *Ontario Environmental Assessment Act*.

2 Study Purpose and Objectives

This Ecological (Terrestrial and Aquatic) work plan outlines the tasks required to support the EA through the characterization of existing conditions and assessment of potential environmental effects of the project on the Terrestrial and Aquatic environment, including the evaluation of the various alternative methods and the identification and assessment of a preferred alternative. This work plan outlines the scope of the Ecological (Terrestrial and Aquatic) work, including protocols and/or standards to be adhered to while the work is undertaken. The specific evaluation criteria, indicators, and data sources to be used and the study areas to be considered are provided below. These items may be adjusted during the EA process.

In accordance with the *Ontario Environmental Assessment Act*, the objectives of the EA are as follows:

1. Describe the environment potentially affected by the proposed undertaking, including both the existing environment as well as the environment that would otherwise be likely to exist in the future without the proposed undertaking;
2. Carry out an evaluation of the environmental effects of the proposed undertaking, using the environmental assessment criteria and studies that have been established through the development of the ToR;
3. Undertake an evaluation of any additional actions that may be necessary to prevent, change or mitigate environmental effects;
4. Provide a description and evaluation of the environmental advantages and disadvantages of the proposed undertaking, based on the net environmental effects that will result following mitigation; and
5. Prepare monitoring, contingency and impact management plans to mitigate the environmental effects of the proposed undertaking.

3 Study Areas

During the EA, existing conditions and potential effects will be considered in the context of two study areas: on-site and off-site. The general study areas proposed for the purposes of the EA are (**Figure 1**):

- On-site Study Area: the existing TCEC.
- Off-site Study Area: the lands within the vicinity of the TCEC extending approximately 1 km out from the On-site Study Area.
    - The Off-site Study Area will include the Gilliland-Geerts Drain downstream and westward of the TCEC to Underpass Road.

These study areas have been adopted for the Ecological Environment. The Off-site Study Area encompasses a 'primary zone of influence' extending 120m from the existing TCEC in keeping with the definition of 'adjacent lands' as set forth in the Natural Heritage Reference Manual (MNRF 2010).

4 Scope of Work

The scope of work for the Ecological (Terrestrial and Aquatic) work includes the development of evaluation criteria, indicators, and data sources, characterization of existing terrestrial and aquatic ecological conditions, assessment of the potential environmental effects of the alternative methods and the preferred alternative, development of mitigation measures and monitoring programs, and reporting as outlined below.

4.1 Evaluation Criteria, Indicators, and Data Sources

The environmental assessment criteria, indicators, and data sources for the terrestrial and aquatic ecological environment are provided in **Table 1**. The assessment criteria, indicators, and data sources will be used to assess the effects of the alternatives and the preferred alternative on the Terrestrial and Aquatic environment. These evaluation criteria and indicators will be finalized during the EA.

Table 1. Evaluation Criteria, Indicators, and Data Sources for the Ecological Environment

Evaluation Criteria	Rationale	Indicators	Data Sources
Ecological Environment			
Terrestrial Ecosystems	Continued or expanded operation of the waste disposal facility may disturb the functioning of natural terrestrial habitats, including rare, threatened or endangered species.	• Predicted effects on vegetation communities and species including rare, threatened or endangered species • Predicted effects on wildlife and wildlife habitat including rare, threatened or endangered species	• Vegetation and wildlife data, including SAR data from previous studies • Terrestrial field studies • Aerial imagery • Local and Indigenous sources of information on the ecological functions of features within the On-site and Off-site Study Areas. • Natural Heritage Reference Manual for Natural Heritage Policies of the Provincial Policy Statement (Ontario Ministry of Natural Resources 2010) • Significant Wildlife Habitat Technical Guide (Ontario Ministry of Natural Resources 2000) • Significant Wildlife Habitat (Schedule Criteria for Ecoregion 7E (Ontario Ministry of Natural Resources and Forestry 2015) • MECP background data • MNRF background data • SCRCA background data

Table 1. Evaluation Criteria, Indicators, and Data Sources for the Ecological Environment

Evaluation Criteria	Rationale	Indicators	Data Sources
			• Natural Heritage Information Centre background data • Ontario Breeding Bird Atlas • Ontario Butterfly Atlas • Ontario Reptile and Amphibian Atlas • Ontario Odonata Atlas • Ontario Mammal Atlas • eBird • iNaturalist • Proposed facility characteristics • Landfill design and operations data • Annual monitoring report data • Results of other discipline assessments • Survey protocol for Ontario's Species at Risk Snakes (MNRF 2016a) • Survey Protocol for Blanding's Turtle in Ontario (MNRF 2015c) • Blanding's Turtle Nest and Nesting Survey Guidelines (MNRF 2016b) • Ontario Wetland Evaluation System: Southern Manual (MNRF 2014)
Aquatic Ecosystems	Continued or expanded operation of the waste disposal facility may disturb the functioning of natural aquatic habitats and species, including rare, threatened or endangered species.	• Predicted effects on aquatic habitat, including fish habitat • Predicted effects on aquatic biota including rare, threatened or endangered species	• Fish and fish habitat survey data from previous studies • Aquatic field studies • Local and Indigenous sources of information on the ecological functions of features within the On-site and Off-site Study Areas. • MNRF review letters of previous existing conditions reports • MNRF aquatic resource data • Fisheries and Oceans Canada (DFO) Aquatic Species at Risk mapping • Annual monitoring report data • Proposed facility characteristics • Landfill design and operations data • Annual monitoring report data • Results of other discipline assessments • Observations obtained as part of interviews with riparian landowners

4.2 Characterization of Existing Conditions

In order to determine a study approach for the Ecological (Terrestrial and Aquatic) Environment component of the EA, existing natural heritage information was first gathered and reviewed to identify key natural heritage features and species that are reported from, or have potential to occur within the On-site and Off-site Study Areas.

4.2.1 Background Data Collection

Available background information pertaining to the biological resources within the On-site and Off-site Study Areas was collected and reviewed to inform this work plan. During the EA, additional information from various sources will be considered and incorporated into an updated Characterization of Existing Conditions as it becomes available. This information has included (or will include) file material from the St. Clair River Conservation Authority (SCRCA), MECP, Ministry of Northern Development, Mines, Natural Resources and Forestry (MNRF), Ontario Breeding Bird Atlas (BSC et al. 2006), Ontario Butterfly Atlas (Macnaughton et al. 2020), Ontario Reptile and Amphibian Atlas (Ontario Nature 2019), Ontario Mammal Atlas (Dobbyn 1994), and online databases, such as the Natural Heritage Information Centre (NHIC), SAR listings at the federal and provincial levels, and species of regional significance.

Previous reporting from the EA prepared in 2004 will be utilized, specifically the natural heritage reporting completed by Gartner Lee Ltd. (2004).

4.2.2 Species at Risk / Species of Conservation Concern Screening

A preliminary screening has been completed to determine the potential for SAR, SCC and their habitats to be present within the On-site and Off-site Study Areas. The habitats on the site, as derived from air photo interpretation and data from existing data sources (e.g., Gartner Lee Ltd. 2004), have been compared to the habitat requirements of SAR and SCC reported from the local area. See Appendix A for the preliminary SAR/SCC screening. Based on the results of the preliminary screening, 17 SAR and SCC were identified as having potentially suitable habitat within the study areas. Surveys for these species will be undertaken and the species will be addressed in the EA.

4.2.3 Significant Wildlife Habitat Screening

Potential Significant Wildlife Habitat (SWH) types were screened based on NRSI's knowledge of the natural heritage features within the study area and using discrete significance established by the MNRF (2015a). The results of the preliminary SWH screenings have informed the surveys required to determine if such habitats are present within the On-site and Off-site Study Areas.

Based on the preliminary screening, 14 Candidate SWH types were identified as potentially occurring within the On-site and Off-site Study Areas, pending further assessment during site investigations. Appendix B provides a summary of the SWH screening exercise, including rationale as to why SWH types are considered "Candidate SWH" or "Not SWH".

4.2.4 Field Surveys and Characterization

As outlined in Section 3 of this work plan, the Off-site Study Area extends to 1km from the perimeter of the On-site Study Area (Figure 1). Field surveys will be completed in the On-site Study area and will also be completed in the Off-Site Study Area to the extent possible, subject to property access. Where property access is not available, surveys in the Off-site Study Area will focus on the lands that can be reviewed from the boundary of the On-site Study Area, as well as from road right of ways (ROWs).

The following field surveys will be completed to characterize the existing natural features and wildlife habitats according to standardized survey protocols:

Vegetation Surveys

- Mapping of vegetation communities using the Ecological Land Classification (ELC) methods for southern Ontario (Lee et al. 1998). Details on the vegetation communities will be recorded, including species composition, dominance, uncommon species or features;
- Three-season vascular flora inventory, consisting 3 visits: 1 each in the spring (early to mid-May), summer (late June to July), and late summer (late August to September) seasons. Any rare species or vegetation communities identified and their location(s) will be recorded with a handheld GPS;
    - Vascular flora inventories will also function to determine the presence of the SAR Butternut (*Juglans cinerea*) and SCC Green Dragon (*Arisaema dracontium*), Puttyroot (*Aplectrum hyemale*), and Black Ash (*Fraxinus nigra*) as identified in Appendix A;
- Wetland boundary and woodland dripline delineation and agency review to confirm boundaries of these features (this will be undertaken within the On-site Study Area only). Wetland boundary delineation will be completed in accordance with the Ontario Wetland Evaluation System (OWES; MNRF 2014). Woodlands will be delineated based on the dripline.

Avifaunal Surveys

- Breeding bird surveys, consisting of 3 visits in the early morning, spaced at least 1 week apart between May 25 and July 10. Point counts (10 min each), walking transects, and area searches will be utilized. Standard breeding evidence will be recorded according to the Ontario Breeding Bird Atlas methodology (OBBA 2020). These surveys, along with habitat characterizations, will allow for the identification of any significant species and SWH that may be present;
    - Within appropriate open grassland habitats that have been identified in Appendix A as potential habitat for the SAR Eastern Meadowlark (*Sturnella magna*) and Bobolink (*Dolichonyx oryzivorus*), breeding bird surveys will follow the methodologies outlined in the Bobolink and Eastern Meadowlark Survey Methodology (MNRF 2015b).
    - In addition to Eastern Meadowlark and Bobolink, several other bird SAR and SCC have been identified in Appendix A; breeding bird surveys will also function to determine the presence of these species;

- During all site visits, including breeding bird surveys, general observations of the abundance and activity of gulls (*Laridae* family) will be documented specifically within the On-site Study Area.
    - Information on any site-specific bird management programs that are currently in place at the existing TCEC facility will be researched and documented as part of the EA.

Herpetofaunal Surveys

- Evening anuran call surveys during the amphibian breeding season, consisting of 3 visits: 1 each in April, May, and June when air temperatures are a minimum of 5°C, 10°C, and 17°C, respectively. Surveys will be completed during the first half of each month, and will follow the methodology outlined in the Marsh Monitoring Program protocol (BSC 2009);
- Daytime anuran call surveys during the breeding season for the SCC Western Chorus Frog (*Pseudacris triseriata* pop. 2), consisting of at least 2 visits at least 24h apart between mid-March and April when air temperature is at least 10°C. Surveys will follow the methodologies outlined in the Survey Protocol for 2020 Western Chorus Frog Long-Term Monitoring Program (Blazing Star Environmental 2020), and be conducted between 1000h and 1800h. Should Western Chorus Frog be detected at any survey location by the end of the 2nd survey, a 3rd survey will not be completed. Should Western Chorus Frog not be detected by the end of the 2nd survey, a 3rd survey will be completed.
- Reptile surveys following a phased approach:
    - Phase 1 will involve a reptile habitat assessment, consisting of 1 visit in late March (prior to the spring reptile emergence period) to determine if suitable habitat for significant snake and turtle species is present. Assessments will be completed by reviewing natural features and comparing available habitats with those preferred by the target species. As summarized in Appendix A of this work plan, target species include the SCC Snapping Turtle (*Chelydra serpentina*) and the SAR Eastern Hog-nosed Snake (*Heterodon platirhinos*);
    - Phase 2 will be initiated should the reptile habitat assessment indicate that suitable habitat is present. Should it be determined that habitat for Eastern Hog-nosed Snake is present, it will be assumed that the species is present in keeping with the methods outlined in the Survey Protocol for Ontario's Species at Risk Snakes (MNRF 2016a) due to the cryptic nature of the species, and no further targeted surveys will be undertaken for this species. Should it be determined that habitat for Snapping Turtle is present, the following surveys will be completed in accordance with the methodologies outlined in the Survey Protocol for Blanding's Turtle in Ontario (MNRF 2015c) and the Blanding's Turtle Nest and Nesting Survey Guidelines (MNRF 2016b), which are also appropriate for assessing the presence of Snapping Turtle:
        - Spring turtle emergence and basking visual encounter surveys, consisting of 5 visits spread over at least 3 weeks and beginning once ice cover has melted. Surveys will occur no later than June 15, and will be conducted during the daytime when weather conditions are suitable for turtle basking;

        - Turtle nest and nesting surveys, consisting of 6 visits on suitable nights during a 3-week period following the first reports of Snapping Turtle nesting in the area. Surveys will consist of area searches for actively-nesting turtles, signs of turtle activity (e.g., tracks, test pits), and any identifiable nests;
    - Reptile area searches will also be carried out in tandem with all other surveys listed in this work plan that are conducted during suitable weather conditions within the reptile active season (April to October). During peak reptile activity periods (e.g., spring emergence, nesting), searches will expand to include driving surveys that will document any reptiles on roadways in the Off-site Study Area. These area searches and driving surveys will inform the general abundance and diversity of reptile species in the On- and Off-site Study Areas;

Insect Surveys

- Insect area searches will be carried out as part of each of the visits listed above in order to determine if Monarch (*Danaus plexippus*) and its larval food plants (Milkweed, *Asclepias* spp.) are present. Surveys will be focused in summer (June, July and August);

Mammal Surveys

- Bat habitat assessments, consisting of 2 site visits: 1 each in leaf-off and leaf-on conditions according to the Survey Protocol for Species at Risk Bats within Treed Habitats (MNRF 2017). Surveys will assess the presence of suitable roosting habitat (e.g., cavity trees, leaf clusters) that may be used by SAR bats;
    - Acoustic surveys aimed at determining the bat species that are present are not included in this work plan. WM's preference is to develop additional disposal capacity through a vertical expansion of the approved landfill. Consequently, no woodland habitat will be removed. Determining the presence or absence of SAR bat species through acoustic surveys is not typically required if habitat removal is not proposed. An assessment of potential effects on any identified habitat is appropriate. It will be assumed that SAR bat species are present if suitable habitat is present. Should a different preferred alternative be identified during the EA that will result in the removal of treed habitats, survey requirements will be confirmed with the MECP at that time;
- During all site visits, general observations of the abundance and activity of all mammal species will be documented specifically within the On-site Study Area. A particular focus will be placed on identifying the presence and type of predatory mammals. Direct observations, as well as signs such as dens, tracks, scats, etc.

Aquatic Surveys

- Aquatic habitat assessments of watercourse features to characterize the current aquatic habitat conditions. This will include an assessment of the general morphology of the features (e.g., bankfull and wetted widths, bank height, riffle/pool characteristics), general flow conditions and water depths, substrate composition, available aquatic habitat and instream cover, riparian vegetation community conditions and adjacent land uses, and in situ water quality measurements (e.g., water temperature, conductivity, pH and turbidity). Surveys will be completed in the spring

and summer. Primary focus will be on the Kersey Drain / Brown Creek, and the Gilliland-Geerts Drains and their headwater tributaries;

  - Flow conditions and water temperature in the watercourses of primary focus will be documented during the completion of other surveys throughout the field season, to provide information on the flow and thermal regimes of the features.

- Fish community surveys will be completed to assess the presence of direct fish habitat in the watercourses of primary focus. Surveys will be undertaken with a backpack electrofishing unit and will be conducted in accordance with the Ontario Stream Assessment Protocol (OSAP) single-pass electrofishing methodology (Stanfield 2017). Once collected, fish will be identified to species and released outside of the sampling area. The number of individual fish, and minimum and maximum lengths for each species, will be recorded along with representative photographs of each species. Water quality conditions, electrofisher settings, and number of shocking seconds for each pass will be documented. Due to the intermittent/ephemeral nature of the features, surveys will be conducted when flows are seasonally elevated in either the spring or fall;

  - While fish community assessments will provide information on the composition and diversity of resident fish populations, they will also function to determine the presence of the SCC Northern Sunfish (*Lepomis peltastes*) as identified in Appendix A;

Other Surveys

- In addition to targeted surveys noted above, all wildlife species will be recorded during field surveys. Any features that may be indicative of SWH or habitat for SAR will be documented in detail, photographed, and georeferenced. General assessments of habitat connectivity and ecological linkage areas will be also be completed during surveys.

4.3 Assessment of Potential Environmental Effects

Using the evaluation criteria, indicators, rationale, and data sources from Section 4.1 and the characterization of existing conditions as described in Section 4.2, the assessment of potential environmental effects will be carried out as follows:

- predict the potential environmental effects for each alternative method (Section 4.3.1);
- identify the preferred alternative based on a comparative evaluation of the potential environmental effects of each alternative method (Section 4.3.2); and
- conduct an effects assessment on the preferred alternative, including the identification of mitigation measures and monitoring programs (Sections 4.3.3).

4.3.1 Evaluation of Alternative Methods

The potential effects of each alternative method will be identified based upon application of the proposed evaluation criteria, indicators and data sources as outlined in Section 4.1. Potential effects can be positive or negative, direct or indirect, and short or long-term. Mitigation measures will be identified to minimize or mitigate the potential effects and then

the net effects are evaluated taking into consideration the application of mitigation measures.

The analysis and evaluation of impacts will be divided into direct, indirect, induced, and cumulative impacts, which will be assessed in the short- and long-terms.

- Direct impacts associated with the disruption or displacement caused by the actual proposed footprint of the undertaking, such as direct impacts to wildlife and/or their habitats;
- Indirect impacts associated with changes in site conditions, such as indirect impacts to wildlife and modifications to drainage and water quantity and quality; and
- Induced impacts associated with impacts after the landfill expansion is in operation, such as the subsequent increase in landfill capacity and the increased demand on the resources by use of the area.

Recommendations with regard to mitigation of construction and residual effects will also be made and opportunities for enhancements will be highlighted. As part of the recommendations outlined, timing windows to avoid impacts will be included, such as tree removal (if required).

4.3.2 Identification of the Preferred Alternative

The alternative methods will be comparatively assessed and evaluated using the proposed evaluation criteria, indicators, and data sources to determine the preferred alternative. The differences in the potential environmental effects remaining following the implementation of mitigation/management measures (i.e., net effects) will be used to identify and compare the advantages and disadvantages of each alternative method. The comparison of alternative methods will include a clear rationale for the selection of the preferred alternative.

4.3.3 Effects Assessment of the Preferred Alternative

Following the identification of the preferred alternative, an effects assessment will be carried out on the preferred alternative considering the same evaluation criteria, indicators, and data sources, and additional studies as required, considering possible mitigation and/or management measures and cumulative effects. The potential effects of the preferred alternative will be compared to the ‘do nothing’ alternative and will examine cumulative impacts associated with surrounding activities over time and space.

4.4 Reporting

Two separate reports will be prepared for the Ecological (Terrestrial and Aquatic) work in support of the EA:

1. A report providing a characterization of Existing Conditions; and
2. A report providing the Effects Assessment.

These reports will be appended to the EA Study Report and will be available for review during the EA. A summary of the existing conditions and effects assessment will be included in the EA Study Report.

The characterization of existing conditions will include details of completed field investigations, technical analyses, methods, results, maps of sensitive features within the On-site and Off-site Study Areas, conclusions, and recommendations.

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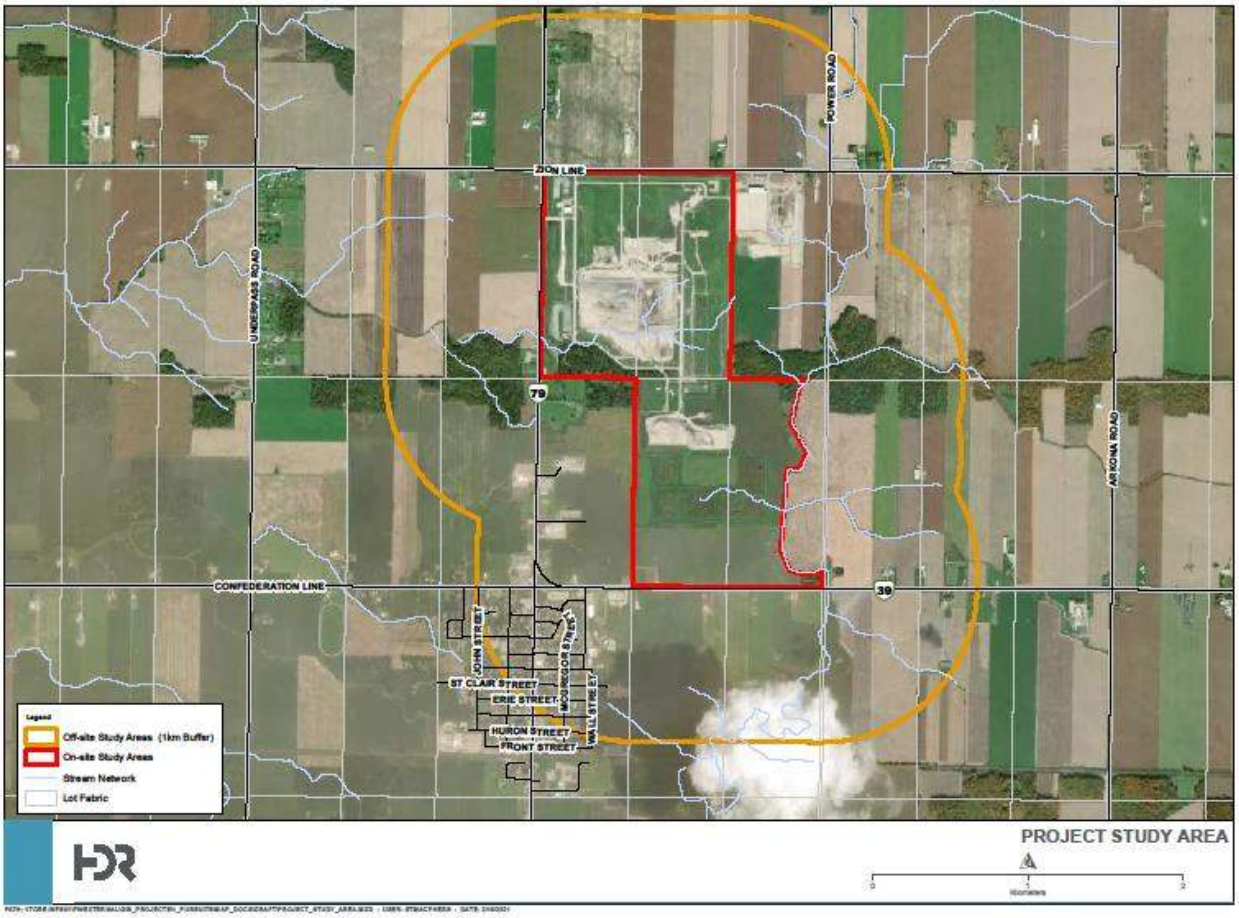
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Figures

Figure 1. General On-site and Off-site Study Areas



A

Species at Risk / Species of Conservation Concern Screening Assessment

Preliminary Species at Risk and Species of Conservation Concern Screening - Twin Creeks Environmental Centre Landfill Optimization Project (Project #2538)

Scientific Name	Common Name	S-RANK[1]	SARO[1]	COSEWIC[2]	SARA[2]	SARA Schedule[2]	Background Source	Habitat Requirements	Suitable Habitat Within Study Areas?
Birds									
Chaetura pelagica	Chimney Swift	S3B	THR	T	T	Schedule 1	BSC et al. 2006	Commonly found in urban areas near buildings; nests in chimneys, hollow trees,and crevices of rock cliffs. Feeds over open water.[3,4]	Unlikely. Cultural woodlands and deciduous forests present within On- and Off-site Study Areas and may contain suitable cavity trees with diameter (dbh) > 50cm, however this species prefers to nest in uncapped chimneys which are rare within the On- and Off-Site Study Areas. Breeding bird surveys will be completed to confirm presence / absence.
Contopus virens	Eastern Wood-pewee	S4B	SC	SC	SC	Schedule 1	Gartner Lee Ltd. 2004; BSC et al. 2006	Mid-canopy layer of forest clearings and edges of deciduous and mixed forest. Abundant in intermediate-age mature forest stands with little understory vegetation.[3,4]	Yes. Deciduous forest and cultural woodland habitats are present within the On- and Off-Site Study Areas. Breeding bird surveys will be completed to confirm presence / absence.
Dolichonyx oryzivorus	Bobolink	S4B	THR	T	T	Schedule 1	Gartner Lee Ltd. 2004; BSC et al. 2006; MNRF 2021b	Large (>10 ha), open expansive grasslands, pastures, hayfields, meadows or fallow fields with dense ground cover. Occassionally nest in large (>50 ha) fields of winter wheat and rye in southwestern Ontario. [3,4]	Yes. Suitable habitat consisting of cultural meadows is present within the On-site Study Area. Active agricultural lands, particularly row crops, found within the Off-site Study Area are not suitable for Bobolink. Breeding bird surveys will be completed to confirm presence / absence.
Hirundo rustica	Barn Swallow	S4B	THR	SC	T	Schedule 1	BSC et al. 2006	Farmlands, rural areas and other open or semi-open areas near body of water. Nests almost exclusively on human-made structures such as open barns, buildings, bridges and culverts.[3,4]	Yes. Suitable foraging and nesting habitat is likely present within the On- and Off-Site Study Areas. Breeding bird surveys will be completed to confirm presence / absence.
Hylocichla mustelina	Wood Thrush	S4B	SC	T	T	Schedule 1	Gartner Lee Ltd. 2004; BSC et al. 2006	Carolinian and Great Lakes-St. Lawrence forest zones. Undisturbed moist mature deciduous or mixed forest with deciduous sapling growth. Near pond or swamp. Must have some trees higher than 12 m.[3,4]	Yes. Deciduous forest and cultural woodland habitats are present within the On- and Off-Site Study Areas. Breeding bird surveys will be completed to confirm presence / absence.
Riparia riparia	Bank Swallow	S4B	THR	T	T	Schedule 1	BSC et al. 2006	Nests in burrows in natural and human-made settings with vertical faces in silt and sand deposits. Ususally on banks of river and lakes, but also found in sand and gravel pits.[3,4]	Possible. Suitable foraging habitat is present within the On- and Off-Site Study Areas. Suitable nesting habitat may be present within the On-site Study Area. Breeding bird surveys will be completed to confirm presence / absence.
Sturnella magna	Eastern Meadowlark	S4B, S3N	THR	T	T	Schedule 1	Gartner Lee Ltd. 2004; BSC et al. 2006; MNRF 2021b	Open pastures, hayfields, grasslands or grassy meadows with elevated singing perches (small trees, shrubs or fence posts). Also weedy borders of croplands, roadsides, orchards, airports, shrubby overgrown fields or other open areas. Generally prefers larger tracts of habitat >10 ha, but will sometimes use smaller tracts.[3,4]	Yes. Suitable habitat consisting of cultural meadows is present within the On-site Study Area. Active agricultural lands, particularly row crops, found within the Off-site Study Area are not suitable for Eastern Meadowlark. Breeding bird surveys will be completed to confirm presence / absence.
Herpetofauna									
Turtles									
Chelydra serpentina	Snapping Turtle	S4	SC	SC	SC	Schedule 1	Ontario Nature 2019	Slow-flowing rivers and streams, lakes, and permanent or semi-permanent wetlands with soft substrates and vegetation. Key habitat requirements: open areas with structures for basking, open sand or gravel areas for nesting, shallow areas with soft substrates to bury in, soft banks or substrates for hibernation.[3]	Yes. A reptile habitat assessment will be completed to confirm the presence of suitable habitat for the species. If suitable habitat is present, targeted surveys for turtles will be completed to confirm presence / absence.

Preliminary Species at Risk and Species of Conservation Concern Screening - Twin Creeks Environmental Centre Landfill Optimization Project (Project #2538)

Scientific Name	Common Name	S-RANK[1]	SARO[1]	COSEWIC[2]	SARA[2]	SARA Schedule[2]	Background Source	Habitat Requirements	Suitable Habitat Within Study Areas?
Snakes									
Heterodon platirhinos	Eastern Hog-nosed Snake	S3	THR	T	T	Schedule 1	MECP 2021	Open habitats, such as open woods, brushland or forest edges, with well-drained loose or sandy soils, well-drained substrates. Specializes in hunting and eating toads; occurs in habitats near or adjacent to wetland habitats where toads are present. Rocks, logs, stumps, etc. are used for shelter. Uses snout to dig nests as well as to dig burrows for overwintering.[5]	Yes. Suitable habitat is likely to be present within the On- and Off-Site Study Areas. A reptile habitat assessment will be completed to confirm the presence of suitable habitat for the species. Should it be determined that habitat for Eastern Hog-nosed Snake is present, it will be assumed that the species is present, and no further targeted surveys will be undertaken.
Anurans									
Pseudacris triseriata pop.2	Western Chorus Frog (Great Lakes - St. Lawrence - Canadian Shield population)	S4	NAR	T	T	Schedule 1	iNaturalist 2021	Moist forest, prairie, meadows, cultural meadows, or marshes. Breeds in shallow, temporary, fishless wetlands, including flooded ditches, marshes, flooded fields, pastures, temporary ponds, pools, and swamps. Hibernates in terrestrial habitats under rocks, logs, leaf litter, loose soil, or in animal burrows.[6]	Yes. Daytime anuran call surveys for breeding frogs and toads will be completed to confirm presence / absence.
Mammals									
Myotis lucifungus	Little Brown Myotis	S3	END	E	E	Schedule 1	Dobbyn 1994	Uses caves, quarries, tunnels, hollow trees or buildings for roosting. Winters in humid caves. Maternity sites in dark warm areas such as attics and barns. Feeds primarily in wetlands and forest edges.[3,4]	Yes. Bat habitat assessments will be conducted to confirm if suitable habitat is present. Should it be determined that habitat for Little Brown Myotis is present, it will be assumed that the species is present.
Myotis septentrionalis	Northern Myotis	S3	END	E	E	Schedule 1	Dobbyn 1994	Roosts in houses and man-made structures but prefers hollow trees or under loose bark. Hibernates in mines or caves. Hunts within forest, below the canopy.[3,4]	Yes. Bat habitat assessments will be conducted to confirm if suitable habitat is present. Should it be determined that habitat for Northern Myotis is present, it will be assumed that the species is present.
Perimyotis subflavus	Tri-colored Bat	S3?	END	E	E	Schedule 1	Dobbyn 1994	Roosts and maternity colonies in older forests and occassionally in barns or other sturctures. Forage over water and along streams in the forest. Hibernate in caves.[3,4]	Yes. Bat habitat assessments will be conducted to confirm if suitable habitat is present. Should it be determined that habitat for Tri-colored Bat is present, it will be assumed that the species is present.
Insects									
Butterflies									
Danaus plexippus	Monarch	S2N, S4B	SC	END	SC	Schedule 1	Macnaughton et al. 2020	Adults found in a diversity of habitats with a variety of wildflowers. Caterpillars are confined to meadows and open areas where milkweeds grow (larval food plants).[3]	Yes. Suitable habitat consisting of cultural meadows and cultural woodlands are present within the On-and Off-Site Study Areas. Insect surveys will be conducted within the study area to determine presence / absence.
Polystoechotes punctata	Speckled Giant Lacewing	SH	-	-	-	-	MNRF 2021b	Cultural and natural landscapes. Extirpated from Ontario by mid-1950s. Only present in western North America (M. Burrell, NHIC pers.comm).	No. Species extirpated from Ontario.
Fish									
Lepomis peltastes pop. 2	Northern Sunfish (Great Lakes - Upper St. Lawrence populations)	S3	SC	SC	SC	Schedule 1	DFO 2019	Shallow vegetated areas of quiet, slow-flowing rivers and streams, as well as warm lakes and ponds, with sandy banks or rocky bottoms.[7]	Yes. Based on past surveys, Kersey Drain / Brown Creek and the Gilliland-Geerts Drain are likely to provide suitable aquatic habitat that could support Northern Sunfish. Fish community assessments will be completed to confirm presence / absence.

Preliminary Species at Risk and Species of Conservation Concern Screening - Twin Creeks Environmental Centre Landfill Optimization Project (Project #2538)

Scientific Name	Common Name	S-RANK[1]	SARO[1]	COSEWIC[2]	SARA[2]	SARA Schedule[2]	Background Source	Habitat Requirements	Suitable Habitat Within Study Areas?
Plants									
Aplectrum hyemale	Puttyroot	S2	-	-	-	-	MNRF 2021b	Rich forests, both upland beech-maple and swamps in moist ground.[8]	Possible. Deciduous forests found within the On- and Off-Site Study Areas may provide suitable growing conditions. Vascular flora inventories will be conducted to determine presence / absence.
Arisaema dracontium	Green Dragon	S3	-	SC	SC	Schedule 3	MNRF 2021b	Moist forests, especially along river banks and floodplains.[8]	Possible. Deciduous forests found within the On- and Off-Site Study Areas may provide suitable growing conditions. Vascular flora inventories will be conducted to determine presence / absence.
Fraxinus nigra	Black Ash	S4	-	T	NS	No Schedule	Gartner Lee Ltd. 2004	Usually on mucky or peaty soils in swamps, such as river floodplains.[8]	Yes. Deciduous forests found within the On- and Off-Site Study Areas provide suitable growing conditions. Vascular flora inventories will be conducted to determine presence / absence.
Juglans cinerea	Butternut	S2?	END	E	E	Schedule 1	Gartner Lee Ltd. 2004	Stream banks and swamps, as well as upland beech-maple, oak-hickory, and mixed hardwood stands.[8]	Yes. Deciduous forests found within the On- and Off-Site Study Areas provide suitable growing conditions. Vascular flora inventories will be conducted to determine presence / absence.

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B

Significant Wildlife Habitat Screening Assessment

Significant Wildlife Habitat Assessment Tables

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Waterfowl Stopover and Staging Areas (Terrestrial)					
Rationale: Habitat important to migrating waterfowl	American Black Duck Northern Pintail Gadwall Blue-winged Teal Green-winged Teal American Wigeon Northern Shoveler Tundra Swan	CUM1 CUT1 - Plus evidence of annual spring flooding from melt water or run-off within these Ecosites. - Fields with seasonal flooding and waste grain in the Long Point, Rondeau, Lake. St. Clair, Grand Bend and Pt. Pelee areas may be important to Tundra Swans.	Fields with sheet water during Spring (mid March to May). • Fields flooding during spring melt and run-off provide important invertebrate foraging habitat for migrating waterfowl. • Agricultural fields with waste grains are commonly used by waterfowl, these are not considered SWH unless they have spring sheet water available[cxlviii] Information Sources • Anecdotal information from the landowner, adjacent landowners or local naturalist clubs may be good information in determining occurrence. • Reports and other information available from Conservation Authorities (CAs) • Sites documented through waterfowl planning processes (eg. EHJV implementation plan) • Field Naturalist Clubs • Ducks Unlimited Canada • Natural Heritage Information Centre (NHIC) Waterfowl Concentration Area	Studies carried out and verified presence of an annual concentration of any listed species, evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"[ccxi] • Any mixed species aggregations of 100[f] or more individuals required. • The area of the flooded field ecosite habitat plus a 100-300m radius buffer dependant on local site conditions and adjacent land use is the significant wildlife habitat[cxlviii]. • Annual use of habitat is documented from information sources or field studies (annual use can be based on studies or determined by past surveys with species numbers and dates). • SWHMIST[cxlix] Index #7 provides development effects and mitigation measures.	Study area highly disturbed, specifically the TCEC. Species are not tolerant to human disturbance. **Not SWH**

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Waterfowl Stopover and Staging Areas (Aquatic)					
Rationale: Important for local and migrant waterfowl populations during the spring or fall migration or both periods combined. Sites identified are usually only one of a few in the eco-district	Canada Goose Cackling Goose Snow Goose Green-winged Teal American Black Duck Northern Pintail Northern Shoveler American Wigeon Gadwall Blue-winged Teal Hooded Merganser Common Merganser Red-breasted Merganser Lesser Scaup Greater Scaup Common Goldeneye Bufflehead Long-tailed Duck Surf Scoter White-winged Scoter Black Scoter Canvasback Redhead Ruddy Duck Brant White-winged Scoter Black Scoter	MAS1 MAS2 MAS3 SAS1 SAM1 SAF1 SWD1 SWD2 SWD3 SWD4 SWD5 SWD6 SWD7	• Ponds, marshes, lakes, bays, coastal inlets, and watercourses used during migration. Sewage treatment ponds and storm water ponds do not qualify as a SWH, however a reservoir managed as a large wetland or pond/lake does qualify. • These habitats have an abundant food supply (mostly aquatic invertebrates and vegetation in shallow water). Information Sources • Environment Canada • Naturalist clubs often are aware of staging/stopover areas • OMNRF Wetland Evaluations indicate presence of locally and regionally significant waterfowl staging. • Sites documented through waterfowl planning processes (eg. EHJV implementation plan) • Ducks Unlimited projects • Element occurrence specification by Nature Serve: http://www.natureserve.org • Natural Heritage Information Centre (NHIC) Waterfowl Concentration Area	Studies carried out and verified presence of: • Aggregations of 100[i] or more of listed species for 7 days[i], results in >700 waterfowl use days. • Areas with annual staging of ruddy ducks, canvasbacks, and redheads are SWH[cxlix] • The combined area of the ELC ecosites and a 100m radius area is the SWH[cxlviii] • Wetland area and shorelines associated with sites identified within the SWHTG[cxlviii] Appendix K[cxlix] are significant wildlife habitat. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"[ccxi] • Annual Use of Habitat is Documented from Information Sources or Field Studies (Annual can be based on completed studies or determined from past surveys with species numbers and dates recorded). • SWHMIST[cxlix] Index #7 provides development effects and mitigation measures.	Suitable habitat is not present within study area. **Not SWH**

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Shorebird Migratory Stopover Area					
Rationale: High quality shorebird stopover habitat is extremely rare and typically has a long history of use	Greater Yellowlegs Lesser Yellowlegs Marbled Godwit Hudsonian Godwit Black-bellied Plover American Golden-Plover Semipalmated Plover Solitary Sandpiper Spotted Sandpiper Semipalmated Sandpiper Pectoral Sandpiper White-rumped Sandpiper Baird's Sandpiper Least Sandpiper Purple Sandpiper Stilt Sandpiper Short-billed Dowitcher Red-necked Phalarope Whimbrel Ruddy Turnstone Sanderling Dunlin	BBO1 BBO2 BBS1 BBS2 BBT1 BBT2 SDO1 SDS2 SDT1 MAM1 MAM2 MAM3 MAM4 MAM5	Shorelines of lakes, rivers and wetlands, including beach areas, bars and seasonally flooded, muddy and un-vegetated shoreline habitats. Great Lakes coastal shorelines, including groynes and other forms of armour rock lakeshores, are extremely important for migratory shorebirds in May to mid-June and early July to October. Sewage treatment ponds and storm water ponds do not qualify as a SWH. Information Sources • Western hemisphere shorebird reserve network • Canadian Wildlife Service (CWS) Ontario Shorebird Survey • Bird Studies Canada • Ontario Nature • Local birders and naturalist clubs • Natural Heritage Information Center (NHIC) Shorebird Migratory Concentration Area	Studies confirming: • Presence of 3 or more of listed species and > 1000[i] shorebird use days during spring or fall migration period (shorebird use days are the accumulated number of shorebirds counted per day over the course of the fall or spring migration period). • Whimbrel stop briefly (<24hrs) during spring migration, any site with >100[i] Whimbrel used for 3 years or more is significant. • The area of significant shorebird habitat includes the mapped ELC shoreline ecosites plus a 100m radius area[cxlviii] • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"[ccxi] • SWHMIST[cxlix] Index #8 provides development effects and mitigation measures.	Suitable habitat is not present within study area. **Not SWH**

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Raptor Wintering Area					
Rationale: Sites used by multiple species, a high number of individuals and used annually are most significant	Rough-legged Hawk Red-tailed Hawk Northern Harrier American Kestrel Snowy Owl Special Concern: Short-eared Owl Bald Eagle	Hawks/Owls: Combination of ELC Community Series; need to have present one Community Series from each land class. Forest: FOD, FOM, FOC Upland: CUM, CUT, CUS, CUW Bald Eagle: Forest Community Series: FOD, FOM, FOC, SWD, SWM, or SWC, on shoreline areas adjacent to large rivers or adjacent to lakes with open water (hunting area).	The habitat provides a combination of fields and woodlands that provide roosting, foraging and resting habitats for wintering raptors. Raptor wintering (hawk/owl) sites need to be > 20ha[cxlviii, cxlix] with a combination of forest and upland[xvi, xvii, xviii, xix, xx, xxi]. Least disturbed sites, idle/fallow or lightly grazed field/meadow (>15ha) with adjacent woodlands[cxlix] Field area of the habitat is to be wind swept with limited snow depth or accumulation. Eagle sites have open water and large trees and snags aviable for roosting[cxlix] Information Sources • OMNRF Districts • Natural clubs • Natural Heritage Information Centre (NHIC) Raptor Winter Concentration Area • Data from Bird Studies Canada • Reports and other information available from CAs • Results of Christmas Bird Counts	Studies confirm the use of these habitats by: • One or more Short-eared Owls, or, One of more Bald Eagles or; at least 10 individuals and two listed hawk/owl species • To be significant a site must be used regularly (3 in 5 years)[cxlix] for a minimum of 20 days by the above number of birds[i]. • The habitat area for an Eagle winter site is the shoreline forest ecosites directly adjacent to the prime hunting area. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"[ccxi] • SWHMIST[cxlix] Index #10 and #11 provides development effects and mitigation measures.	Study area highly disturbed, specifically the TCEC. Species are not tolerant to human disturbance. **Not SWH**

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Bat Hibernacula					
Rationale: Bat hibernacula, are rare habitats in all Ontario landscapes.	Big Brown Bat Eastern Pipistrelle/Tri-colored Bat	Bat Hibernacula may be found in these ecosites: CCR1 CCR2 CCA1 CCA2 (Note: buildings are not considered to be SWH)	Hibernacula may be found in caves, mine shafts, underground foundations and Karsts. Active mine sites should not be considered The locations of bat hibernacula are relatively poorly known. Information Sources • OMNRF for possible locations and contact for local experts • Natural Heritage Information Centre (NHIC) Bat Hibernaculum • Ministry of Northern Development and Mines for location of mine shafts • Clubs that explore caves (eg. Sierra Club) • University Biology Departments with bat experts	• All sites with confirmed hibernating bats are SWH[i]. • The area includes 200m radius around the entrance of the hibernaculum[cxlviii, ccvii, í]. for the development types and 1000m for wind farms [ccv.] • Studies are to be conducted during the peak swarming period (Aug. – Sept.). Surveys should be conducted following methods outlined in the[ccv]."Bats and Bat Habitats: Guidelines for Wind Power Projects" [ccv] • SWHMIST[cxlix] Index #1 provides development effects and mitigation measures.	Suitable habitat not present within study area. **Not SWH**

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Bat Maternity Colonies					
Rationale: Known locations of forested bat maternity colonies are extremely rare in all Ontario landscapes.	Big Brown Bat Silver-haired Bat	Maternity colonies considered SWH are found in forested Ecosites. All ELC Ecosites in ELC Community Series: FOD FOM SWD SWM	Maternity colonies can be found in tree cavities, vegetation and often in building [sxxii, xxv, xxvi, xxvii, xxxi] (buildings are not considered to be SWH). • Maternity roosts are not found in caves and mines in Ontario[xxii]. • Maternity colonies located in Mature deciduous or mixed forest stands[ccix, ccx] with >10/ha large diameter (>25cm dbh) wildlife trees[ccvii]. • Female Bats prefer wildlife tree (snags) in early stages of decay, class 1-3[ccxiv] or class 1 or 2[ccxii]. • Silver-haired Bats prefer older mixed or deciduous forest and form maternity colonies in tree cavities and small hollows. Older forest areas with at least 21 snags/ha are preferred[ccx]. Information Sources • OMNRF for possible locations and contact for local experts • University Biology Departments with bat experts	Maternity Colonies with confirmed use by: • >10 Big Brown Bats[i] • >5 Adult Female Silver-haired Bats[i] • The area of the habitat includes the entire woodland or the forest stand ELC Ecosite containing the maternity colonies[i]. • Evaluation methods for maternity colonies should be conducted following methods outlined in the "Bats and Bat Habitats: Guidelines for Wind Power Projects"[ccv]. • SWHMIST[cxlix] Index #12 provides development effects and mitigation measures.	Suitable habitat is present within the study area. Bat habitat surveys will be completed in 2021 to determine presence / absence of this feature. **Candidate SWH**

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Turtle Wintering Area					
Rationale: Generally sites are the only known sites in the area. Sites with the highest number of individuals are most significant.	Midland Painted Turtle Special Concern: Northern Map Turtle Snapping Turtle	Snapping and Midland Painted Turtles: ELC Community Classes: SW, MA, OA and SA ELC Community Series: FEO and BOO Northern Map Turtle: Open Water areas such as deeper rivers or streams and lakes with current can also be used as over-wintering habitat.	• For most turtles, wintering areas are in the same general area as their core habitat. Water has to be deep enough not to freeze and have soft mud substrates. • Over-wintering sites are permanent water bodies, large wetlands, and bogs or fens with adequate Dissolved Oxygen[cix, cx, cxi, cxviii]. • Man-made ponds such as sewage lagoons or storm water ponds should not be considered SWH Information Sources • EIS studies carried out by Conservation Authorities • Field naturalists clubs • OMNRF Ecologist or Biologist • Natural Heritage Information Centre (NHIC)	• Presence of 5 over-wintering Midland Painted Turtles is significant[i]. • One or more Northern Map Turtle or Snapping Turtle over-wintering within a wetland is significant[í]. • The mapped ELC ecosite area with the over wintering turtles is the SWH. If the hibernation site is within a stream or river, the deep-water pool where the turtles are over wintering is the SWH. • Over wintering areas may be identified by searching for congregations (Basking Areas) of turtles on warm, sunny days during the fall (Sept. – Oct.) or spring (Mar. – Apr)[cvii]. Congregation of turtles is more common where wintering areas are limited and therefore significant[cix, cx, cxi, cxii]. • SWHMIST[cxiix] Index #28 provides development effects and mitigation measures for turtle wintering habitat.	Suitable habitat is present within the study area. Reptile surveys will be conducted in 2021 to determine presence, although absence cannot be ruled out without more extensive surveys. **Candidate SWH**

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Reptile Hibernaculum					
Rationale: Generally sites are the only known sites in the area. Sites with the highest number of individuals are most significant	Snakes: Eastern Gartersnake Northern Watersnake Northern Red-bellied Snake Northern Brownsnake Smooth Green Snake Northern Ring-necked Snake Special Concern: Milksnake Eastern Ribbonsnake	For all snakes, habitat may be found in any ecosite in southern Ontario other than very wet ones. Talus, Rock Barren, Crevice and Cave, and Alvar sites may be directly related to these habitats. Observations of congregations of snakes on sunny warm days in the spring or fall is a good indicator. The existence of rock piles or slopes, stone fences, and crumbling foundations assist in identifying candidate SWH.	For snakes, hibernation takes place in sites located below frost lines in burrows, rock crevices and other natural locations. Areas of broken and fissured rock are particularly valuable since they provide access to subterranean sites below the frost line[xliv, l, li, lii, cxii]. Wetlands can also be important over-wintering habitat in conifer or shrub swamps and swales, poor fens, or depressions in bedrock terrain with sparse trees or shrubs with sphagnum moss or sedge hummock ground cover. Information Sources • In spring, local residents or landowners may have observed the emergence of snakes on their property (e.g. old dug wells). • Reports and other information available from CAs • Local naturalists and experts, as well as university herpetologists may also know where to find some of these sites. • Natural Heritage Information Centre (NHIC)	Studies confirming: • Presence of snake hibernacula used by a minimum of five individuals of a snake sp., or, individuals of two or more snake spp. • Congregations of a minimum of five individuals of a snake sp., or, individuals of two or more snake spp. near potential hibernacula (eg. foundation or rocky slope) on sunny warm days in Spring (Apr/May) and Fall (Sept/Oct)[í]. • Note: If there are Special Concern Species present, then site is SWH • Note: Sites for hibernation possess specific habitat parameters (e.g. temperature, humidity, etc.) and consequently are used annually, often by many of the same individuals of a local population (i.e. strong hibernation site fidelity). Other critical life processes (e.g. mating) often take place in close proximity to hibernacula. The feature in which the hibernacula is located plus a 30m buffer is the SWH[í]. • SWHMIST[cxlix] Index #13 provides development effects and mitigation measures for snake hibernacula.	Suitable habitat may be present within the study area. Reptile surveys will be completed in 2021 to determine presence, although absence cannot be ruled out without more extensive surveys. **Candidate SWH**

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Colonially - Nesting Bird Breeding Habitat (Bank and Cliff)					
Rationale: Historical use and number of nests in a colony make this habitat significant. An identified colony can be very important to local populations. All swallow population are declining in Ontario.	Cliff Swallow Northern Rough-winged Swallow (this species is not colonial but can be found in Cliff Swallow colonies)	Eroding banks, sandy hills, borrow pits, steep slopes, and sand piles Cliff faces, bridge abutments, silos, barns Habitat found in the following ecosites: CUM1 CUT1 CUS1 BLO1 BLS1 BLT1 CLO1 CLS1 CLT1	• Any site or areas with exposed soil banks, undisturbed or naturally eroding that is not a licensed/permitted aggregate area. • Does not include man-made structures (bridges or buildings) or recently (2 years) disturbed soil areas, such as berms, embankments, soil or aggregate stockpiles. • Does not include a licensed/permitted Mineral Aggregate Operation. Information Sources • Reports and other information available from CAs • Ontario Breeding Bird Atlas[ccv]. • Bird Studies Canada: Nature Counts http://www.birdscanada.org/birdmon/ • Field Naturalist clubs	Studies confirming: • Presence of 1 or more nesting sites with 8[cxlvix] or more cliff swallow pairs and/or rough-winged swallow pairs during the breeding season. • A colony identified as SWH will include a 50m radius habitat area from the peripheral nests[ccvii]. • Field surveys to observe and count swallow nests are to be completed during the breeding season. Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"[ccxi]. • SWHMIST[cxlix] Index #4 provides development effects and mitigation measures.	Suitable habitat may be present within the study area. Breeding bird surveys will be completed in 2021 to determine presence/absence. **Candidate SWH**

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Colonially - Nesting Bird Breeding Habitat (Tree/Shrubs)					
Rationale: Large colonies are important to local bird population, typically sites are only known colony in area and are used annually.	Great Blue Heron Black-crowned Night-Heron Great Egret Green Heron	SWM2 SWM3 SWM5 SWM6 SWD1 SWD2 SWD3 SWD4 SWD5 SWD6 SWD7 FET1	• Nests in live or dead standing trees in wetlands, lakes, islands, and peninsulas. Shrubs and occasionally emergent vegetation may also be used. • Most nests in trees are 11 to 15 m from ground, near the top of the tree. Information Sources • Ontario Breeding Bird Atlas[ccv], colonial nest records. • Ontario Heronry Inventory 1991 available from Bird Studies Canada or NHIC (OMNRF). • Natural Heritage Information Centre (NHIC) Mixed Wader Nesting Colony • Aerial photographs can help identify large heronries. • Reports and other information available from CAs • MNRF District Offices • Field naturalist clubs	Studies confirming: • Presence of 2 or more active nests of Great Blue Heron or other list species. • The habitat extends from the the edge of the colony and a minimum 300m radius or extent of the Forest Ecosite containing the colony or any island <15.0ha with a colony is the SWH[cc, ccvii]. • Confirmation of active colonies must be achieved through site visits conducted during the nesting season (April to August) or by evidence such as the presence of fresh guano, dead young and/or eggshells • SWHMIST[cxlix] Index #5 provides development effects and mitigation measures.	Marginal suitable habitat is present within the study area, however, criterion species are not tolerant of heavily industrial environment of the immediate study area. **Not SWH**

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Colonially - Nesting Bird Breeding Habitat (Ground)					
Rationale: Colonies are important to local bird population, typically sites are only known colony in area and are used annually.	Herring Gull Great Black-backed Gull Little Gull Ring-billed Gull Common Tern Caspian Tern Brewer's Blackbird	Any rocky island or peninsula (natural or artificial) within a lake or large river (two-lined on a 1:50,000 NTS map). Close proximity to watercourses in open fields or pastures with scattered trees or shrubs (Brewer's Blackbird) MAM1 – 6 MAS1 – 3 CUM CUT CUS	• Nesting colonies of gulls and terns are on islands or peninsulas associated with open water or in marshy areas. • Brewers Blackbird colonies are found loosely on the ground in or in low bushes in close proximity to streams and irrigation ditches within farmlands. Information Sources • Ontario Breeding Bird Atlas[ccv], rare/colonial species records. • Canadian Wildlife Service • Reports and other information available from CAs • Natural Heritage Information Centre (NHIC) Colonial Waterbird Nesting Area • MNRF District Offices • Field naturalist clubs	Studies confirming: • Presence of >25 active nests for Herring Gulls, >5 active nests for Common Tern or >2 active nests for Caspian Tern[í]. • Any active nesting colony of one or more Little Gull, and Great Black-backed Gull is significant[í]. • Presence of 5 or more pairs for Brewer's Blackbird[í]. • The edge of the colony and a minimum 150m radius area of the habitat, or the extent of the ELC ecosites containing the colony or any island <3.0ha with a colony is the SWH[cc, ccvii]. • Studies would be done during May/June when actively nesting. Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"[ccxi]. • SWHMIST[cxlix] Index #6 provides development effects and mitigation measures.	Suitable habitat is not present within the study area. **Not SWH**

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Migratory Butterfly Stopover Areas					
Rationale: Butterfly stopover areas are extremely rare habitats and are biologically important for butterfly species that migrate south for the winter	Painted Lady Red Admiral Special Concern: Monarch	Combination of ELC Community Series; need to have present one Community Series from each landclass: Field: CUM CUT CUS Forest: FOC FOD FOM CUP Anecdotally, a candidate sight for butterfly stopover will have a history of butterflies being observed.	A butterfly stopover area will be a minimum of 10ha in size with a combination of field and forest habitat present, and will be located within 5km of Lake Ontario and Erie[cxlix]. • The habitat is typically a combination of field and forest, and provides the butterflies with a location to rest prior to their long migration south[xxxii, xxxiii, xxxiv, xxxv, xxxvi]. • The habitat should not be disturbed, fields/meadows with an abundance of preferred nectar plants and woodland edge providing shelter are requirements for this habitat[cxlviii, cxlix]. • Staging areas usually provide protection from the elements and are often spits of land or areas with the shortest distance to cross the Great Lakes[xxxvii, xxxviii, xxxix, xl, xli]. Information Sources • MNRF District Offices • Natural Heritage Information Centre (NHIC) • Agriculture Canada in Ottawa may have list of butterfly experts. • Field Naturalist Clubs • Toronto Entomologists Association • Conservation Authorities	Studies confirm: • The presence of Monarch Use Days (MUD) during fall migration (Aug/Oct)[xliii]. MUD is based on the number of days a site is used by Monarchs, multiplied by the number of individuals using the site. Numbers of butterflies can range from 100-500/day[xxxvii], significant variation can occur between years and multiple years of sampling should occur[xl, xlii]. • Observational studies are to be completed and need to be done frequently during the migration period to estimate MUD • MUD of >5000 or >3000 with the presence of Painted Ladies or White Admiral's is to be considered significant[l]. • SWHMIST[cxlix] Index #16 provides development effects and mitigation measures.	Study area is located >5km from the Lake Ontario and Erie shoreline. **Not SWH**

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Landbird Migratory Stopover Areas					
Rationale: Sites with a high diversity of species as well as high numbers are most significant	All migratory songbirds Canadian Wildlife Service Ontario website: http://www.on.ec.gc.ca/wildlife_e.html All migrant raptors species Ontario Ministry of Natural Resources: Fish and Wildlife Conservation Act, 1997. Schedule 7: Specially Protected Birds (Raptors)	All Ecosites associated with these ELC Community Series: FOC FOM FOD SWC SWM SWD	Woodlots need to be >5 ha[i] in size and within 5km [iv, v, vi, vii, viii, ix, x, xi, xii, xiii, xiv, xv] of Lake Ontario and Erie. If woodlands are rare in an area of shoreline, woodland fragments 2-5ha can be considered for this habitat • If multiple woodlands are located along the shoreline those Woodlands <2km from Lake Erie or Ontario are more significant[cxlix]. • Sites have a variety of habitats: forest, grassland and wetland complexes[cxlix]. • The largest sites are more significant[cxlix] • Woodlots and forest fragments are important habitats to migrating birds[ccxviii], these features located along the shore and located within 5km of Lake Ontario and Lake Erie are Candidate SWH[cxlviii]. Information Sources • Bird Studies Canada • Ontario Nature • Local birders and naturalist clubs • Ontario Important Bird Areas (IBA) Program	Studies confirm: • Use of the habitat by >200 birds/day and with >35 spp. with at least 10 bird spp. recorded on at least 5 different survey dates[i]. This abundance and diversity of migrant bird species is considered above average and significant. • Studies should be completed during spring (March/May) and fall (Aug/Oct) migration using standardized assessment techniques. Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"[ccxi]. • SWHMIST[cxlix] Index #9 provides development effects and mitigation measures.	Study area is located >5km from the Lake Ontario and Erie shoreline. **Not SWH**

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Deer Winter Congregation Areas					
Rationale: Deer movement during winter in the southern areas of Ecoregion 7E are not constrained by snow depth, however deer will annually congregate in large numbers in suitable woodlands to reduce or avoid the impacts of winter conditions [cxlviii]	White-tailed Deer	All Forested Ecosites with these ELC Community Series: FOC FOM FOD SWC SWM SWD Conifer plantations (CUP) smaller than 50 ha may also be used.	• Woodlots >100 ha in size or if large woodlots are rare in a planning area woodlots>50ha[i]. • Deer movement during winter in Ecoregion 7E are not constrained by snow depth, however deer will annually congregate in large numbers in suitable woodlands[cxlviii]. • Large woodlots > 100ha and up to 1500 ha are known to be used annually by densities of deer that range from 0.1-1.5 deer/ha[ccxxiv]. • Woodlots with high densities of deer due to artificial feeding are not significant[i]. Information Sources • MNRF District Offices • LIO/NRVIS	Studies confirm: • Deer management is an MNRF responsibility, deer winter congregation areas considered significant will be mapped by MNRF[cxlviii]. • Use of the woodlot by white-tailed deer will be determined by MNRF, all woodlots exceeding the area criteria are significant, unless determined not to be significant by MNRF[i]. • Studies should be completed during winter (Jan/Feb) when >20cm of snow is on the ground using aerial survey techniques[ccxxiv], ground or road surveys, or a pellet count deer density survey[ccxxv]. • SWHMIST[cxlix] Index #2 provides development effects and mitigation measures.	The MNRF has not identified this SWH within the study area. **Not SWH**

Significant Wildlife Habitat Assessment Tables

Table 2. Characteristics of Rare Vegetation Communities for Ecoregion 7E.

Rare Vegetation Community[1]	Candidate SWH			Confirmed SWH	Study Area
	ELC Ecosite Codes[1]	Habitat Description[1]	Detailed Information and Sources[1]	Defining Criteria[1]	Assessment Details
Cliff and Talus Slopes					
Rationale: Cliffs and Talus Slopes are extremely rare habitats in Ontario.	Any ELC Ecosite within Community Series: TAO CLO TAS CLS TAT CLT	A Cliff is vertical to near vertical bedrock >3m in height. A Talus Slope is rock rubble at the base of a cliff made up of coarse rocky debris.	Most cliff and talus slopes occur along the Niagara Escarpment. Information Sources • The Niagara Escarpment Commission has detailed information on location of these habitats. • OMNRF Districts • Natural Heritage Information Centre (NHIC) has location information available on their website • Field naturalist clubs • Conservation Authorities	• Confirm any ELC Vegetation Type for Cliffs or Talus Slopes[lxxviii] • SWHMIST[cxlix] Index #21 provides development effects and mitigation measures.	Vegetation community is not present within study area. **Not SWH**

Table 2. Characteristics of Rare Vegetation Communities for Ecoregion 7E.

Rare Vegetation Community[1]	Candidate SWH			Confirmed SWH	Study Area
	ELC Ecosite Codes[1]	Habitat Description[1]	Detailed Information and Sources[1]	Defining Criteria[1]	Assessment Details
Sand Barrens					
Rationale: Sand barrens are rare in Ontario and support rare species. Most Sand Barrens have been lost due to cottage development and forestry.	ELC Ecosites: SBO1 SBS1 SBT1 Vegetation cover varies from patchy and barren to continuous meadow (SBO1), thicket-like (SBS1), or more closed and treed (SBT1). Tree cover always ≤ 60%.	Sand Barrens typically are exposed sand, generally sparsely vegetated and caused by lack of moisture, periodic fires and erosion. They have little or no soil and the underlying rock protrudes through the surface. Usually located within other types of natural habitat such as forest or savannah. Vegetation can vary from patchy and barren to tree covered but less than 60%.	A sand barren area >0.5ha in size Information Sources • OMNRF Districts • Natural Heritage Information Centre (NHIC) has location information available on their website • Field naturalist clubs • Conservation Authorities	• Confirm any ELC Vegetation Type for Sand Barrens[lxxviii] • Site must not be dominated by exotic or introduced species (<50% vegetative cover are exotics sp)[i]. • SWHMIST[cxlix] Index #20 provides development effects and mitigation measures.	Vegetation community is not present within study area. **Not SWH**

Table 2. Characteristics of Rare Vegetation Communities for Ecoregion 7E.

Rare Vegetation Community[1]	Candidate SWH			Confirmed SWH	Study Area
	ELC Ecosite Codes[1]	Habitat Description[1]	Detailed Information and Sources[1]	Defining Criteria[1]	Assessment Details
Alvar					
Rationale: Alvars are extremely rare habitats in Ecoregion 7E	ALO1 ALS1 ALT1 FOC1 FOC2 CUM2 CUS2 CUT2-1 CUW2 **Five Alvar Indicator Species:** 1) Carex crawei 2) Panicum philadelphicum 3) Eleocharis compressa 4) Scutellaria parvula 5) Trichostema brachiatum These indicator species are very specific to Alvars within Ecoregion 7E[cxlix]	An alvar is typically a level, mostly unfractured calcareous bedrock feature with a mosaic of rock pavements and bedrock overlain by a thin veneer of soil. The hydrology of alvars is complex, with alternating periods of inundation and drought. Vegetation cover varies from sparse lichen-moss associations to grasslands and shrublands and comprising a number of characteristic or indicator plant. Undisturbed alvars can be phyto- and zoogeographically diverse, supporting many uncommon or are relict plant and animals species. Vegetation cover varies from patchy to barren with a less than 60% tree cover[lxxviii].	An Alvar site > 0.5ha in size[lxxv]. Alvar is particularly rare in Ecoregion 7E where the only known sites are found in the western islands of Lake Erie[cxcix]. Information Sources • Alvars of Ontario (2000), Federation of Ontario Naturalists[lxxvi]. • Ontario Nature – Conserving Great Lakes Alvars[ccviii]. • Natural Heritage Information Centre (NHIC) has location information available on their website • OMNRF Staff • Field Naturalist clubs • Conservation Authorities	Field studies identify four of the five **Alvar indicator species**[lxxv] at a candidate Alvar site is Significant • Site must not be dominated by exotic or introduced species (<50% vegetative cover exotics). • The alvar must be in excellent condition and fit in with surrounding landscape with few conflicting land uses[lxxv]. • SWHMIST[cxlix] Index #17 provides development effects and mitigation measures.	Vegetation community is not present within study area. **Not SWH**

Table 2. Characteristics of Rare Vegetation Communities for Ecoregion 7E.

Rare Vegetation Community[1]	Candidate SWH			Confirmed SWH	Study Area
	ELC Ecosite Codes[1]	Habitat Description[1]	Detailed Information and Sources[1]	Defining Criteria[1]	Assessment Details
Old Growth Forest					
Rationale: Due to historic logging practices and land clearance for agriculture, old growth forest is rare in Ecoregion 7E.	Forest Community Series: FOD FOC FOM SWD SWC SWM	Old growth forests are characterized by heavy mortality or turnover of overstorey trees resulting in a mosaic of gaps that encourage development of a multi-layered canopy and an abundance of snags and downed woody debris.	Woodland area is >0.5ha Information Sources • OMNRF Forest Resource Inventory mapping • OMNRF Districts • Field naturalist clubs • Conservation Authorities • Sustainable Forestry Licence (SFL) companies will possibly know locations through field operations. • Municipal forestry departments	Field Studies will determine: • If dominant trees species of the ecosite are >140 years old, then stand is Significant Wildlife Habitat[cxlviii]. • The forested area containing the old growth characteristics will have experienced no recognizable forestry activities [cxlviii] (cut stumps will not be present) • Determine ELC Vegetation Type for forest area containing the old growth characteristics[lxxviii]. • SWHMIST[cxlix] Index #23 provides development effects and mitigation measures.	Vegetation community is not present within study area. **Not SWH**

Table 2. Characteristics of Rare Vegetation Communities for Ecoregion 7E.

Rare Vegetation Community[1]	Candidate SWH			Confirmed SWH	Study Area
	ELC Ecosite Codes[1]	Habitat Description[1]	Detailed Information and Sources[1]	Defining Criteria[1]	Assessment Details
Savannah					
Rationale: Savannahs are extremely rare habitats in Ontario.	TPS1 TPS2 TPW1 TPW2 CUS2	A Savannah is a tallgrass prairie habitat that has tree cover between 25 – 60%. In Ecoregion 7E, known Tallgrass Prairie and savannah remnants are scattered between Lake Huron and Lake Erie, near Lake St. Clair, north of and along the Lake Erie shoreline, in Brantford and in the Toronto area (north of Lake Ontario)[cc].	No minimum size to site[l] Site must be restored or a natural site. Remnant sites such as railway right of ways are not considered to be SWH. Information Sources • OMNRF Districts • Natural Heritage Information Centre (NHIC) has location data available on their website • Field naturalists clubs • Conservation Authorities	Field studies confirm one or more of the Savannah indicator species listed in[lxxv] Appendix N should be present[l]. Note: Savannah plant spp. list from Ecoregion 7E should be used. • Area of the ELC Vegetation type is the SWH[lxxviii]. • Site must not be dominated by exotic or introduced species (<50% vegetative cover exotics). • SWHMIST[cxlix] Index #18 provides development effects and mitigation measures.	Suitable habitat not present within study area. **Not SWH**

Table 2. Characteristics of Rare Vegetation Communities for Ecoregion 7E.

Rare Vegetation Community[1]	Candidate SWH			Confirmed SWH	Study Area
	ELC Ecosite Codes[1]	Habitat Description[1]	Detailed Information and Sources[1]	Defining Criteria[1]	Assessment Details
Tallgrass Prairie					
Rationale: Tallgrass Prairies are extremely rare habitats in Ontario.	TPO1 TPO2	A Tallgrass Prairie has ground cover dominated by prairie grasses. An open Tallgrass Prairie habitat has < 25% tree cover. In Ecoregion 7E, known Tallgrass Prairie and savannah remnants are scattered between Lake Huron and Lake Erie, near Lake St. Clair, north of and along the Lake Erie shoreline, in Brantford and in the Toronto area (north of Lake Ontario)[cc].	No minimum size to site[l]. Site must be restored or a natural site. Remnant sites such as railway right of ways are not considered to be SWH. Information Sources • Natural Heritage Information Centre (NHIC has location information available on their website • OMNRF Districts • Field naturalists clubs • Conservation Authorities	Field studies confirm one or more of the Prairie indicator species listed in[lxxv] Appendix N should be present[l]. Note: Prairie plant spp. list from Ecoregion 7E should be used. • Area of the ELC Vegetation Type is the SWH[lxxviii]. • Site must not be dominated by exotic or introduced species (<50% vegetative cover exotics). • SWHMIST[cxlix] Index #19 provides development effects and mitigation measures.	Suitable habitat not present within study area. **Not SWH**

Table 2. Characteristics of Rare Vegetation Communities for Ecoregion 7E.

Rare Vegetation Community[1]	Candidate SWH			Confirmed SWH	Study Area
	ELC Ecosite Codes[1]	Habitat Description[1]	Detailed Information and Sources[1]	Defining Criteria[1]	Assessment Details
Other Rare Vegetation Communities					
Rationale: Plant communities that often contain rare species which depend on the habitat for survival.	Provincially Rare S1, S2 and S3 vegetation communities are listed in Appendix M of the SWHTG[cxlviii]. Any ELC Ecosite Code that has a possible ELC Vegetation Type that is Provincially Rare is Candidate SWH.	Rare Vegetation Communities may include beaches, fens, forest, marsh, barrens, dunes and swamps.	ELC Ecosite codes that have the potential to be a rare ELC Vegetation Type as outlined in appendix M[cxlviii]. The OMNRF/NHIC will have up to date listing for rare vegetation communities. Information Sources • Natural Heritage Information Centre (NHIC) has location information available on their website • OMNRF Districts • Field naturalists clubs • Conservation Authorities	Field studies should confirm if an ELC Vegetation Type is a rare vegetation community based on listing within Appendix M of SWHTG[cxlviii]. • Area of the ELC Vegetation Type polygon is the SWH. • SWHMIST[cxlix] Index #37 provides development effects and mitigation measures.	Based on preliminary ELC work, rare vegetation communities are not present within the study area. Ecological Land Classification surveys in 2021 will confirm presence/absence. **Unlikely SWH**

Significant Wildlife Habitat Assessment Tables

Table 3. Characteristics of Specialized Wildlife Habitat for Ecoregion 7E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Waterfowl Nesting Area					
Rationale: Important to local waterfowl populations, sites with greatest number of species and highest number of individuals are significant	American Black Duck Northern Pintail Northern Shoveler Gadwall Blue-winged Teal Green-winged Teal Wood Duck Hooded Merganser Mallard	All upland habitats located adjacent to these wetland ELC Ecosites are Candidate SWH: MAS1 MAS2 MAS3 SAS1 SAM1 SAF1 MAM1 MAM2 MAM3 MAM4 MAM5 MAM6 SWT1 SWT2 SWD1 SWD2 SWD3 SWD4 **Note: includes adjacency to Provincially Significant Wetlands**	A waterfowl nesting area extends: 120m[cxlix] from a wetland (>0.5ha) or a wetland (>0.5ha) with small wetlands (0.5ha) within 120m or a cluster of 3 or more small (<0.5 ha) wetlands within 120m of each individual wetland where waterfowl nesting is known to occur[cxlix]. • Upland areas should be at least 120m wide so that predators such as racoons, skunks, and foxes have difficulty finding nests. • Wood Ducks and Hooded Mergansers utilize large diameter trees (>40cm dbh) in woodlands for cavity nest sites. Information Sources • Ducks Unlimited staff may know the locations of particularly productive nesting sites. • OMNRF Wetland Evaluations for indication of significant waterfowl nesting habitat. • Reports and other information available from CAs	Studies confirmed: • Presence of 3 or more nesting pairs for listed species excluding Mallards[i], or, • Presence of 10 or more nesting pairs for listed species including Mallards[i]. • Any active nesting site of an American Black Duck is considered significant. • Nesting studies should be completed during the spring breeding season (April - June). Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"[ccxi] • A field study confirming waterfowl nesting habitat will determine the boundary of the waterfowl nesting habitat for the SWH, this may be greater or less than 120m[cxlviii] from the wetland and will provide enough habitat for waterfowl to successfully nest. • SWHMIST[cxlix] Index #25 provides development effects and mitigation measures.	Suitable habitat may be present within study area. Breeding bird surveys will be completed in 2021 to confirm presence/absence. **Candidate SWH**

Table 3. Characteristics of Specialized Wildlife Habitat for Ecoregion 7E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Bald Eagle and Osprey Nesting, Foraging and Perching Habitat					
Rationale: Nest sites are fairly uncommon in Ecoregion 7E and are used annually by these species. Many suitable nesting locations may be lost due to increasing shoreline development pressures and scarcity of habitat.	Osprey Special Concern: Bald Eagle	ELC Forest Community Series: FOD, FOM, FOC, SWD, SWM and SWC directly adjacent to riparian areas – rivers, lakes, ponds and wetlands.	Nests are associated with lakes, ponds, rivers or wetlands along forested shorelines, islands, or on structures over water. Osprey nests are usually at the top a tree whereas Bald Eagle nests are typically in super canopy trees in a notch within the tree's canopy. Nests located on man-made objects are not to be included as SWH (e.g. telephone poles and constructed nesting platforms). Information Sources • Natural Heritage Information Center (NHIC) compiles all known nesting sites for Bald Eagles in Ontario • MNRF values information (LIO/NRVIS) will list known nesting locations, Note: data from NRVIS is provided as a point format and does not include all the habitat. • Nature Counts, Ontario Nest Records Scheme data • OMNRF Districts • Check the Ontario Breeding Bird Atlas[ccv] or Rare Breeding Birds in Ontario for species documented • Reports and other information available from CAs • Field naturalists clubs	Studies confirm the use of these nests by: • One or more active Osprey or Bald Eagle nests in an area[cxlviii]. • Some species have more than one nest in a given area and priority is given to the primary nest with alternate nests included within the area of the SWH. • For an Osprey, the active nest and a 300m radius around the nest or the contiguous woodland stand is the SWH[ccvii], maintaining undisturbed shorelines with large trees within this area is important[cxlviii]. • For a Bald Eagle the active nest and a 400-800m radius around the nest is the SWH[cvi, ccvii]. Area of the habitat from 400-800m is dependant on site lines from the nest to the development and inclusion of perching and foraging habitat[cvi]. • To be significant a site must be used annually. When found inactive, the site must be known to be inactive for ≥3 years or suspected of not being used for >5 years before being considered not significant[ccvii]. • Observational studies to determine nest site use, perching sites and foraging areas need to be done from mid March to mid August. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"[ccxi] • SWHMIST[cxlix] Index #26 provides development effects and mitigation measures.	Suitable habitat not present within study area. **Not SWH**

Table 3. Characteristics of Specialized Wildlife Habitat for Ecoregion 7E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Woodland Raptor Nesting Habitat					
Rationale: Nests sites for these species are rarely identified; these area sensitive habitats are often used annually by these species.	Northern Goshawk Cooper's Hawk Sharp-shinned Hawk Red-shouldered Hawk Barred Owl Broad-winged Hawk	May be found in all forested ELC Ecosites. May also be found in SWC, SWM, SWD and CUP3	All natural or conifer plantation woodland/forest stands combined >30ha or with >4ha of interior habitat[lxxxviiii, lxxxix, xc, xci, xciii, xciv, xcv,xcvi, cxxxiii]. Interior habitat determined with a 200m buffer[cxlviii]. • Stick nests found in a variety of intermediate-aged to mature conifer, deciduous or mixed forests within tops or crotches of trees. Species such as Coopers hawk nest along forest edges sometimes on peninsulas or small off-shore islands. • In disturbed sites, nests may be used again, or a new nest will be in close proximity to old nest. Information Sources • OMNRF Districts • Check the Ontario Breeding Bird Atlas[ccv] or Rare Breeding Birds in Ontario for species documented. • Check data from Bird Studies Canada • Reports and other information available from CAs	Studies confirm: • Presence of 1 or more active nests from species list is considered significant[cxlviii]. • Red-shouldered Hawk and Northern Goshawk – A 400m radius around the nest or 28 ha of habitat is the SWH[ccvii].(the 28ha habitat area would be applied where optimal habitat is irregularly shaped around the nest) • Barred Owl – A 200m radius around the nest is the SWH[ccvii]. • Broad-winged Hawk and Coopers Hawk – A 100m radius around the nest is the SWH[ccvii]. • Sharp-Shinned Hawk – A 50m radius around the nest is the SWH[ccvii]. • Conduct field investigations from early March to end of May. The use of call broadcasts can help in locating territorial (courting/nesting) raptors and facilitate the discovery of nests by narrowing down the search area. • SWHMIST[cxlix] Index #27 provides development effects and mitigation measures.	Suitable habitat not present within study area. **Not SWH**

Table 3. Characteristics of Specialized Wildlife Habitat for Ecoregion 7E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Turtle Nesting Area					
Rationale: These habitats are rare and when identified will often be the only breeding site for local populations of turtles.	Midland Painted Turtle Special Concern: Northern Map Turtle Snapping Turtle	Exposed mineral soil (sand or gravel) areas adjacent (<100m)[cxlviii] or within the following ELC Ecosites: MAS1 MAS2 MAS3 SAS1 SAM1 SAF1 BOO1 FEO1	• Best nesting habitat for turtles are close to water and away from roads and sites less prone to loss of eggs by predation from skunks, raccoons or other animals. • For an area to function as a turtle-nesting area, it must provide sand and gravel that turtles are able to dig in and are located in open, sunny areas. Nesting areas on the sides of municipal or provincial road embankments and shoulders are not SWH. • Sand and gravel beaches adjacent to undisturbed shallow weedy areas of marshes, lakes, and rivers are most frequently used. Information Sources • Use Ontario Soil Survey reports and maps to help find suitable substrate for nesting turtles (well-drained sands and fine gravels). • Check the Ontario Herpetofaunal Summary Atlas records or other similar atlases for uncommon turtles; location information may help to find potential nesting habitat for them. • Natural Heritage Information Center (NHIC) Field naturalist clubs	Studies confirm: • Presence of 5 or more nesting Midland Painted Turtles[l] • One or more Northern Map Turtle or Snapping Turtle nesting is a SWH[i] • The area or collection of sites within an area of exposed mineral soils where the turtles nest, plus a radius of 30-100m around the nesting area dependant on slope, riparian vegetation and adjacent land use is the SWH[cxlviii]. • Travel routes from wetland to nesting area are to be considered within the SWH as part of the 30-100m area of habitat[cxlix]. • Field investigations should be conducted in prime nesting season typically late spring to early summer. Observation studies observing the turtles nesting is a recommended method. • SWHMIST[cxlix] Index #28 provides development effects and mitigation measures for turtle nesting habitat.	Suitable habitat is present within the study area. Reptile surveys will be conducted in 2021 to determine presence, although absence cannot be ruled out without more extensive surveys. **Candidate SWH**

Table 3. Characteristics of Specialized Wildlife Habitat for Ecoregion 7E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Seeps and Springs					
Rationale: Seeps/Springs are typical of headwater areas and are often at the source of coldwater streams	Wild Turkey Ruffed Grouse Spruce Grouse White-tailed Deer Salamander spp.	Seeps/Springs are areas where ground water comes to the surface. Often they are found within headwater areas within forested habitats. Any forested Ecosite within the headwater areas of a stream could have seeps/springs.	Any forested area (with <25% meadow/field/pasture) within the headwaters of a stream or river system[cxvii, cxlix]. • Seeps and springs are important feeding and drinking areas especially in the winter will typically support a variety of plant and animal species[cxix, cxx, cxxi, cxxii, cxiii, cxiv]. Information Sources • Topographical Map • Thermography • Hydrological surveys conducted by CAs and MOE • Field naturalists and landowners • Municipalities and Conservation Authorities may have drainage maps and headwater areas mapped	Field Studies confirm: • Presence of a site with 2 or more[í] seeps/springs should be considered SWH. • The area of a ELC forest ecosite containing the seeps/springs is the SWH. The protection of the recharge area considering the slope, vegetation, height of trees and groundwater condition need to be considered in delineation of the habitat[cxlviii]. • SWHMIST[cxlix] Index #30 provides development effects and mitigation measures.	Seeps or springs may be present within the study area. Field surveys will be conducted to confirm presence/absence. **Candidate SWH**

Table 3. Characteristics of Specialized Wildlife Habitat for Ecoregion 7E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Amphibian Breeding Habitat (Woodland)					
Rationale: These habitats are extremely important to amphibian biodiversity within a landscape and often represent the only breeding habitat for local amphibian populations	Eastern Newt Blue-spotted Salamander Spotted Salamander Gray Treefrog Spring Peeper Western Chorus Frog Wood Frog	All Ecosites associated with these ELC Community Series: FOC FOM FOD SWC SWM SWD Breeding pools within the woodland or the shortest distance from forest habitat are more significant because they are more likely to be used due to reduced risk to migrating amphibians.	• Presence of a wetland, pond or woodland pool (including vernal pools) >500m^2 (about 25m diameter) [ccvii] within or adjacent (within 120m) to a woodland (no minimum size)[clxxxii, lxiii, lxv, lxvi, lxvii, lxviii, lxix, lxx]. Some small wetlands may not be mapped and may be important breeding pools for amphibians. • Woodlands with permanent ponds or those containing water in most years until mid-July are more likely to be used as breeding habitat[cxlviii]. Information Sources • Ontario Herpetofaunal Summary Atlas (or other similar atlases) for records • Local landowners may also provide assistance as they may hear spring-time choruses of amphibians on their property. • OMNRF Districts and wetland evaluations • Field naturalist clubs • Canadian Wildlife Service Amphibian Road Call Survey • Ontario Vernal Pool Association: http://www.ontariovernalpools.org	Studies confirm: • Presence of breeding population of 1 or more of the listed newt/salamander species or 2 or more of the listed frog/toad species with at least 20 individuals (adults or eggs masses) or 2 or more of the listed frog/toad species with Call Level Codes of 3. • A combination of observational study and call count surveys [cviii] will be required during the spring (March-June) when amphibians are concentrated around suitable breeding habitat within or near the woodland/wetlands. • The habitat is the wetland area plus a 230m radius of woodland area[lxiii, lxv, lxvi, lxvii, lxviii, lxix, lxx, lxxi]. If a wetland area is adjacent to a woodland, a travel corridor connecting the wetland to the woodland is to be included in the habitat. • SWHMIST[cxlix] Index #14 provides development effects and mitigation measures.	Suitable habitat is present within the study area. Field surveys will be completed in 2021 to confirm presence/absence. **Candidate SWH**

Table 3. Characteristics of Specialized Wildlife Habitat for Ecoregion 7E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Amphibian Breeding Habitat (Wetland)					
Rationale: Wetlands supporting breeding for these amphibian species are extremely important and fairly rare within Central Ontario Landscapes	Eastern Newt American Toad Spotted Salamander Four-toed Salamander Blue-spotted Salamander Gray Treefrog Western Chorus Frog Northern Leopard Frog Pickerel Frog Green Frog Mink Frog Bullfrog	ELC Community Classes SW, MA, FE, BO, OA and SA. Typically these wetland ecosites will be isolated (>120m) from woodland ecosites, however larger wetlands containing predominantly aquatic species (e.g. Bull Frog) may be adjacent to woodlands.	• Wetlands >500m^2 (about 25m diameter)[ccvii] supporting high species diversity are significant: some small or ephemeral habitats may not be identified on MNR mapping and could be important amphibian breeding habitats[clxxxiv]. • Presence of shrubs and logs increase significance of pond for some amphibian species because of available structure for calling, foraging, escape and concealment from predators. • Bullfrogs require permanent water bodies with abundant emergent vegetation. Information Sources • Ontario Herpetofaunal Summary Atlas (or other similar atlases) • Canadian Wildlife Service Amphibian Road Surveys and Backyard Amphibian Call Count. • OMNRF Districts and wetland evaluations • Reports and other information available from CAs	Studies confirm: • Presence of breeding population of 1or more of the listed newt/salamander species or 2 or more of the listed frog or toad species and with at least 20 breeding individuals (adults and eggs masses)[lxxi, lxxiii] or 2 or more of the listed frog/toad species with Call Level of 3. or; Wetland with confirmed breeding Bullfrogs are significant[i]. • The ELC ecosite wetland area and the shoreline are the SWH. • A combination of observational study and call count surveys cviii to determine breeding/larval stages will be required during the spring (May March-June) when amphibians are concentrated around suitable breeding habitat within or near the woodland/wetlands. • If a SWH is determined for Amphibian Breeding Habitat (Wetlands) then Movement Corridors are to be considered as outlined in Table 1.4.1 of this Schedule. • SWHMIST[cxdix] Index #15 provides development effects and mitigation measures.	Suitable habitat may be present within the study area. Field surveys will be completed in 2021 to confirm presence/absence. **Candidate SWH**

Table 3. Characteristics of Specialized Wildlife Habitat for Ecoregion 7E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Woodland Area-Sensitive Bird Breeding Habitat					
Rationale: Large, natural blocks of mature woodland habitat within the settled areas of Southern Ontario are important habitats for area sensitive interior forest song birds.	Yellow-bellied Sapsucker Red-breasted Nuthatch Veery Blue-headed Vireo Northern Parula Black-throated Green Warbler Blackburnian Warbler Black-throated Blue Warbler Ovenbird Scarlet Tanager Winter Wren Pileated Woodpecker Special Concern: Cerulean Warbler Canada Warbler	All Ecosites associated with these ELC Community Series: FOC FOM FOD SWC SWM SWD	• Habitats where interior forest breeding birds are breeding, typically large mature (>60 yrs. old) forest stands or woodlots >30ha[cv, cxxxi, cxxxii, cxxxiii, cxxxiv, cxxxv, cxxxvi, cxxxvii, cxxxviii, cxxxix, cxl, cxli, cxlii, cxliii, cxliv, cxlv, cxlvi, cl, cli, clii, cliii, cliv, clv, clvi, clvii, clviii, clix]. • Interior forest habitat is at least 200m from forest edge habitat[clxiv]. Information Sources • Local birder clubs • Canadian Wildlife Service (CWS) for the location of forest bird monitoring • Bird Studies Canada conducted a 3-year study of 287 woodlands to determine the effects of forest fragmentation on forest birds and to determine what forests were of greatest value to interior species. • Reports and other information available from CAs	Studies confirm: • Presence of nesting or breeding pairs of 3 or more of the listed wildlife species[l]. • Note: any site with breeding Cerulean Warblers or Canada Warbler is to be considered SWH[l]. • Conduct field investigations in early summer when birds are singing and defending their territories. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"[ccxi] • SWHMIST[cxlix] Index #34 provides development effects and mitigation measures.	Suitable habitat not present within study area. **Not SWH**

Significant Wildlife Habitat Assessment Tables

Table 4. Characteristics of Habitat for Species of Conservation Concern for Ecoregion 7E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Marsh Bird Breeding Habitat					
Rationale: Wetlands for these bird species are typically productive and fairly rare in Southern Ontario landscapes.	American Bittern Virginia Rail Sora Common Gallinule American Coot Pied-billed Grebe Marsh Wren Sedge Wren Common Loon Green Heron Trumpeter Swan Special Concern: Black Tern Yellow Rail	MAM1 MAM2 MAM3 MAM4 MAM5 MAM6 SAS1 SAM1 SAF1 FEO1 BOO1 For Green Heron: All SW, MA and CUM1 sites	• Nesting occurs in wetlands • All wetland habitat is to be considered as long as there is shallow water with emergent aquatic vegetation present[cxxiv]. • For Green Heron, habitat is at the edge of water such as sluggish streams, ponds and marshes sheltered by shrubs and trees. Less frequently, it may be found in upland shrubs or forest a considerable distance from water. Information Sources • OMNRF Districts and wetland evaluations • Field naturalist clubs • Natural Heritage Information Centre (NHIC) • Reports and other information available from CAs • Ontario Breeding Bird Atlas[ccv]	Studies confirm: • Presence of 5 or more nesting pairs of Sedge Wren or Marsh Wren or breeding by any combination of 4 or more of the listed species[i]. • Note: any wetland with breeding of 1 or more Trumpeter Swans, Black Terns, Green Heron or Yellow Rail is SWH[i]. • Area of the ELC ecosite is the SWH • Breeding surveys should be done in May/June when these species are actively nesting in wetland habitats. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"[ccxi] • SWHMIST[cxlix] Index #35 provides development effects and mitigation measures	Suitable habitat may be present. Breeding bird surveys will be completed in 2021 to determine presence/absence. **Candidate SWH**

Table 4. Characteristics of Habitat for Species of Conservation Concern for Ecoregion 7E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Open Country Bird Breeding Habitat					
Rationale: This wildlife habitat is declining throughout Ontario and North America. Species such as the Upland Sandpiper have declined significantly the past 40 years based on CWS (2004) trend records.	Upland Sandpiper Grasshopper Sparrow Vesper Sparrow Northern Harrier Savannah Sparrow Special Concern: Short-eared Owl	CUM1 CUM2	Large grassland areas (includes natural and cultural fields and meadows) >30ha[clx, clxi, clxii, clxiii, clxiv, clxv, clxvi, clxvii, clxviii, clxix]. Grasslands not Class 1 or 2 agricultural lands, and not being actively used for farming (i.e. no row cropping or intensive hay or livestock pasturing in the last 5 years)[i]. Grassland sites considered significant should have a history of longevity, either abandoned fields, mature hayfields and pasturelands that are at least 5 years or older. The Indicator bird species are area sensitive requiring larger grassland areas than the common grassland species. Information Sources • Agricultural land classification maps Ministry of Agriculture • Local birder clubs • Ontario Breeding Bird Atlas[ccv] • EIS Reports and other information available from CAs	Field Studies confirm: • Presence of nesting or breeding of 2 or more of the listed species[l]. • A field with 1 or more breeding Short-eared Owls is to be considered SWH. • The area of SWH is the contiguous ELC ecosite field areas. • Conduct field investigations of the most likely areas in spring and early summer when birds are singing and defending their territories. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"[ccxi] • SWHMIST[cxlix] Index #32 provides development effects and mitigation measures	Suitable habitat may be present. Breeding bird surveys will be completed in 2021 to determine presence/absence. **Candidate SWH**

Table 4. Characteristics of Habitat for Species of Conservation Concern for Ecoregion 7E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Shrub/Early Successional Bird Breeding Habitat					
Rationale: This wildlife habitat is declining throughout Ontario and North America. The Brown Thrasher has declined significantly over the past 40 years based on CWS (2004) trend records.	Indicator Spp: Brown Thrasher Clay-coloured Sparrow Common Spp. Field Sparrow Black-billed Cuckoo Eastern Towhee Willow Flycatcher Special Concern: Yellow-breasted Chat Golden-winged Warbler	CUT1 CUT2 CUS1 CUS2 CUW1 CUW2 Patches of shrub ecosites can be complexed into a larger habitat such as woodland area for some bird species.	Large natural field areas succeeding to shrub and thicket habitats >10ha[clxiv] in size. Shrub land or early successional fields, not class 1 or 2 agricultural lands, not being actively used for farming (i.e. no row-cropping, haying or live-stock pasturing in the last 5 years)[i]. Shrub thicket habitats (>10 ha) are most likely to support and sustain a diversity of these species[clxxiii]. Shrub and thicket habitat sites considered significant should have a history of longevity, either abandoned fields or pasturelands. Information Sources • Agricultural land classification maps, Ministry of Agriculture. • Local bird clubs • Ontario Breeding Bird Atlas[ccv] • Reports and other information available from CAs	Field Studies confirm: • Presence of nesting or breeding of 1 of the indicator species and at least 2 of the common species[i]. • A field with breeding Yellow-breasted Chat or Golden-winged Warbler is to be considered as Significant Wildlife Habitat[i]. • The area of the SWH is the contiguous ELC ecosite field/thicket area. • Conduct field investigations of the most likely areas in spring and early summer when birds are singing and defending their territories • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"[ccxi] • SWHMIST[cxlix] Index #33 provides development effects and mitigation measures.	Suitable habitat may be present. Breeding bird surveys will be completed in 2021 to determine presence/absence. **Candidate SWH**

Table 4. Characteristics of Habitat for Species of Conservation Concern for Ecoregion 7E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Terrestrial Crayfish					
Rationale: Terrestrial Crayfish are only found within SW Ontario in Canada and their habitats are very rare. [Ccii]	Chimney or Digger Crayfish (*Fallicambarus fodiens*) Devil Crawfish or Meadow Crayfish (*Cambarus Diogenes*)	MAM1 MAM2 MAM3 MAM4 MAM5 MAM6 MAS1 MAS2 MAS3 SWD SWT SWM CUM1 with inclusions of above meadow marsh ecosites can be used by terrestrial crayfish	Wet meadow and edges of shallow marshes (no minimum size) identified should be surveyed for terrestrial crayfish. • Constructs burrows in marshes, mudflats, meadows, the ground can't be too moist. Can often be found far from water. • Both species are a semi-terrestrial burrower which spends most of its life within burrows consisting of a network of tunnels. Usually the soil is not too moist so that the tunnel is well formed. Information Sources • Information sources from "Conservation Status of Freshwater Crayfishes" by Dr. Premek Hamr for the WWF and CNF March 1998.	Studies Confirm: • Presence of 1 or more individuals of species listed or their chimneys (burrows) in suitable marsh meadow or terrestrial sites[cci]. • Area of ELC Ecosite or an ecoelement area of meadow marsh or swamp within the large ecosite area is the SWH • Surveys should be done April to August in temporary or permanent water. Note the presence of burrows or chimneys are often the only indicator of presence, observance or collection of individuals is very difficult [cci] • SWHMIST[cxlix] Index #36 provides development effects and mitigation measures.	Suitable habitat may be present within mineral meadow marsh lands found within the study area. Area searches will be conducted to confirm presence/absence. **Candidate SWH**

Table 4. Characteristics of Habitat for Species of Conservation Concern for Ecoregion 7E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Special Concern and Rare Wildlife Species					
Rationale: These species are quite rare or have experienced significant population declines in Ontario	All Special Concern and Provincially Rare (S1-S3, SH) plant and animal species. Lists of these species are tracked by the Natural Heritage Information Centre (NHIC).	All plant and animal element occurrences (EO) within a 1 or 10km grid. Older element occurrences were recorded prior to GPS being available, therefore location information may lack accuracy.	When an element occurrence is identified within a 1 or 10 km grid for a Special Concern or provincially Rare species; linking candidate habitat on the site needs to be completed to ELC Ecosites[lxxviii]. Information Sources • Natural Heritage Information Centre (NHIC) will have the Special Concern and Provincially Rare (S1-S3, SH) species lists and element occurrences for these species. • NHIC Website: "Get Information" http://nhic.mnr.gov.on.ca • Ontario Breeding Bird Atlas[ccv] • Expert advice should be sought as many of the rare spp. have little information available about their requirements.	Studies Confirm: • Assessment/inventory of the site for the identified special concern or rare species needs to be completed during the time of year when the species is present or easily identifiable. • The area of the habitat to the finest ELC scale that protects the habitat form and function is the SWH, this must be delineated through detailed field studies. The habitat neess to be easily mapped and cover an important life stage component for a species e.g. specific nesting habitat for foraging habitat. • SWHMIST[cxlix] Index #37 provides development effects and mitigation measures.	Special Concern and Provincially Rare plant and animal species are possible within the study area. Wildlife and vegetation surveys will be conducted within the study area to confirm presence/absence. **Candidate SWH**

Significant Wildlife Habitat Assessment Tables

Table 5. Characteristics of Animal Movement Corridors for Ecoregion 7E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Amphibian Movement Corridors					
Rationale: Movement corridors for amphibians moving from their terrestrial habitat to breeding habitat can be extremely important for local populations.	Eastern Newt American Toad Blue-spotted Salamander Spotted Salamander Four-toed Salamander Gray Treefrog Northern Leopard Frog Pickerel Frog Western Chorus Frog	Corridors may be found in all ecosites associated with water. • Corridors will be determined based on identifying the significant breeding habitat for these species in Table 1.1.	Movement corridors between breeding habitat and summer habitat[clxxiv, clxxv, clxxvi, clxxvii, clxxviii, clxxix, clxxx, clxxxi] Movement corridors must be considered when Amphibian breeding habitat is confirmed as SWH from Table 1.2.2 (Amphibian Breeding Habitat – Wetland) of this Schedule[i]. Information Sources • MNRF District Office • Natural Heritage Information Centre NHIC • Reports and other information available from CAs • Field naturalist Clubs	• Field Studies must be conducted at the time of year when species are expected to be migrating or entering breeding sites. • Corridors should consist of native vegetation, with several layers of vegetation. Corridors unbroken by roads, waterways or bodies, and undeveloped areas are most significant[cxlix]. • Corridors should have at least 15m of vegetation on both sides of waterway[cxlix] or be up to 200m wide[cxlix] of woodland habitat and with gaps <20m[cxlix] • Shorter corridors are more significant than longer corridors, however amphibians must be able to get to and from their summer and breeding habitat[cxlix]. • SWHMIST[cxlix] Index #40 provides development effects and mitigation measures.	Amphibian Breeding Habitat may be present within the study area. If Amphibian Breeding Habitat - Wetland is confirmed, an Amphibian Movement Corridor will be identified. Anuran surveys are to be completed in 2021. **Candidate SWH**

Significant Wildlife Habitat Assessment Tables

Table 6. Exceptions for Ecodistricts within Ecoregion 7E.

	Wildlife Habitat and Species	Candidate SWH			Confirmed SWH	Study Area
		Ecosites	Habitat Description	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
EcoDistrict						
7E-2	Bat Migratory Stopover Area Rationale: Stopover areas for long distance migrant bats are important during fall migration. Hoary Bat Eastern Red Bat Silver-haired Bat	No specific ELC types		• Long distance migratory bats typically migrate during late summer and early fall migrating summer breeding habitats throughout Ontario to southern wintering areas. Their annual fall migration may concentrate these species of bats at stopover areas. • This is the only known bat migratory stopover habitats based on current information. <u>Information Sources</u> • OMNRF for possible locations and contact for local experts • University of Waterloo, Biology Department	• Long Point (42°35'N, 80°30'E, to 42°33'N, 80°03'E) has been identified as a significant stop-over habitat for fall migrating Silver-haired bats, due to significant increases in abundance, activity and feeding that was documented during fall migration[ccxv]. • The confirmation criteria and habitat areas for this SWH are still being determined. • SWHMIST[cxlix] Index #38 provides development effects and mitigation measures	This study area does not fall within the Long Point area. **Not SWH**

Human Health Assessment Review Work Plan

Twin Creeks Environmental Centre Landfill Optimization Project

Waste Management of Canada Corporation

Watford, Ontario

March 30, 2022

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Acronyms

Acronym	Definition
CEI	Cantox Environmental Inc.
CR	Concentration Ratio
EA	Environmental Assessment
HCl	Hydrogen chloride
HHRA	Human Health Risk Assessment
ILCR	Incremental Lifetime Cancer Risk
MECP	Ministry of Environment, Conservation and Parks
NOx	Oxides of Nitrogen
PAHs	Polycyclic Aromatic Hydrocarbons
SO_2	Sulphur Dioxide
TCEC	Twin Creeks Environmental Centre
ToR	Terms of Reference
VOC	Volatile Organic Compound
WHO	World Health Organization
WMCC	Waste Management of Canada Corporation

1 Introduction

This Human Health Assessment Review work plan has been prepared to support the environmental assessment (EA) for the Twin Creeks Environmental Centre Landfill Optimization Project (the Project) and will be appended to the Terms of Reference (ToR) for the EA to be submitted to the Ministry of Environment, Conservation and Parks (MECP) for approval.

Waste Management of Canada Corporation (WM), the owner and operator of the Twin Creeks Environmental Centre (TCEC) in Watford, Ontario, has initiated an EA seeking approval to increase the landfill airspace capacity at the TCEC. The TCEC has approximately 13.2M m³ of remaining approved landfill airspace, which corresponds to about 10 years of operating life (2021 to 2031). This optimization project could provide additional airspace capacity of up to approximately 14M m³, which could extend the site life by about 12 years (from 2031 to 2043). There would be no change to the current 301 ha site area, the approved service area, or the annual fill rate.

The TCEC is a regional facility that provides safe and convenient disposal services for communities, businesses and industries serving the Province of Ontario. The landfill is approved to receive municipal, industrial, commercial, and institutional solid non-hazardous wastes generated, including non-hazardous contaminated soil.

The TCEC is engineered with environmental protection systems that meet or exceed regulatory requirements and are subject to highly regulated monitoring and reporting requirements. Systems include engineered liners and covers, leachate collection and removal, landfill gas collection and control, and on-site leachate disposal through phytoremediation. The TCEC provides landfill gas, for heating, to the 40-acre greenhouse facility adjacent to the landfill property. Prior to this, all landfill gas was flared. The intent is for the landfill to supply gas for heating to the greenhouses for 25 years.

Leachate that is generated in the waste is conveyed toward a perimeter leachate collection system. WM received approval to treat leachate through a phytoremediation system consisting of a 9.3 ha poplar system planted on the existing landfill cap in 2003. Surplus leachate is trucked off-site to approved wastewater treatment plants.

WM pays host community fees annually to the Township of Warwick. Since 2009, when the TCEC Expansion Landfill began receiving waste, WM has contributed over $24M in host community fees and municipal property taxes to the Township.

There is a need for the continued development of the TCEC as it is a significant component of the provincial waste management network and infrastructure, which is lacking in sufficient and secure long-term disposal capacity. Optimizing the future development of the TCEC allows for on-going sustainable business operations and continued provision of essential financial support for community services and programs.

The purpose of the EA is to assess the potential effects of the proposed landfill optimization on the environment. The EA will be carried out in accordance with the requirements of the *Ontario Environmental Assessment Act*.

2 Study Purpose and Objectives

This Human Health Assessment Review work plan outlines the tasks required to support the EA through the characterization of existing conditions and assessment of potential environmental effects of the project on human health, including the evaluation of the various alternative methods and the identification and assessment of a preferred alternative. This work plan outlines the scope of the Human Health Assessment Review, including protocols and/or standards to be adhered to while the work is undertaken. The specific evaluation criteria, indicators, and data sources to be used and the study areas to be considered are provided below. These items may be adjusted during the EA process.

In accordance with the *Ontario Environmental Assessment Act*, the objectives of the EA are as follows:

1. Describe the environment potentially affected by the proposed undertaking, including both the existing environment as well as the environment that would otherwise be likely to exist in the future without the proposed undertaking;
2. Carry out an evaluation of the environmental effects of the proposed undertaking, using the environmental assessment criteria and studies that have been established through the development of the ToR;
3. Undertake an evaluation of any additional actions that may be necessary to prevent, change or mitigate environmental effects;
4. Provide a description and evaluation of the environmental advantages and disadvantages of the proposed undertaking, based on the net environmental effects that will result following mitigation; and
5. Prepare monitoring, contingency, and impact management plans to mitigate the environmental effects of the proposed undertaking.

3 Study Areas

During the EA, existing conditions and potential effects will be considered in the context of two study areas: on-site and off-site. The general study areas proposed for the purposes of the EA are (**Figure 1.** General On-Site and Off-site Study Areas

):

- On-site Study Area: the existing TCEC.
- Off-site Study Area: the lands within the vicinity of the TCEC extending approximately 1 km out from the On-site Study Area.

The 2005 HHRA extended the off-site study area to 3.5 km from the landfill site consistent with the air quality study completed at the time. The current air quality assessment has extended their study area to 5 km from the TCEC. While data from the current air quality study will be used as comparison to those completed in the original 2005 HHRA, the highest ground-level air concentrations would be expected to occur in close proximity to the landfill. As such, the additional 1.5 km extended area within the

current Off-site Study Area is unlikely to affect the comparison to the original 2005 HHRA, despite the difference in size of the Off-site Study Areas.

For the Human Health Assessment Review, the general Off-site Study Area has been extended to include lands within approximately 1 km from the TCEC.

4 Scope of Work

The scope of work for Human Health Assessment Review includes the development of evaluation criteria, indicators, and data sources, characterization of existing human health conditions, assessment of the potential environmental effects of the preferred alternative, development of mitigation measures and monitoring programs, and reporting as outlined below.

4.1 Evaluation Criteria, Indicators, and Data Sources

The environmental assessment criteria, indicators, and data sources for the Human Health Assessment Review are provided in **Table 1**. The assessment criteria, indicators, and data sources will be used to assess the effects of the preferred alternative on human health. These evaluation criteria and indicators focus on air exposure pathways based on the conclusions of the 2005 Warwick Landfill Expansion EA, and may be updated during the EA.

Table 1. Evaluation Criteria, Indicators, and Data Sources for the Human Health Assessment Review

Evaluation Criteria	Rationale	Indicators	Data Sources
Human Health	Construction and operation activities at a waste disposal site can lead to increase to increased levels of particulates (dust) and related metals in the air.	• Predicted acute and chronic health-based concentration ratios arising from air concentrations of particulate matter (dust) and related metals at identified sensitive receptor locations within the Study Area. Refer to **Table 2** for complete list of assessed contaminants. • Frequency of any exceedance of applicable standards, limits, or guidelines at identified receptors	• Data used in previous 2005 risk assessment. • Available background ambient air data • Ground-level air concentrations modelled by Air Quality team for proposed preferred alternative and associated frequency data • Off-site receptors identified in coordination with other disciplines • Published health-based regulatory benchmarks or toxicity reference values (TRVs) for each contaminant of concern
	Waste disposal site and associated operations can emit gaseous contaminants that can degrade air quality.	• Predicted acute and chronic health-based concentration ratios arising from air concentrations of gaseous contaminants at identified sensitive receptor locations within the Study Area. Refer to **Table 2** for complete list of assessed contaminants. • Frequency of any exceedance of applicable standards, limits, or guidelines at identified receptors	

4.2 Characterization of Existing Conditions

An evaluation of potential health effects from expected operations at the proposed expansion of the then Warwick Landfill in the form of a detailed human health risk assessment (HHRA) conducted by Cantox Environmental Inc. (now Intrinsik Corp.) was included in the Warwick Landfill Expansion EA conducted in 2005.

In general, a HHRA is a scientific study that evaluates the potential for the occurrence of adverse health effects from exposures of people (receptors) to contaminants of concern (COCs) present in surrounding environmental media (e.g., air, soil, sediment, surface water, groundwater, food, etc.), under existing or predicted exposure conditions. HHRA procedures are based on the fundamental dose-response principle of toxicology. The response of an individual to a contaminant exposure increases in proportion to the contaminant concentration in critical target tissues where adverse effects may occur. The concentrations of contaminants in the target tissues (the dose) are determined by the degree of exposure, which is proportional to the contaminant concentrations in the environment where the receptor resides, works, or visits. All contaminants (both natural and man-made) have the potential to cause effects in people and the ecosystem. It is the contaminant concentration, the route and amount of exposure, and the inherent toxicity of the contaminant that determines the level of risk for adverse health effects to occur. As such, an HHRA allows stakeholders to evaluate the potential health implications of a proposed project and address potential mitigation options should potential health risks be identified.

4.2.1 Summary of 2005 Landfill Expansion HHRA

As a requirement of the then Ontario Ministry of the Environment (MOE), through the EA process and ToR review, WM was required to conduct an HHRA to evaluate landfill air emissions. The HHRA was established to evaluate the potential human health impacts, on nearby residential communities that could arise from expected airborne emissions associated with the proposed landfill expansion. The HHRA was carried out in compliance with the risk assessment procedures endorsed by relevant regulatory agencies such as the MOE, Environment Canada, Health Canada, and the United States Environmental Protection Agency.

The HHRA evaluated the potential human health impacts on nearby residential communities, that could arise from expected airborne emissions associated with the proposed landfill expansion. Future air emissions associated with the expansion were predicted by air dispersion modellers using a series of Ministry-approved computer models. The estimated future ground-level air concentrations of contaminants resulting from the proposed landfill expansion were then used in the HHRA study.

The objective of the HHRA was to determine whether expected emissions from the proposed Landfill expansion would pose unacceptable health risks to residents living in the study area. The original study area encompassed receptors within 3.5 km of the existing landfill site, extending past Highway 402 to the north and including the nearby village of Watford to the south. The HHRA evaluated the potential health impacts associated with predicted landfill emissions to people residing (or potentially residing) at specific locations which were predicted to have the highest ground-level air concentrations. Both long-term (chronic) and short-term (i.e., 24-hour exposure durations) related health

risks were evaluated at individual receptor locations. Acute health risks associated with very short durations of exposure (i.e., ½-hour and 1-hour) to combustion gases were also evaluated at the maximum fence-line location since it was considered plausible that an individual could spend small amounts of time at this location (CEI, 2005).

Different time frames which were representative of different landfill operating phases were also evaluated. A baseline/background scenario which reflected the pre-expansion conditions at the landfill site were first considered. Six (6) future operating time frames within the projected lifespan of the facility were also considered including Year 2005, Year 2010, Year 2015, Year 2020, Year 2025 and Year 2030 and represent predicted emissions following expansion through to closure of the facility.

In the original 2005 HHRA, health risks were estimated using both deterministic and stochastic analyses. A deterministic approach involves using conservative (i.e., protective), discrete values for each parameter (e.g., a child is assumed to play outside 5 hours per day) to generate a single point estimate health risk value. A stochastic approach involved using probability distributions of exposure parameters rather than single point estimate values (e.g., a child is assumed to play outside between 3 and 7 hours per day) to generate a possible range or distribution of health risk estimates.

In addition to evaluating the health impacts associated with emissions of non-methane organic compounds produced by the landfill itself, dusts generated from within the landfill and along two different potential access routes (i.e., Zion Line to the north and County Road 79 to the west) were considered. Based on the results of the air quality assessment, County Road 79 (the west entrance) was considered to be the preferred access route, due to the smaller amount of dust generated. As a result, the HHRA focussed on the west entrance (i.e., County Road 79) during the quantitative evaluation of particulate from crustal sources. Products of incomplete combustion (e.g., polycyclic aromatic hydrocarbons (PAHs) and dioxins/furans) as a result of the landfill flare and leachate treatment options (i.e., evaporation/incineration) were also considered and assessed.

The 2005 HHRA employed the standard HHRA framework and assessed the following COCs. At the time, the MOE required that WM include an initial list of 17 non-methane organic compounds which have been previously identified as posing the greatest concern to human health at landfill sites in Ontario. As a result of the peer review process and consideration of leachate treatment options, additional compounds (including products of incomplete combustion, particulate matter and metals) were selected for inclusion in the HHRA.

Table 2. Proposed Contaminants of Concern for the Human Health Assessment Review

COC Group	COC Source	COC		
Landfill Gases	Landfill gases produced by decomposition of landfill wastes	1,1-Dichloroethane 1,2-Dichloroethane Butan-2-ol 1,1,2-Trichloroethane 1,1,2,2-Tetrachloroethane 1,1-Dichloroethylene	Methylene chloride Methyl mercaptan Trichloroethylene Bromodichloromethane Vinyl Chloride Octane	Dimethylsulphide Chloroethane Hydrogen sulphide Benzene Ethyl mercaptan
Combustion Gases and Products of Incomplete Combustion	Landfill flare and leachate treatment options (evaporation/incineration)	Sulphur dioxide Hydrogen chloride	Nitrogen dioxide Benzo(a)pyrene-TEQ (representing carcinogenic PAH group)	Carbon monoxide Dioxin/Furans (TEQ)
Particulate	Crustal sources (*i.e.*, soil) due to on- and off-site activities; contaminated soils; and various combustion sources including motor vehicle exhaust	Total Suspended Particulate (TSP)	PM_{10}	$PM_{2.5}$
Metals	Leachate treatment option (evaporation/incineration)	Arsenic Mercury	Cadmium Nickel	Lead

Polycyclic aromatic hydrocarbons (PAHs) are a group of ubiquitous environmental pollutants that typically arise from incomplete combustion or related chemical processes. Similar to the dioxin/furan group, they are known to be a family of chemicals which act through similar toxicological modes of action based on the primary carcinogen in the group, benzo(a)pyrene. Toxic equivalency factors/quotients (TEF/TEQs) are commonly used in risk assessment to express the toxicity of complex mixtures. For PAHs, TEF values are available for assessing their carcinogenic potential and are expressed as benzo[a]pyrene equivalents (*i.e.*, benzo[a]pyrene-TEQ or BAP-TEQ). As part of a risk assessment process, rather than assessing each of the carcinogenic PAHs individually, the environmental concentrations can be combined based on their individual TEQ values to express the environmental concentration of the overall carcinogenic PAH group as a BAP-TEQ concentration. In the 2005 HHRA, air concentrations of the PAHs were provided as BAP-TEQ concentrations. For the current review, the Air Quality group will provide BAP-TEQ air concentrations to permit an apples-to-apples comparison.

As an initial step in the Human Health Assessment Review, the list of assessed contaminants may be reduced based upon screening conducted by the Air Quality group. As noted in the Air Quality workplan:

> "The potential effects of the proposed landfill optimization will be assessed based on key indicator contaminants. Since the existing TCEC has been well characterized through studies such as the 2005 EA, the 2016 Environmental Screening Report, and various ECA applications, it has been determined which contaminants are of particular interest. The key indicator contaminants were developed based on a review of previous studies completed for the existing TCEC facility, as well as an understanding of the contaminants typically emitted by landfill operations. In general, the contaminants with predicted concentrations greater than 15% of their current criteria

in the previously completed 2016 Twin Creeks Environmental Screening report were determined to be the key indicator contaminants."

As noted previously, a series of long-term residential exposure scenarios were used to evaluate potential health risks resulting from exposures to non-carcinogenic COCs at the maximum discrete receptor location. Annual average air concentrations under pre-expansion (i.e., background/baseline) conditions and six future operating conditions (2005, 2010, 2015, 2020, 2025 and 2030) were evaluated in the HHRA. For carcinogenic COCs, a lifetime residential exposure scenario evaluating incremental lifetime cancer risks (ILCRs) at the maximum discrete receptor location was assessed. For this scenario, predicted ground-level air concentration data over a 70-year lifespan (modelled data from 2005 through 2075) were used to approximate average lifetime daily exposures to the carcinogenic COCs, for a residential receptor conservatively assumed to live at the maximum discrete receptor location for their entire lifetime (CEI, 2005).

For the 2005 HHRA, the following exposure pathways were considered:

- Inhalation of Air;
- Inhalation of Soils and Dusts;
- Ingestion of Soils and Dusts;
- Ingestion of Locally Grown Produce;
- Ingestion of Locally Derived Beef and Dairy Products;
- Ingestion of Breast Milk; and
- Dermal Exposure to Soils and Dusts.

The HHRA applied standard regulatory-approved assumptions and methodologies to estimate potential health risks from both acute and chronic exposures to the modelled COC concentrations for the baseline conditions and over the six discrete time-slice scenarios (*i.e.*, 2005, 2010, 2020, 2025, and 2030). The results of the HHRA were as follows:

Short-Term Acute Human Health Impacts

- All 24-hour exposure durations were evaluated at the maximum discrete receptor location and at the maximum fenceline location.
- No short-term adverse health effects were predicted to occur as a result of exposure to combustion gases at the maximum receptor location under the *landfill flare only* or *landfill flare plus evaporation/incineration* options.
- With the exception of SO_2 in Year 26, all ½-hour and 1-hour concentrations modelled at the maximum fence-line location were less than the corresponding benchmark under both the *landfill flare only* and *landfill flare plus evaporation/incineration* options.
- Given the conservatism of the WHO SO_2 air quality criterion and the exposure assumptions employed, the HHRA concluded that the CR value of 1.1 (*i.e.*, 10% above the criteria) predicted for operational year 2030 at the maximum fence-line location under the *landfill flare plus evaporation/incineration* option was considered to be of minimal significance.

Chronic Long-Term Human Health Impacts

- Long-term non-cancer health risks as a result of predicted exposures to landfill gases from the proposed expansion were considered minimal (i.e., CR values less than 1.0) at the maximum discrete receptor location.
- ILCR estimates for all COCs including metals, products of incomplete combustion and VOCs from all sources) were below the regulatory benchmark of one-in-one million risk level.
- Chronic human health risks associated with exposure to emissions resulting from both the *landfill flare only* scenario (i.e., PAHs, dioxin/furans), and the *landfill flare plus evaporation/incineration* scenario (i.e., dioxins/furans, benzo(a)pyrene, lead, cadmium, arsenic, nickel and mercury) were all below the corresponding regulatory benchmarks, and in many cases significantly so.
- Annual concentration ratio values for chronic exposures to all combustion gases (i.e., CO, SO_2, NOx and HCl) at the maximum discrete receptor location for both the *landfill flare only* and the *landfill flare plus leachate incineration* were below the corresponding regulatory benchmarks.
- Given the small magnitude and low frequency of exceedances predicted for PM_{10} and $PM_{2.5}$ under assumed worst-case conditions at the maximum residential receptor location, and the level of conservatism used in the HHRA, the HHRA concluded that likelihood of adverse health effects occurring as a result of exposure to particulate matter was extremely low.

4.2.2 Confirmation of Current Conditions based on 2005 HHRA (pre-proposed expansion)

Given the current proposed landfill optimization involves no change in the landfill footprint, approved service area, or annual fill rate, one would not expect significant changes in the assumptions used in the original HHRA. As such, to confirm that the conclusions of the original 2005 HHRA still hold for the current landfill (post proposed expansion), it is proposed that the following steps be taken as part of the current EA process:

- A comparison of the results of the contaminant analyses from the recent annual monitoring program against assumptions made in the original 2005 HHRA. This will include all available empirical data from the annual monitoring program. Preference will be given to the most recent available air monitoring data (*i.e.*, 2018 and 2019, where available);
- An assessment of new contaminants identified for potential health risks, and the reassessment of contaminants detected in recent annual compliance monitoring at concentrations higher, or lower than those considered in the original 2005 HHRA; and
- A review of recent regulatory risk assessment guidance (including toxicological reference values, exposure parameters, etc.) compared to those used in the original 2005 HHRA to identify if there have been any significant changes in standard assessment procedures that may impact HHRA conclusions.

Should these reviews identify additional contaminants that should be evaluated that were not on the original COC list in the 2005 HHRA, these will be highlighted for further assessment as part of this process. Should a dramatic increase in concentration be identified that could pose a risk through secondary pathways (*i.e.*, farmed produce, country foods), these will be highlighted for further assessment as part of this process.

4.3 Assessment of Potential Environmental Effects of the Preferred Alternative

As part of the EA, the alternative methods will be comparatively assessed and evaluated for the other environmental components (i.e., those components forming the natural, socio-economic, cultural, and built environments), using their proposed evaluation criteria, indicators, and data sources to determine the Preferred Alternative.

Based on an examination of the proposed alternative methods, it is unlikely that any of the alternative methods would alter the conclusions of the human health assessment review. As such, the review will focus on a comparison of the Preferred Alternative to the risk assessment work previously completed in 2005.

As previously noted, given the current proposed expansion involves no change in the landfill footprint, approved service area, or annual fill rate, one would not expect significant changes in the assumptions used in the original HHRA. As such, the conclusions of the original 2005 HHRA will be confirmed for the current landfill (post proposed expansion).

It is acknowledged that a fill rate change was permitted for the Twin Creeks Environmental Centre in 2017. The implications of this change will be evaluated as per its potential impacts on the assumptions and conclusions of the original 2005 HHRA.

To assess the effects of the preferred alternative, an evaluation of the data produced from the various components in the current landfill optimization EA (e.g., air quality, surface water, groundwater, etc.) will be conducted to determine whether they differ significantly from those used in the original 2005 HHRA. This assessment will include an evaluation of whether new receptor locations may be relevant (i.e., have any residential homes been built closer to the facility since the 2005 HHRA) and whether localized surface water impacts may have broader impacts that were not assessed in the 2005 HHRA. While it is noted that the Off-site Study area has been extended from 3.5 km in the original 2005 HHRA to 5 km in the current EA, this is unlikely to impact the comparison between the current landfill and the preferred alternative as the highest potential risks related to air emissions are typically in the closest proximity to the landfill (*i.e.*, not in the area from 3.5 to 5 km away from the landfill).

An effects assessment will be carried out considering the same evaluation criteria, indicators, and data sources, and additional studies as required, considering possible mitigation and/or management measures and cumulative effects. The potential effects of the preferred alternative will be compared to the ‘do nothing’ alternative.

4.4 Reporting

Two separate reports will be prepared for Human Health Assessment Review in support of the EA:

1. A report providing a characterization of Existing Conditions; and
2. A report providing the Effects Assessment.

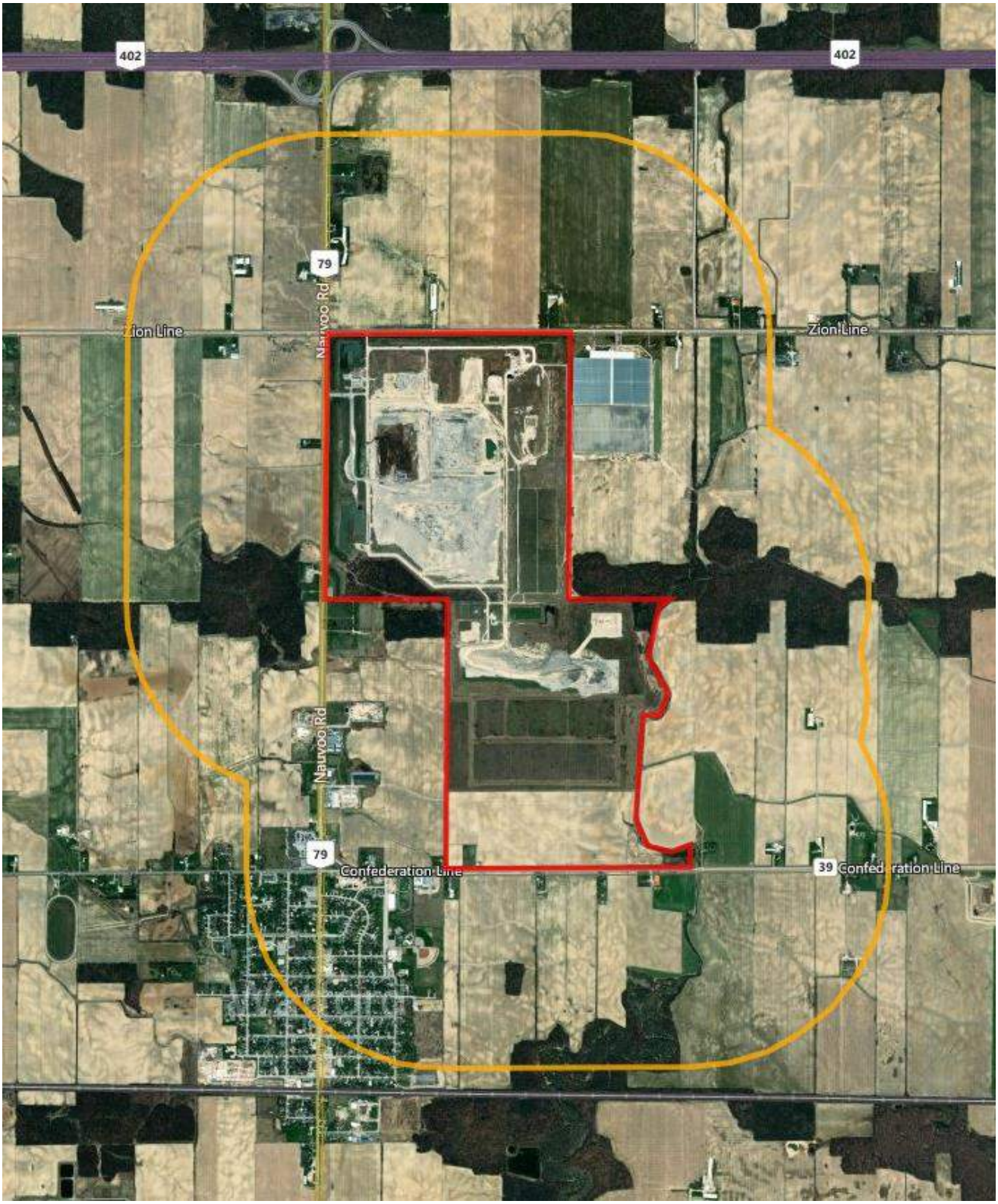
These reports will be appended to the EA Study Report and will be available for review during the EA. A summary of the existing conditions and effects assessment will be included in the EA Study Report.

5 References

CEI. 2005. Human Health Risk Assessment of the Proposed Warwick Landfill Expansion. Cantox Environmental Inc. September 2005.

Figures

Figure 1. General On-Site and Off-site Study Areas



LEGEND

On-Site Study Area

General Off-Site Study Area (1 km)

Hydrogeology Work Plan

Twin Creeks Environmental Centre Landfill Optimization Project

Waste Management of Canada Corporation

Watford, Ontario

March 30, 2022

Prepared by:

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Acronyms

Acronym	Definition
EA	Environmental Assessment
ECA	Environmental Compliance Approval
EMP	*Environmental Monitoring Plan* (Jagger Hims Limited, 2007)
MECP	Ministry of Environment, Conservation and Parks
PDL	Primary Drainage Layer
PLIL	Primary Leachate Indicator List
SDL	Secondary Drainage Layer
SLIL	Secondary Leachate Indicator List
TCEC	Twin Creeks Environmental Centre
ToR	Terms of Reference
WM	Waste Management of Canada Corporation
Waste ECA	Amended Environmental Compliance Approval (ECA) No. A032203, dated December 19, 2020

1 Introduction

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The Hydrogeology discipline evaluates the flow and quality of groundwater with its movement through the Site. The evaluation compares assessed groundwater quality results against established provincial standards, as well as current established site-specific criteria per MECP approval. The hydrogeology evaluation considers specific chemical concentrations, as well as flow direction of groundwater.

Waste Management of Canada Corporation (WM), the owner and operator of the Twin Creeks Environmental Centre (TCEC) in Watford, Ontario, has initiated an EA seeking approval to increase the landfill airspace capacity at the TCEC. The TCEC has approximately 13.2M m³ of remaining approved landfill airspace, which corresponds to about 10 years of operating life (2021 to 2031). This optimization project could provide additional airspace capacity of up to approximately 14M m³, which could extend the site life by about 12 years (from 2031 to 2043). There would be no change to the current 301 ha site area, the approved service area, or the annual fill rate.

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Leachate that is generated in the waste is conveyed through an under-drain system toward a perimeter leachate collection system. WM received approval to treat leachate through a phytoremediation system consisting of a 9.3 ha poplar system planted on the existing landfill cap in 2003. Surplus leachate is trucked off-Site to approved wastewater treatment plants.

WM pays host community fees annually to the Township of Warwick. Since 2009, when the TCEC Expansion Landfill began receiving waste, WM has contributed over $24M in host community fees to the Township.

There is a need for the continued development of the TCEC as it is a significant component of the provincial waste management network and infrastructure, which is lacking in sufficient and secure long-term disposal capacity. Optimizing the future development of the TCEC allows for on-going sustainable business operations and continued provision of essential financial support for community services and programs.

The purpose of the EA is to assess the potential effects of the proposed landfill optimization on the environment. The EA will be carried out in accordance with the requirements of the *Ontario Environmental Assessment Act*.

2 Study Purpose and Objectives

This Hydrogeology work plan outlines the tasks required to support the EA through the characterization of existing conditions and assessment of potential environmental effects of the project on the geologic and hydrogeologic environment and groundwater quality, including the evaluation of the various alternative methods and the identification and assessment of a preferred alternative. This work plan outlines the scope of the hydrogeology work, including protocols and/or standards to be adhered to while the work is undertaken. The specific evaluation criteria, indicators, and data sources to be used and the study areas to be considered are provided below. These items may be adjusted during the EA process.

In accordance with the *Ontario Environmental Assessment Act*, the objectives of the EA are as follows:

1. Describe the environment potentially affected by the proposed undertaking, including both the existing environment as well as the environment that would otherwise be likely to exist in the future without the proposed undertaking;
2. Carry out an evaluation of the environmental effects of the proposed undertaking, using the environmental assessment criteria and studies that have been established through the development of the ToR;
3. Undertake an evaluation of any additional actions that may be necessary to prevent, change or mitigate environmental effects;
4. Provide a description and evaluation of the environmental advantages and disadvantages of the proposed undertaking, based on the net environmental effects that will result following mitigation; and
5. Prepare monitoring, contingency and impact management plans to mitigate the environmental effects of the proposed undertaking.

3 Study Areas

During the EA, existing conditions and potential effects will be considered in the context of two study areas: on-Site and off-Site. The general study areas proposed for the purposes of the EA are presented below and shown in **Figure 1**.

- On-Site Study Area: the existing TCEC.
- Off-Site Study Area (vicinity): the lands within the vicinity of the TCEC extending approximately 1 kilometre off WM's property boundaries. It is noted that the regional geologic area (5 to 10 kilometres from Site) will be documented, but the effects of the landfill optimization project would not be expected beyond the Off-Site Study Area.

Both the on-Site and off-Site Study Areas are located within till plains, with the remnants of a shoreline scarp located to the west near County Road 79. The Regional Setting is between 5 to 10 kilometres of the Site and is based on watershed boundaries, and is located within the southeastern portion of the Horseshoe Moraines physiographic region and within the St. Clair Clay Plain physiographic region. The Horseshoe Moraines consist of a large horseshoe-shaped landform that includes a series of moraines aligned roughly parallel to the Lake Huron shoreline. The Site, in context to the Regional Setting is presented in **Figure 2**.

4 Scope of Work

The scope of work for hydrogeology includes the development of evaluation criteria, indicators, and data sources, characterization of the existing geologic and hydrogeologic environmental conditions, assessment of the potential environmental effects of the alternative methods and the preferred alternative, development of mitigation measures and monitoring programs, and reporting as outlined below.

The hydrogeologic assessment will evaluate:

- Existing groundwater quality trends around the Site in context to current and proposed Site operations;
- Groundwater flow within each hydrostratigraphic unit as a result of increasing volume of waste being disposed in the Expansion Landfill from the landfill optimization project; and
- Evaluation of the contaminating lifespan (CLS) of the Expansion Landfill.

4.1 Evaluation Criteria, Indicators, and Data Sources

The environmental assessment criteria, indicators, and data sources for the hydrogeologic environment are provided in **Table 1**. The assessment criteria, indicators, and data sources will be used to assess the effects of the alternatives and the preferred alternative on the hydrogeologic environment. These evaluation criteria and indicators may be modified during the EA.

Table 1. Evaluation Criteria, Indicators, and Data Sources for the Hydrogeologic Environment

Evaluation Criteria	Rationale	Indicators	Data Sources
Natural Environment			
Geology and Hydrogeology			
Groundwater Quality	Contaminants associated with waste disposal at the Site have the potential to enter the groundwater and impact on-Site groundwater. Acceptable groundwater quality, which is 80% of the Guideline B-7 criteria for the PLIL parameters, must be shown at the Site boundaries.	• Predicted effects on groundwater quality on-Site from increased waste quantities disposed within the Expansion Landfill • Predicted contaminating lifespan	• Applicable regulatory documentation (i.e. Amended Site ECAs, MECP guidelines, technical standards, etc.). • Landfill Environmental Monitoring Plan (Jagger Hims Limited, 2007) (EMP), and as amended per MECP approval. • Historical Hydrogeological studies. • Liquid level monitoring data for on-Site groundwater monitoring wells and leachate monitoring stations. • Liquid level monitoring data for surface water. • Groundwater quality monitoring data at on-Site monitoring wells as outlined in the EMP. • Quarterly and Annual Site compliance monitoring reports. • Leachate generation and management assessments, as outlined in the Leachate Management Plan, (March 2020) (HDR, 2019). • Proposed facility characteristics, including service life estimates. • Water well survey within the off-Site study area.

Table 1. Evaluation Criteria, Indicators, and Data Sources for the Hydrogeologic Environment

Evaluation Criteria	Rationale	Indicators	Data Sources
Groundwater Quantity	The landfill optimization has the potential to affect the established hydraulic trap design for the Expansion Landfill and understood groundwater flow patterns on-Site and Off-Site	• Predicted effect of landfill optimization on groundwater flow and quantity both on-Site and off-Site.	• Applicable regulatory documentation (i.e. Amended Site ECAs, MECP guidelines, technical standards, etc.) • Liquid level monitoring data for on-Site groundwater monitoring wells and leachate monitoring stations. • Historical Hydrogeological studies. • Water well records to be reviewed to understand the effect on groundwater quantity on-Site and off-Site as result of off-Site water well use in the area. • Quarterly and Annual Site compliance monitoring reports. • Water taking tracking from the Secondary Drainage Layer. • Proposed facility characteristics. • Water well survey within the off-Site study area.

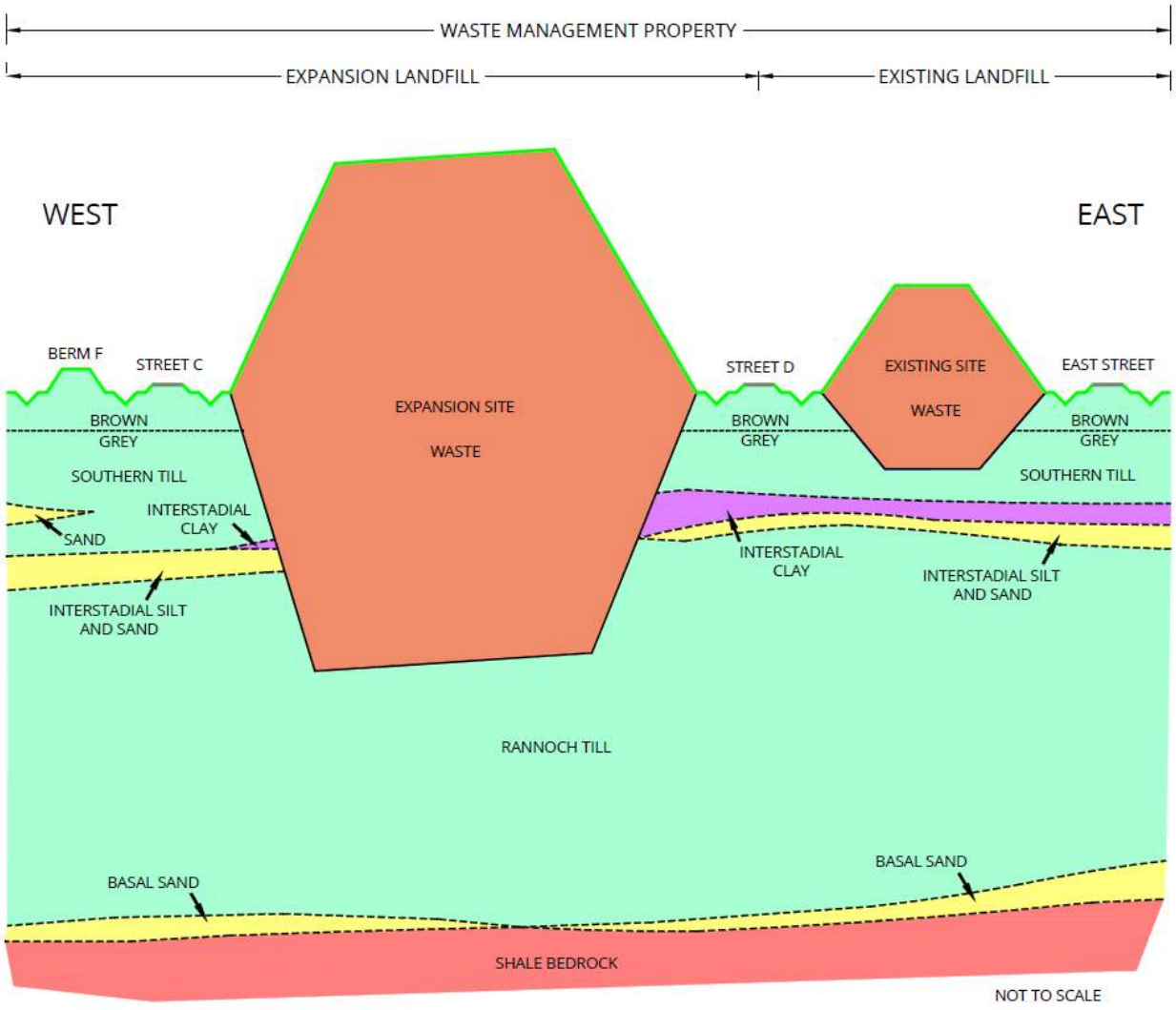
4.2 Characterization of Existing Conditions

As part of the environmental assessment process, there is a requirement to document the existing conditions that occur at the Site. This is to develop a general baseline condition understanding so that the effects from the project can be assessed. For the hydrogeologic assessment, baseline conditions will be defined using the established hydrogeologic monitoring program completed at the Site.

The hydrogeologic monitoring program for the Site is developed to assess that groundwater at the Site is not unacceptably degraded in comparison to the background quality, and that flow at the Site is in accordance with the hydraulic trap design of the Expansion Landfill.

4.2.1 On-Site Study Area Geologic Setting

The understood on-Site study area geologic stratigraphy is subdivided into the following main units: 1) the Southern Till; 2) interstadial deposits; 3) the Rannoch Till; and 4) bedrock and the overlying basal sand. Each unit is shown in the following cross-section.



The characteristics of each of the aforementioned geologic units will be documented to outline existing conditions at the Site.

4.2.2 On-Site Study Area Hydrogeologic Setting

Site Hydrogeology

There is an established groundwater setting below the Site. The stratigraphic sequence described above can be associated with hydrostratigraphic units, as summarized below. It is noted that although each stratigraphic unit is identified as part of a hydrostratigraphic unit, each unit has a hydraulic influence on the others.

Stratigraphic Unit	Hydrostratigraphic Unit	Approximate Depth to top of Hydrostratigraphic Unit (m)
Southern Till: Brown Zone	Active Aquitard	0.0
Southern Till: Grey Zone	Upper Aquitard	1.6 to 7.9
Interstadial Deposits: Clay and Silt	Upper Aquitard	1.6 to 7.9
Interstadial Deposits: Silt and Sand	Interstadial Silt & Sand	4.0 to 10.7
Rannoch Till	Lower Aquitard	4.5 to 12.5
Fractured Bedrock and Basal Sand	Interface Aquifer	22.8 to 29.3

The characteristics of each of the aforementioned hydrogeologic units will be documented to outline existing conditions at the Site. Additionally, the Site hydrogeology with respect to the broader regional hydrogeology will be documented with respect to source water protection.

4.2.3 Off-Site Study Area Geologic and Hydrogeologic Setting

Off-Site Geology

The understood off-Site study area geologic stratigraphy is similar to that of the on-Site study area where it is subdivided into the following main units: 1) the Southern Till; 2) interstadial deposits; 3) the Rannoch Till; and 4) bedrock and the overlying basal sand.

Off-Site Hydrogeology

The established groundwater setting below the Site is also similar to that of the on-Site study area which is comprised of the stratigraphic sequence as shown above in section 4.2.2.

4.2.4 Site Leachate Collection Infrastructure

The leachate collection infrastructure is critical to the protection of groundwater resources at the Site. The fundamental design of the Expansion Landfill is hydraulic containment, which is the inducement of groundwater flow towards the landfill footprint thereby preventing the outward movement of leachate. As a best practice, the leachate levels at the Existing Landfill are similarly managed, but levels are also managed in consideration of leachate storage for volume availability to operate the on-Site Poplar System phytoremediation system as an environmental stewardship proactive alternative to off-Site

disposal at a wastewater treatment plant. The extraction of leachate within the Existing Landfill is prioritized based on the leachate elevations for each individual waste cell to promote inward hydraulic gradients, except where leachate is stored in the waste during late winter and early spring for irrigation application to the Poplar System in the subsequent growing season. It is noted that from a compliance perspective, the Existing Landfill is evaluated for groundwater and surface water quality, and not from a hydraulic containment perspective.

Documentation of the details of the interaction of the leachate collection systems for both the Existing and Expansion Landfills on the groundwater within each hydrostratigraphic unit will be completed to outline how these systems protect the groundwater resources at the Site.

Existing Landfill Leachate Collection Infrastructure

Within the Existing Landfill, Cells 3S, 4, 5, 6, 7, 8, 9, 10, 11, Cell 12 and the Sump are completed with leachate collection and pumping systems, while Cell 3 relies on the leachate collection systems of the adjacent cells. These manholes, along with 9 inter-waste leachate level monitoring wells are assessed semi-annually per the EMP for input to leachate management. The assessed maintenance holes and leachate level monitoring wells are presented on **Figure 3**.

The leachate collection principles for each of the aforementioned cells, and the findings from the established monitoring program for the aforementioned leachate assessment locations will be documented to outline existing conditions.

Expansion Landfill Infrastructure

Hydraulic containment of the Expansion Landfill occurs immediately upon excavation of a given waste disposal cell. The upward and inward movement of groundwater is slowly saturating the secondary drainage layer (SDL). Pumping stations PS2, PS4, and PS6, as well as future PS8 are operated in a ‘normally off’ position to allow for groundwater accumulation within the SDL.

The leachate collection system in the primary drainage layer (PDL) is designed to maintain a hydraulic trap design of the Expansion Landfill whereby leachate is maintained below the level of the water in the SDL, as well as adjacent groundwater levels and pressures.

Monitoring of the PDL and SLD pumping stations are assessed in accordance with the EMP. Additionally, to supplement the PDL pumping station leachate level monitoring, inter-waste leachate levels are assessed from select early vertical gas collection wells. The assessed PDL and SDL pumping stations, as well as the early vertical gas collection wells used for level monitoring are presented on **Figure 3**.

The existing conditions of these two drainage layers will be documented to outline the principals of the hydraulic trap design for the Expansion Site. Chemical findings for the Expansion Site leachate will be documented to outline the relationship of leachate quality to groundwater quality at the Site.

4.2.5 On-Site Groundwater Monitoring

Groundwater monitoring wells are developed within each of the hydrostratigraphic units that have the greatest potential to readily show potential landfill leachate effects, as well as are sources of drinking water supply in the vicinity of the Site.

The hydrostratigraphic units including the **Active Aquitard**; **Interstadial Silt and Sand**; and **Interface Aquifer** are monitored semiannually in accordance with the EMP to assess for potential landfill leachate effects on groundwater quality.

The location of each of the following monitoring wells, as presented as monitoring well nests (i.e., OW16 represents OW16-6 and OW16-7), is provided in **Figure 3**.

Hydrostratigraphic Unit	Monitoring Wells
Active Aquitard	OW16-6, OW17-4, OW40D-4, OW54A-4, OW56-4, OW57-4, OW58-6, OW59-6, OW60-4, OW61-4, OW62-5, OW67-4, OW68-5, OW69-5, OW70B-5, OW71A-5, OW72-6, OW73-6, OW75-3, OW76-5, OW77-4, OW78-4, OW79-5, OW80-3, OW81-5, OW82(new), OW83(new), OW84(new), OWOW85-5
Interstadial Silt and Sand	OW16-7, OW40A-7, OW46-7, OW47-6, OW54-10, OW57-15, OW58-17, OW60-8, OW61-6, OW62-7, OW67-11, OW72-10, OW73-9, OW75-7, OW78-6, OW79-7, OW80-6, OW81-7, OW82(new), OW83(new), OW84(new), OW85-8
Interface Aquifer	OW17-30, OW19-29, OW39A-26, OW40A-28, OW49-29, OW60-25, OW61-26, OW62-30, OW79-26, OW80-27, OW81-27, OW82(new), OW83(new), OW84(new), Cemetery Well

Note: 1) Italicized denotes monitoring well is inactive as it is to be used to evaluate the Poplar Plantation two (2) months prior to activation of the system.
2) (new) denotes that monitoring well to be installed per the installation frequency outlined in the Environmental Monitoring Plan (EMP) dated December 20, 2007.

There are three groundwater Primary Leachate Indicator List (PLIL) parameters (chloride, nitrate (as N), and boron) that would most readily show as a landfill leachate effect on groundwater if shown together in elevated concentrations compared to background concentrations. It is the PLIL parameters that are assessed for compliance with the site-specific groundwater trigger concentrations per the EMP. It is noted that the established comprehensive groundwater monitoring program at the Site has shown acceptable quality and predicted groundwater flow for each hydrostratigraphic unit at the Site since monitoring began.

Groundwater data collected from the Site for the established comprehensive environmental monitoring program serve as a strong baseline database in order to document existing conditions, as well as to be assessed to evaluate potential effects from the landfill optimization project on groundwater flow and quality for each of the aforementioned hydrostratigraphic units. Documentation of the mechanics of the monitoring program will be completed. This documentation will outline the rationale for the development of the monitoring program to evaluate for possible landfill leachate effects on groundwater, which will include what parameters are assessed, where sampling locations are located, when is sampling initiated, and how the quality results are assessed to evaluate existing conditions.

Presented below are the assessments that will be completed to document existing conditions and to evaluate potential effects from the landfill optimization project on groundwater quality and flow at the Site.

Evaluation of Groundwater Quality

The landfill optimization project has the potential to affect groundwater quality by the increased volume of waste being disposed and the make-up of waste to be disposed. The data from the established comprehensive monitoring program will serve as a strong baseline comprehensive database in order to document existing conditions, as well as to be assessed to evaluate potential effects from the landfill optimization project on groundwater quality.

An assessment of the PLIL Parameters will be completed of existing groundwater quality data compared to the leachate quality collected from the Expansion Site. This assessment will evaluate actual imperial chemical data from the leachate collected from the newer waste (< 12 years old) compared to predicted data used in the EMP. The intent of the assessment of the three PLIL Parameters (chloride, nitrate, and boron) will be to determine that the PLIL Parameters are still the most suitable parameters for evaluating possible landfill leachate effects on groundwater quality.

Evaluation of Groundwater Quantity (Flow)

The landfill optimization project has the potential to affect groundwater quantity, or more specifically the flow direction of the groundwater. This is important as the Expansion Site is designed based on hydraulic containment (the inducement of inward groundwater gradients towards the waste mound).

Similar to the evaluation for groundwater quality, documentation of the mechanics of the monitoring program will be completed to evaluate groundwater flow. This will document the rationale for the development of the monitoring program to evaluate for possible landfill effects on groundwater flow, what assessment considerations are evaluated, where monitoring wells are located, when levels and pressures are assessed, and how the monitoring results are assessed to evaluate existing conditions.

The available groundwater and leachate liquid elevation data will be assessed since disposal activities occurred in the Expansion Site to evaluate if there is a correlation to groundwater levels and pressures as a result of increased volume of waste disposed over the years.

4.2.6 Contaminating Lifespan

Leachate at the Site is generated by the percolation of infiltrating precipitation through the column of waste at Site. Consequently, the waste at the Site is degraded by the percolation of infiltrating precipitation over time. At a point in time in the future, the waste will be so degraded that the percolating precipitation will no longer generate leachate of sufficient strength that it would unacceptably affect groundwater quality.

There is a requirement for the Site to calculate the point in time in the future when the leachate would no longer negatively affect groundwater quality at the Site boundary. This duration of time in the future when the leachate would no longer negatively affect groundwater quality is termed the contaminating lifespan (CLS). As the Expansion Landfill has a significantly larger and newer volume of waste than the Existing Landfill, it is the waste in the Expansion Landfill that defines the duration of the CLS.

The existing conditions for the CLS for the Site will be documented, which will be presented in two manners: 1) the CLS for the current waste placed in the Expansion Landfill; and 2) the CLS for the fully constructed Expansion Landfill per its current approval volume. The documentation will outline the input considerations that are used to calculate the CLS for the Expansion Landfill.

Evaluation of the Contaminating Lifespan

The contaminating lifespan (CLS) for Expansion Landfill has the potential to be affected by the landfill optimization project. An evaluation of the CLS will be completed to present how the different volumes of waste for each alternative will affect the duration of the CLS for the Site.

4.3 Assessment of Potential Environmental Effects

Using the evaluation criteria, indicators, rationale, and data sources from Section 4.1 and the characterization of existing conditions as described in Section 4.2, the assessment of potential environmental effects will be carried out as follows:

- predict the potential environmental effects for each alternative method (Section 4.3.1);
- identify the preferred alternative based on a comparative evaluation of the potential environmental effects of each alternative method (Section 4.3.2); and
- conduct an effects assessment on the preferred alternative, including the identification of mitigation measures and monitoring programs (Sections 4.3.3).

4.3.1 Evaluation of Alternative Methods

The potential effects of each alternative method will be identified based upon application of the proposed evaluation criteria, indicators and data sources as outlined in Section 4.1. Potential effects can be positive or negative, direct or indirect, and short or long-term. Mitigation measures will be identified to minimize or mitigate the potential effects and then the net effects are evaluated taking into consideration the application of mitigation measures.

The proposed facility characteristics of each alternative method will be reviewed to determine potential interactions with groundwater quality and flow. The criteria and indicators listed in **Table 1** will be applied to each alternative method to determine potential effects.

For the evaluation of the hydrogeologic environment, the characterization of the existing conditions outlined in Section 4.2 for groundwater quality and flow, as well as the CLS for the Expansion Site will be used to assess potential effects that each of the alternative methods of the landfill optimization project may have on the Site.

4.3.2 Identification of the Preferred Alternative

The alternative methods will be comparatively assessed and evaluated using the proposed evaluation criteria, indicators, and data sources to determine the preferred alternative. The differences in the potential environmental effects remaining following the implementation of mitigation/management measures (i.e., net effects) will be used to identify and compare

the advantages and disadvantages of each alternative method. The comparison of alternative methods will include a clear rationale for the selection of the preferred alternative.

4.3.3 Effects Assessment of the Preferred Alternative

Following the identification of the preferred alternative, an effects assessment will be carried out on the preferred alternative considering the same evaluation criteria, indicators, and data sources, and additional studies as required, considering possible mitigation and/or management measures and cumulative effects. The potential effects of the preferred alternative will be compared to the 'do nothing' alternative.

Climate change has affected the frequency and intensity (less frequent and more intense) of precipitation events that are occurring globally, as well as at the Site. On-Site monitoring of precipitation began during 2003, with the first full year in 2004. The available on-Site precipitation data will be evaluated and compared to the two most relevant (closest with sufficient data) Environment Canada climatic stations in consideration of year to year patterns since 2004, as well as in consideration of relevant historical 30-year normal amounts (as measured at the Environment Canada climatic stations). The assessment will enable an evaluation of precipitation infiltration into the waste cells (in other words: leachate generation) which may be affected by landfill optimization and therefore the chemical strength of the leachate within the waste mound could change up or down as a result of the landfill optimization program. The assessment will also enable an evaluation of the potential for increased leachate seeps/springs and mounding of leachate within the waste mound. Weaker or stronger strength leachate will impact the contaminating lifespan of the landfill, down or up, respectively. This assessment will be completed for the Preferred Alternative.

4.4 Reporting

Two separate reports will be prepared for the Hydrogeological Environment in support of the EA:

1. A report providing a characterization of Existing Conditions; and
2. A report providing the Effects Assessment.

These reports will be appended to the EA Study Report and will be available for review during the EA. A summary of the existing conditions and effects assessment will be included in the EA Study Report.

The characterization of existing conditions will include details of completed field investigations to date, technical analyses of available data, assessment methods, interpretation of results for compliance with the Waste and Sewage ECAs, as well as provide a summary of conclusions and recommendations.

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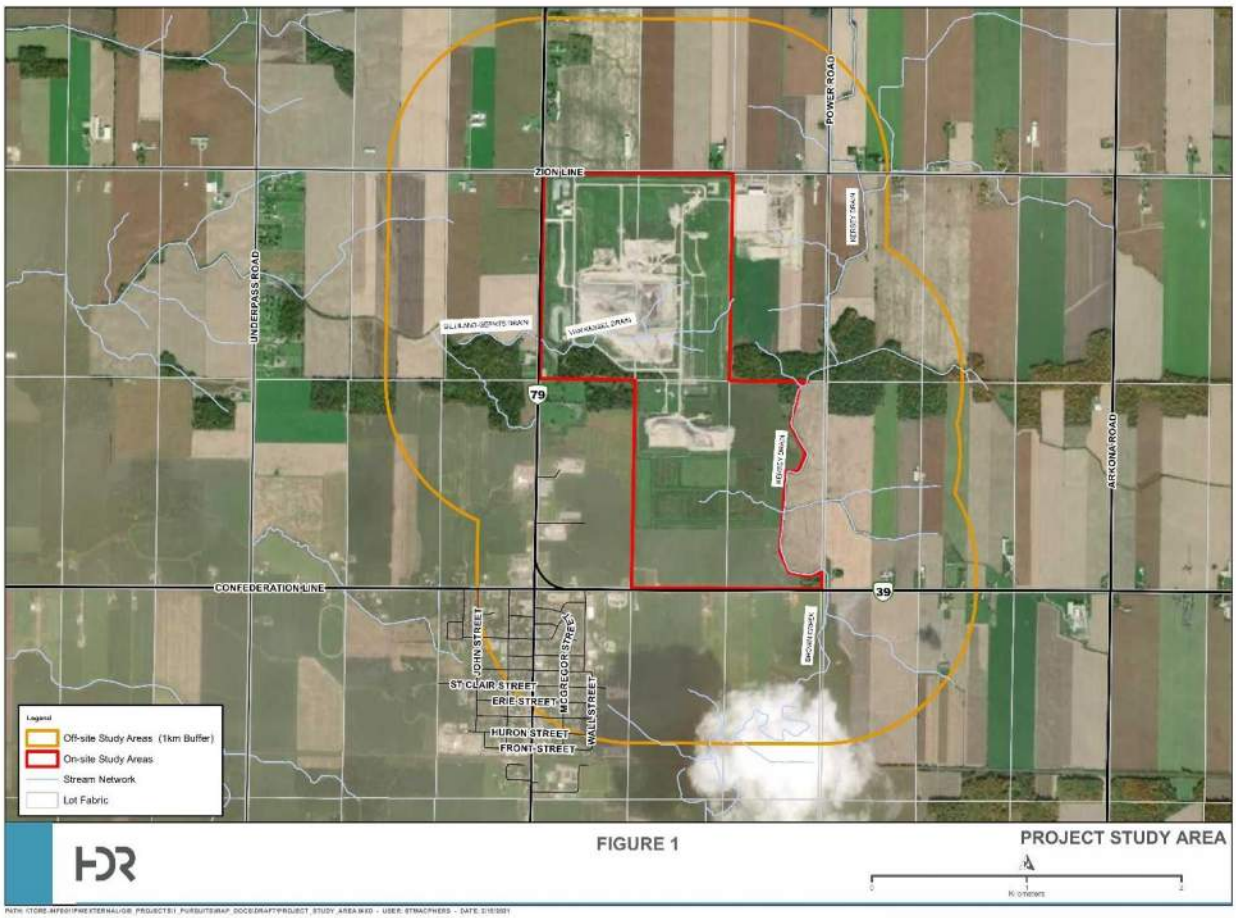
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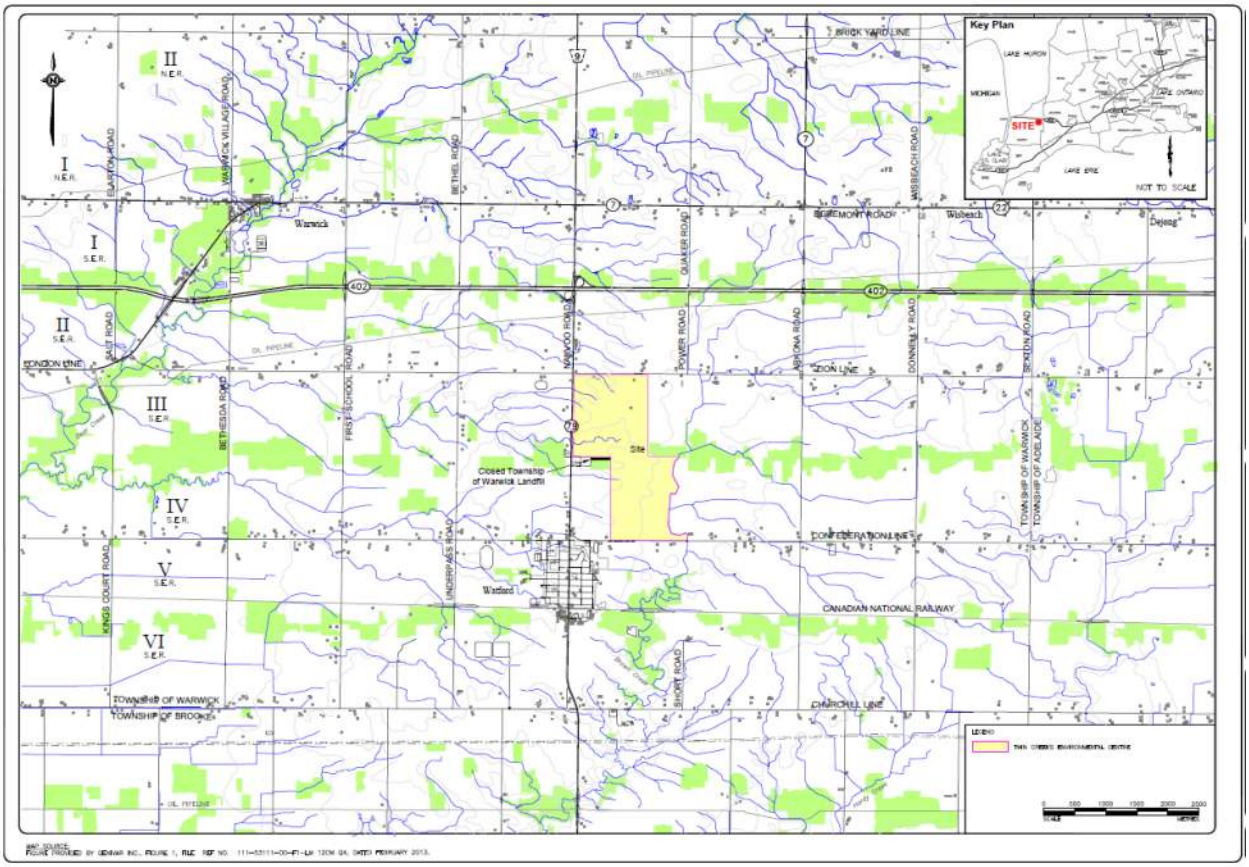
Figures

Figure 1. General On-Site and Off-Site Study Areas



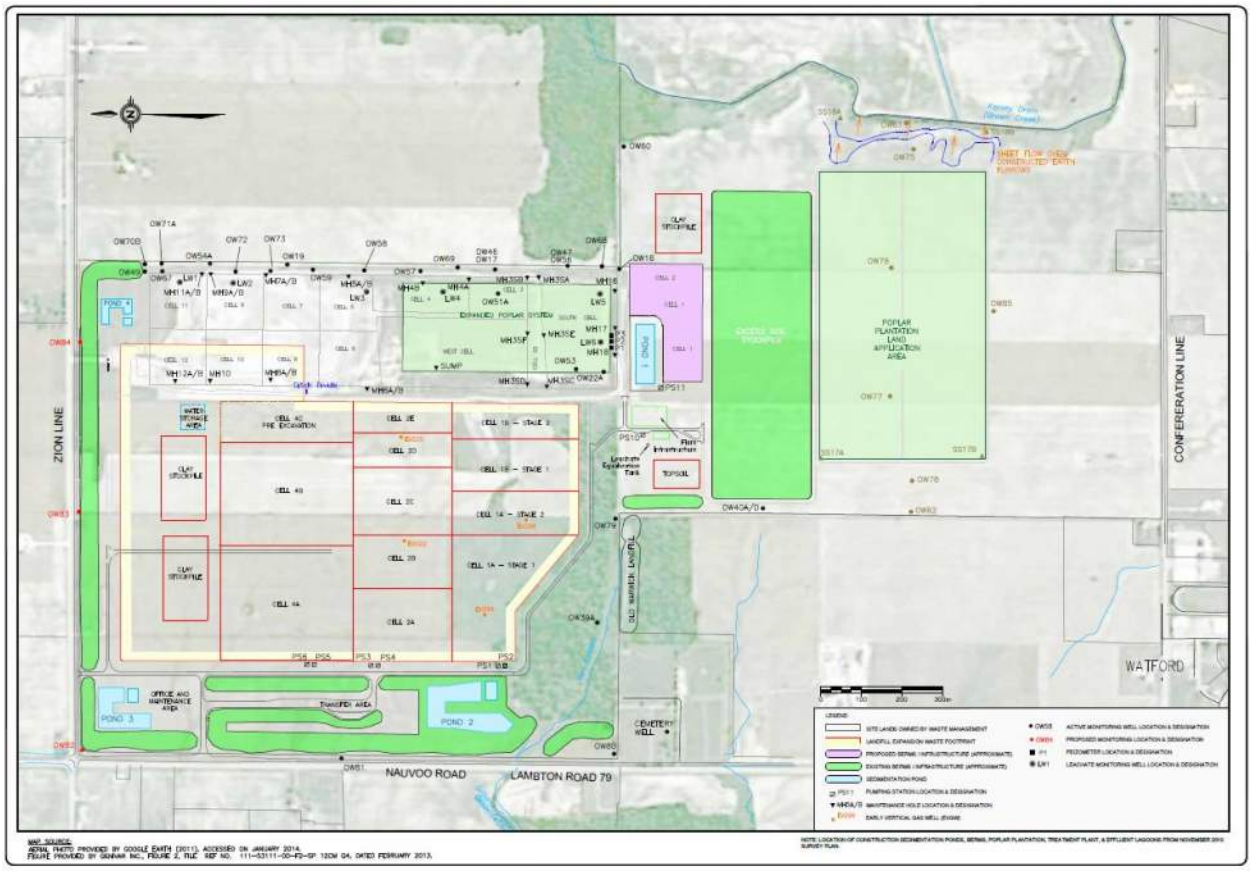
Source: HDR, 2021

Figure 2. Site Location in Regional Setting



Source: RWDI, April 2021

Figure 3. Hydrogeologic Monitoring Network



Source: RWDI, April 2021

Land Use Work Plan

Twin Creeks Environmental Centre Landfill Optimization Project

Waste Management of Canada Corporation

Watford, Ontario

March 30, 2022

Prepared by:

Monteith Brown Planning Consultants
610 Princess Avenue, London ON, N6B 2B9

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Acronyms

Acronym	Definition
EA	Environmental Assessment
MBPC	Monteith Brown Planning Consultants
MECP	Ministry of Environment, Conservation and Parks
OMAFRA	Ontario Ministry of Agriculture, Food and Rural Affairs
OP	Official Plan
TCEC	Twin Creeks Environmental Centre
ToR	Terms of Reference
WM	Waste Management of Canada Corporation
ZBL	Zoning By-law

1 Introduction

This Land Use work plan has been prepared to support the environmental assessment (EA) for the Twin Creeks Environmental Centre Landfill Optimization Project (the Project) and will be appended to the Terms of Reference (ToR) for the EA to be submitted to the Ministry of Environment, Conservation and Parks (MECP) for approval.

The Province of Ontario sets out the legislative framework for land use planning in Ontario through the *Planning Act*, which describes how land uses may be controlled, and who may control them. The effects of the proposed landfill expansion on current and future land uses within the On-Site and Off-Site Study Areas will be evaluated through the EA process, with a particular focus on existing and planned "sensitive land uses," as defined by the PPS and the MECP D-1 Guidelines on Land Use and Compatibility.

Waste Management of Canada Corporation (WM), the owner and operator of the Twin Creeks Environmental Centre (TCEC) in Watford, Ontario, has initiated an EA seeking approval to optimize the landfill design and operation, maximizing the use of the constructed infrastructure and the significant investment made at the TCEC. The optimization could involve a vertical expansion of the landfill within the approved 101.8 ha Expansion Landfill footprint by modifying the side slopes and increasing the elevation of the landfill. This optimization could provide additional airspace of up to approximately 14M m^3, which could extend the site life by approximately 12 years (from 2032 to 2044). There would be no change to the current 101.8 ha landfill footprint area, the approved service area, or the annual fill rate.

The TCEC is a regional facility that provides safe and convenient disposal services for communities, businesses and industries serving the Province of Ontario. The landfill is approved to receive municipal, industrial, commercial, and institutional solid non-hazardous wastes generated, including non-hazardous contaminated soil.

The TCEC is engineered with environmental protection systems that meet or exceed regulatory requirements and are subject to highly regulated monitoring and reporting requirements. Systems include engineered liners and covers, leachate collection and removal, landfill gas collection and control, and on-site leachate disposal through phytoremediation. The TCEC provides landfill gas, for heating, to the 40-acre greenhouse facility adjacent to the landfill property. Prior to this, all landfill gas was flared. The intent is for the landfill to supply gas for heating to the greenhouses for 25 years.

Leachate that is generated in the waste is conveyed toward a perimeter leachate collection system. WM received approval to treat leachate through a phytoremediation system consisting of a 9.3 ha poplar system planted on the existing landfill cap in 2003. Surplus leachate is trucked off-site to approved wastewater treatment plants.

WM pays host community fees annually to the Township of Warwick. Since 2009, when the TCEC Expansion Landfill began receiving waste, WM has contributed over $23M in host community fees to the Township.

There is a need for the continued development of the TCEC as it is a significant component of the provincial waste management network and infrastructure, which is lacking in sufficient and secure long-term disposal capacity. Optimizing the future development of

the TCEC allows for on-going sustainable business operations and continued provision of essential financial support for community services and programs.

The purpose of the EA is to assess the potential effects of the proposed landfill optimization on the environment. The EA will be carried out in accordance with the requirements of the *Ontario Environmental Assessment Act*.

2 Study Purpose and Objectives

This Land Use work plan outlines the tasks required to support the EA through the characterization of existing conditions and assessment of potential environmental effects of the project on the Land Use environment, including the evaluation of the various alternative methods and the identification and assessment of a preferred alternative. This work plan outlines the scope of the Land Use work, including protocols and/or standards to be adhered to while the work is undertaken. The specific evaluation criteria, indicators, and data sources to be used and the study areas to be considered are provided below. These items may be adjusted during the EA process.

In accordance with the *Ontario Environmental Assessment Act*, the objectives of the EA are as follows:

1. Describe the environment potentially affected by the proposed undertaking, including both the existing environment as well as the environment that would otherwise be likely to exist in the future without the proposed undertaking;
2. Carry out an evaluation of the environmental effects of the proposed undertaking, using the environmental assessment criteria and studies that have been established through the development of the ToR;
3. Undertake an evaluation of any additional actions that may be necessary to prevent, change or mitigate environmental effects;
4. Provide a description and evaluation of the environmental advantages and disadvantages of the proposed undertaking, based on the net environmental effects that will result following mitigation; and
5. Prepare monitoring, contingency and impact management plans to mitigate the environmental effects of the proposed undertaking.

3 Study Areas

During the EA, existing conditions and potential effects will be considered in the context of two study areas: on-site and off-site. The general study areas proposed for the purposes of the EA are shown on **Figure 1**, with the Land-Use-specific Off-Site Study Area shown on **Figure 2**.

- On-Site Study Area: the existing TCEC.
- Off-Site Study Area: The Land Use Planning assessment Off-Site Study area corresponds to the Off-Site Study Area identified for the Socio-Economic Assessment,

including lands within 1 km of the On-Site Study Area, as well as the entire Settlement Area of Watford.

When evaluating effects across the study areas, all applicable Provincial D-series guidelines will be considered in the scope of this EA, including guidelines D-1, D-1-1, D-1-2, and D-1-3, as well as D-4, D-4-1, D-4-2, and D-4-3. The Provincial 'D-4' Guidelines for Land Uses on or Near Landfills and Dumps identifies that "*the Ministry considers the most significant contaminant discharges and visual problems to be normally within 500 metres of the perimeter of a fill area",* and recommends that this distance be used as a study area for land use proposals, although the actual influence areas may vary by individual landfills (s.s. 5.3).

4 Scope of Work

The scope of work for Land Use includes the development of evaluation criteria, indicators, and data sources, characterization of existing Land Use conditions, assessment of the potential environmental effects of the alternative methods and the preferred alternative, development of mitigation measures and monitoring programs, and reporting as outlined below.

4.1 Evaluation Criteria, Indicators, and Data Sources

The environmental assessment criteria, indicators, and data sources which will be used to assess the effects of the alternatives and the preferred alternative on the Land Use environment are provided in **Table 1**. These evaluation criteria and indicators will be finalized through the EA process.

Table 1. Evaluation Criteria, Indicators, and Data Sources for Land Use

Evaluation Criteria	Rationale	Indicators	Data Sources
Current and Planned Future Land Use			
Effects on Current and Future Land Uses	The continued operation of the landfill may not be fully compatible with certain current and/or planned future land uses in the Off-Site Study Area. Waste disposal facilities can potentially have a negative impact on sensitive land uses, in the vicinity of the site.	• Current land use • Planned land use • Type(s) and proximity of off-site recreational resources within 1 km of a landfill footprint potentially affected • Type(s) and proximity of off-site sensitive land uses as defined by the Provincial Policy Statement and the MECP D-1 Guidelines (e.g., dwellings, churches, parks) within 1 km of a landfill footprint potentially affected • Type(s) and proximity of agricultural land use/operations (e.g., organic, cash crop, livestock)	• Planning Act • Provincial Policy Statement • All applicable Provincial D-series guidelines, including guidelines D-1, D-1-1, D-1-2 and D-1-3 (Land Use and Compatibility), as well as D-4, D-4-1, D4-2, and D-4-2 (Land Use On or Near Landfills and Dumps) • Lambton County Official Plan • Township of Warwick Official Plan • Township of Warwick Zoning By-law 121 of 2012 • Aerial photographic mapping, utilizing the following sources: Lambton County GIS, St. Clair Region Conservation Authority, OMAFRA Agricultural Information Atlas, Google Maps, and Bing Maps • Canadian Lands Inventory mapping • Field reconnaissance • Published data on public recreational facilities/activities • Proposed facility characteristics • Landfill design and operations data • The results of other discipline assessments for this EA, where applicable

Source: HDR & MBPC

4.2 Characterization of Existing Conditions

The EA will evaluate the effects of the proposed landfill expansion on current and future land uses within the On-Site and Off-Site Study Areas. In particular, waste disposal facilities may have a significant effect on sensitive land uses (as defined in the PPS, the 'D-1' Guidelines, and the 'D-4' Guidelines, see **Table 2**) within the vicinity of the site. The EA process will also identify the extend of the amendments required to be consistent with current Provincial policies, legislation, and guidelines.

The characterization of existing conditions will be informed by the Land Use planning framework in Ontario, which is set out in Provincial legislation through the *Planning Act*, The *Act* describes how land uses may be controlled, and who may control them. The Provincial Policy Statement ('PPS') (2020) is issued by the Province under the *Planning Act* and provides policy direction on matters of provincial interest related to land-use planning and development, which are implemented at the County and Municipal levels of government through Official Plans and Zoning By-laws (i.e., the County of Lambton Official Plan, Township of Warwick Official Plan, and Township of Warwick Zoning By-law No. 121 of 2012). All land-use planning decisions in Ontario must be consistent with the PPS.

The analysis will also be informed by a review of the Provincial 'D-1 Land Use and Compatibility' and 'D-4 Land Use On or Near Landfills and Dumps' guidelines, issued under the legislative authority of the *Environmental Protection Act, Environmental Assessment Act, Planning Act,* and other related legislation. The objective of the 'D-1' guidelines is *"to minimize or prevent, through the use of buffers, the exposure of any person, property, plant or animal life to adverse effects associated with the operation of specified facilities"*, including landfills (s.s. 1.2). The 'D-4' guidelines were written specifically to assist planning authorities in determining how to decide what types of land uses are appropriate near landfilled waste.

Table 2. Provincial Definition of 'Sensitive Land Use'

Source	Definition
Provincial Policy Statement (2020)	*Sensitive land uses: means buildings, amenity areas, or outdoor spaces where routine or normal activities occurring at reasonably expected times would experience one or more adverse effects from contaminant discharges generated by a nearby major facility. Sensitive land uses may be a part of the natural or built environment. Examples may include, but are not limited to: residences, day care centres, and educational and health facilities.*
D-1-3 Land Use Compatibility Definitions	*Sensitive Land Use* *A building, 'amenity area' or outdoor space where routine or normal activities occurring at reasonably expected times would experience 1 or more 'adverse effect(s)' from contaminant discharges generated by a nearby 'facility'. The 'sensitive land use' may be a part of the natural or built environment. Depending upon the particular 'facility' involved, a sensitive land use and associated activities may include one or a combination of:* *i. residences or facilities where people sleep (e.g., single and multi-unit dwellings, nursing homes, hospitals, trailer parks, camping grounds, etc.). These uses are considered to be sensitive 24 hours/day.* *ii. a permanent structure for non-facility related use, particularly of an institutional nature (e.g., schools, churches, community centres, day care centres).* *iii. certain outdoor recreational uses deemed by a municipality or other level of government to be sensitive (e.g., trailer park, picnic area, etc.).* *iv. certain agricultural operations (e.g., cattle raising, mink farming, cash crops and orchards).* *v. bird/wildlife habitats or sanctuaries*.

Table 2. Provincial Definition of 'Sensitive Land Use'

Source	Definition
D-4 Land Use On or Near Landfills and Dumps	*Sensitive land uses for landfills currently in operation* *Any existing or committed land use which includes:* *a. a permanent structure used in animal husbandry; or* *b. agricultural land used for pasturing livestock; or* *c. a permanent structure where:* *i. a person sleeps, or* *ii. a person is present on a full time basis; but not including food or motor vehicle service facilities adjacent to a highway, utility operations, scrap yards, heavy industrial uses, gravel pits, quarries, mining or forestry activities; or* *d. cemeteries*

Source: PPS (2020), D-1-3 Land Use Compatibility Definitions, D-4 Land Use On or Near Landfills and Dumps

The following tasks will be undertaken to fully characterize existing conditions within the On-Site and Off-Site Study Areas:

1. Collect Background Information on the Land-Use Planning Context
    a. A review of relevant background documents will be undertaken to inform the understanding of the land-use planning context, including the County of Lambton Official Plan, the Township of Warwick Official Plan, and the Township of Warwick Zoning By-law 121 of 2012, and their respective schedules.
2. Undertake a Desktop Review of Aerial Photographic Mapping
    a. A range of data sources, including but not limited to Lambton County GIS online mapping, St. Clair Region Conservation Authority online mapping, the OMAFRA Agricultural Information Atlas, Google Maps, and Bing Maps, will be utilized to identify existing sensitive land uses, recreational resources, and agricultural operations within the Off-Site Study Area, and note where 'planned' land uses differ from existing land uses.
3. Request Data on Recreational Facilities
    a. Data will be requested from the Township and the County (if applicable) on the usage of public recreational facilities within the Off-Site Study Area.
4. Site Visit
    a. A field visit to the On-Site and Off-Site Study Areas will be arranged to ensure a thorough understanding of existing land-use conditions. A 'windshield tour' of the Off-Site Study Area will be conducted to take photographs of sensitive land uses.
5. Produce a Detailed Characterization of Land-Use Conditions
    a. The findings from the background document review, desktop mapping review, data requests, and field investigations will be synthesized into a detailed characterization of conditions within the On-Site and Off-Site Study Areas, identifying specific receptors that are considered to be "sensitive land uses" under the established PPS and 'D-1' Guidelines. Locations within the Off-Site Study Area that may accommodate sensitive land uses in the future (based on the existing planning framework) will also be identified to recognize where the proposed landfill expansion may have a negative impact on future development.

For the purposes of the EA, the Land Use and Socio-Economic Studies will be conducted separately. Information will be shared between the two assessments as appropriate.

4.3 Assessment of Potential Environmental Effects

Using the evaluation criteria, indicators, rationale, and data sources from Section 4.1 and the characterization of existing conditions as described in Section 4.2, the assessment of potential environmental effects will be carried out as follows:

- predict the potential environmental effects for each alternative method (Section 4.3.1);
- identify the preferred alternative based on a comparative evaluation of the potential environmental effects of each alternative method (Section 4.3.2); and
- conduct an effects assessment on the preferred alternative, including the identification of mitigation measures and monitoring programs (Section 4.3.3).

4.3.1 Evaluation of Alternative Methods

The potential effects of each alternative method will be identified based upon application of the proposed evaluation criteria, indicators and data sources as outlined in Section 4.1. Potential effects can be positive or negative, direct or indirect, and short or long-term. Indirect impacts are those impacts on Land Use that result from an effect of the project on another discipline. Mitigation measures will be identified to minimize or mitigate the potential effects and then the net effects are evaluated taking into consideration the application of mitigation measures.

An effects assessment for the ‘Current and Future Land Uses’ criterion will be conducted by evaluating how each of the Alternative Methods will affect the sensitive land uses within the Off-Site Study Area that were identified through the ‘Characterization of Existing Conditions’. As noted above, “sensitive land uses” will be identified by using the definitions found in the Provincial Policy Statement, the ‘D-1-3’ Guidelines, and the ‘D-4’ Guidelines, as those definitions were written by the Province to include land uses that may be negatively impacted by landfills. Any required land use approvals for the Alternative Methods will be identified as part of this evaluation, as appropriate.

Mitigation and monitoring programs for the ‘Land Use’ discipline will be based on the land-use planning tools available to the County of Lambton and the Township of Warwick through the *Planning Act*, as well as the ‘D-4’ Guidelines provided by the Province to guide land use approvals within and near landfills and dumps.

4.3.2 Identification of the Preferred Alternative

The alternative methods will be comparatively assessed and evaluated using the proposed evaluation criteria, indicators, and data sources to determine the preferred alternative. The differences in the potential environmental effects remaining following the implementation of mitigation/management measures (i.e., net effects) will be used to identify and compare the advantages and disadvantages of each alternative method. The comparison of alternative methods will include a clear rationale for the selection of the preferred alternative.

4.3.3 Effects Assessment of the Preferred Alternative

Following the identification of the preferred alternative, an effects assessment will be carried out on the preferred alternative considering the same evaluation criteria, indicators, and data sources, and additional studies as required, considering possible mitigation and/or management measures and cumulative effects. The potential effects of the preferred alternative will be compared to the 'do nothing' alternative.

4.4 Reporting

Two separate reports will be prepared for Land Use in support of the EA:

1. A report providing a characterization of Existing Conditions; and
2. A report providing the Effects Assessment.

These reports will be appended to the EA Study Report and will be available for review during the EA. A summary of the existing conditions and effects assessment will be included in the EA Study Report.

The Land Use assessment will be informed by the land-use planning framework established in Ontario through the *Planning Act*. The characterization of existing conditions will include details of completed field investigations, technical analyses, methods, results, maps of sensitive features within the On-Site and Off-Site Study Areas, conclusions, and recommendations.

5 References

County of Lambton
2020 County of Lambton Official Plan

Province of Ontario
1990 *Planning Act*, R.S.O. 1990, c. P. 13

Province of Ontario
1994 D-4 Land Use On or Near Landfills and Dumps

Province of Ontario
1995 D-1 Land Use and Compatibility

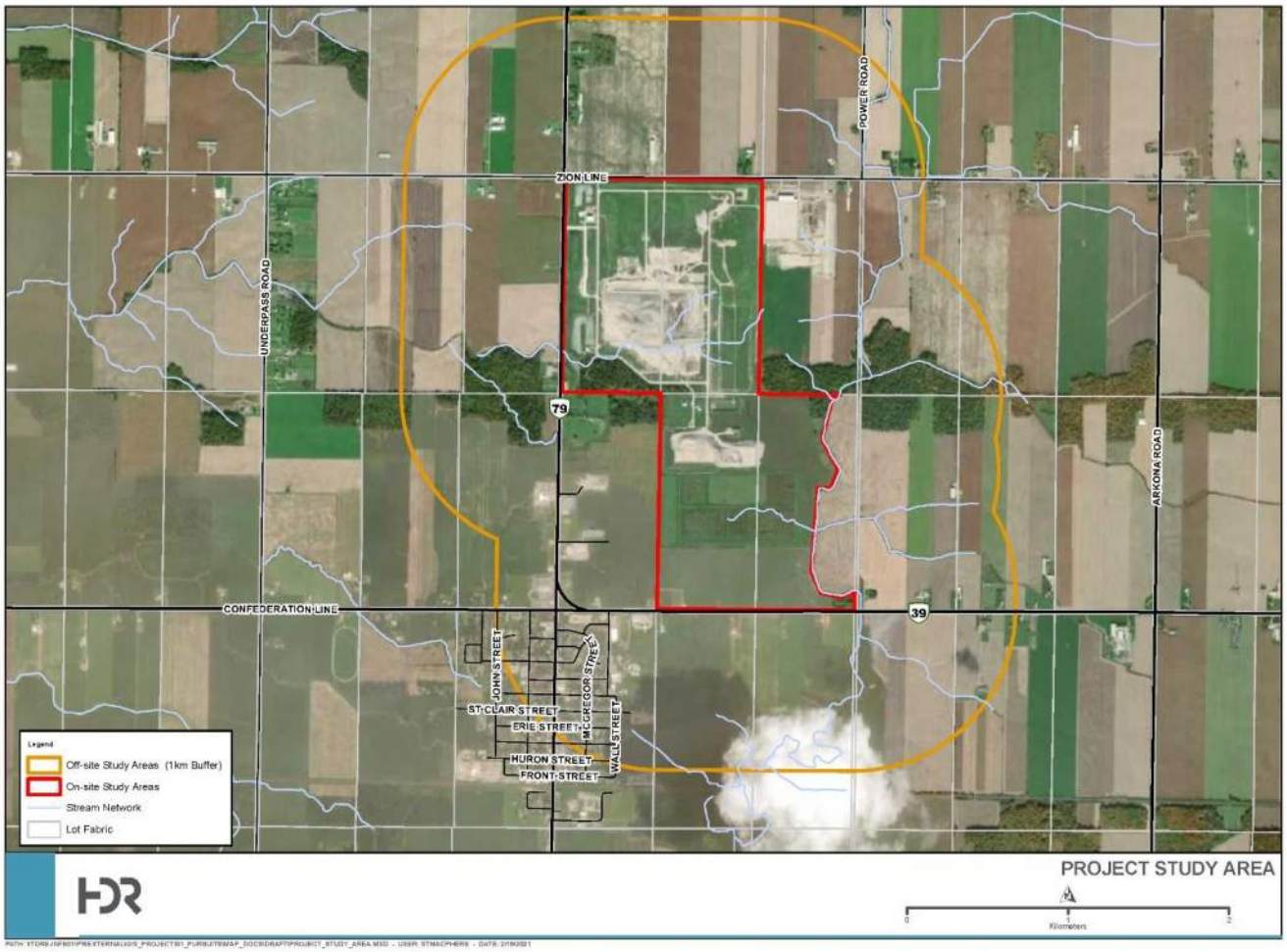
Province of Ontario
2020 Provincial Policy Statement (2020) Under the *Planning Act*.

Township of Warwick
2011 Township of Warwick Official Plan

Township of Warwick
2012 Township of Warwick Zoning By-law 121 of 2012

Figures

Figure 1. General On-Site and Off-Site Study Areas



Source: HDR Inc. (2021)

Figure 2. Land Use On-Site and Off-Site Study Areas



Source: MBPC (2021)

Noise Assessment Work Plan

Twin Creeks Environmental Centre Landfill Optimization Project

Waste Management of Canada Corporation

Watford, Ontario

March 30, 2022

Prepared by:

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Acronyms

Acronym	Definition
EA	Environmental Assessment
MECP	Ministry of the Environment, Conservation and Parks
TCEC	Twin Creeks Environmental Centre
ToR	Terms of Reference
WM	Waste Management of Canada Corporation

1 Introduction

This Noise Assessment Work Plan has been prepared to support the environmental assessment (EA) for the Twin Creeks Environmental Centre Landfill Optimization Project (the Project) and will be appended to the Terms of Reference (ToR) for the EA to be submitted to the Ministry of the Environment, Conservation and Parks (MECP) for approval.

Waste Management of Canada Corporation (WM), the owner and operator of the Twin Creeks Environmental Centre (TCEC) in Watford, Ontario, has initiated an EA seeking approval to increase the landfill airspace capacity at the TCEC. The TCEC has approximately 13.2M m³ of remaining approved landfill airspace, which corresponds to about 10 years of operating life (2021 to 2031). This optimization project could provide additional airspace capacity of up to approximately 14M m³, which could extend the site life by about 12 years (from 2031 to 2043). There would be no change to the current 301 ha site area, the approved service area, haul route, or the annual fill rate.

Activities with associated noise sources that are included in this assessment are landfilling (i.e., bulldozers, haul trucks, excavators, compactors, portable generators used in landfilling), ancillary facilities (i.e., landfill gas management system and public drop-off), and construction (i.e., bulldozers, haul trucks, and excavators related to capping).

There are no existing or proposed sources of vibration associated with the site.

The TCEC is a regional facility that provides safe and convenient disposal services for communities, businesses and industries serving the Province of Ontario. The landfill is approved to receive municipal, industrial, commercial, and institutional solid non-hazardous wastes generated, including non-hazardous contaminated soil.

The TCEC is engineered with environmental protection systems that meet or exceed regulatory requirements and are subject to highly regulated monitoring and reporting requirements. Systems include engineered liners and covers, leachate collection and removal, landfill gas collection and control, and on-site leachate disposal through phytoremediation. The TCEC provides landfill gas, for heating, to the 40-acre greenhouse facility adjacent to the landfill property. Prior to this, all landfill gas was flared. The intent is for the landfill to supply gas for heating to the greenhouses for 25 years.

Leachate that is generated in the waste is conveyed toward a perimeter leachate collection system. WM received approval to treat leachate through a phytoremediation system consisting of a 9.3 ha poplar system planted on the existing landfill cap in 2003. Surplus leachate is trucked off-site to approved wastewater treatment plants.

WM pays host community fees annually to the Township of Warwick. Since 2009, when the TCEC Expansion Landfill began receiving waste, WM has contributed over $23M in host community fees to the Township.

There is a need for the continued development of the TCEC as it is a significant component of the provincial waste management network and infrastructure, which is lacking in sufficient and secure long-term disposal capacity. Optimizing the future development of

the TCEC allows for on-going sustainable business operations and continued provision of essential financial support for community services and programs.

The purpose of the EA is to assess the potential effects of the proposed landfill optimization on the environment. The EA will be carried out in accordance with the requirements of the *Ontario Environmental Assessment Act*.

2 Study Purpose and Objectives

This noise assessment work plan outlines the tasks required to support the EA through the characterization of existing conditions and assessment of potential environmental effects of the project on the noise assessment environment, including the evaluation of the various alternative methods and the identification and assessment of a preferred alternative. This work plan outlines the scope of the noise and vibration assessment work, including protocols and/or standards to be adhered to while the work is undertaken. The specific evaluation criteria, indicators, and data sources to be used and the study areas to be considered are provided below. These items may be adjusted during the EA process.

In accordance with the *Ontario Environmental Assessment Act*, the objectives of the EA are as follows:

1. Describe the environment potentially affected by the proposed undertaking, including both the existing environment as well as the environment that would otherwise be likely to exist in the future without the proposed undertaking;
2. Carry out an evaluation of the environmental effects of the proposed undertaking, using the environmental assessment criteria and studies that have been established through the development of the ToR;
3. Undertake an evaluation of any additional actions that may be necessary to prevent, change or mitigate environmental effects;
4. Provide a description and evaluation of the environmental advantages and disadvantages of the proposed undertaking, based on the net environmental effects that will result following mitigation; and
5. Prepare monitoring, contingency and impact management plans to mitigate the environmental effects of the proposed undertaking.

3 Study Areas

During the EA, existing conditions and potential effects will be considered in the context of three study areas: on-site, along the haul routes, and off-site. The general study areas proposed for the purposes of the EA are (**Figure 1**):

- On-site study area: the existing TCEC.
- Off-site study area: the lands within the vicinity of the TCEC extending approximately 1 km out from the On-site Study Area.
- Off-site haul route area, within 1 km from the primary haul route from Highway 402 to the site entrance.

These initial study areas will be reviewed and refined following the analysis of the existing conditions. If necessary, and depending on study findings, the Off-site study area may be expanded or contracted. For the purposes of noise assessment, receptor locations in the Off-site study area may include those locations that represent the following:

1. Residences;
2. Schools, day nurseries, community centres, hospitals, hotels, motels;
3. Places of worship that are not on commercially or industrially zoned land; and
4. Accessible properties that are vacant and zoned to allow future sensitive use.

If it is deemed necessary per study findings or required to support other disciplines, additional receptors may be added to the analysis.

4 Scope of Work

The scope of work for the noise assessment includes the development of evaluation criteria, indicators, and data sources, characterization of existing noise and vibration assessment conditions, assessment of the potential environmental effects of the alternative methods and the preferred alternative, development of mitigation measures and monitoring programs, and reporting as outlined below.

4.1 Evaluation Criteria, Indicators, and Data Sources

The environmental assessment criteria, indicators, and data sources for the noise and vibration assessment environment are provided in **Table 1**. The assessment criteria, indicators, and data sources will be used to assess the effects of the alternatives and the preferred alternative on the noise and vibration assessment environment. These evaluation criteria and indicators will be finalized during the EA.

Table 1. Evaluation Criteria, Indicators, and Data Sources for Noise Assessment

Evaluation Criteria	Rationale	Indicators	Data Sources
Noise	Activities related to construction/rehabilitation, operation of the landfill and ancillary sources, and the off-site haul route can result in an increase in off-site noise levels	• Predicted site-related noise levels (measured in dBA or dBAI) • Change in sound levels (dB)	• Annual on-site noise monitoring data • Off-site noise monitoring • Manufacturer noise specifications • Noise measurement of on-site sources • Applicable MECP guidelines, technical standards and models • Aerial mapping and field reconnaissance to confirm off-site receptors • Topographic and land-use mapping • Land use zoning plans • Proposed facility characteristics • Landfill design and operations data • Traffic counting, characterization and modelling studies

4.1.1 Sound Level Criteria

Landfill Operations

The applicable sound level limit for existing landfilling activities is provided by the MECP *Noise Guidelines for Landfill Sites (Landfill Guidelines)* (MOE 1998), as presented in **Table** 2. *Landfill Guidelines* defines landfilling operations as construction and rehabilitation as well as conveyance activity. The guideline specifies that the sound level limits do not apply to ancillary facilities and off-site haul road; therefore, these sources are not to be included in the assessment of existing conditions of the landfill operations.

When elevated background, or ambient, sound levels are assessed, *Landfill Standards: A Guideline on the Regulatory and Approval Requirements for New or Expanding Landfilling Sites* (MOE 2012) states that if "the environment [is] dominated by noise sources of man-made activities, such as industry, commerce of road transportation, which produce sound in excess of the above limits, the higher sound levels may be used as the limit, provided that the noise sources are not under consideration for noise abatement by the Municipality or the MECP" (MOE 2012, p. 60). This definition indicates that noise from nearby roadways can be considered as part of the existing background sound level. An investigation of background sound levels and their implications on the sound level limits in **Table 2** can be considered as part of the EA.

Stationary Sources

The sound level limits that will be applicable for ancillary activities are provided by the MECP's *Publication NPC-300: Environmental Noise Guideline – Stationary and Transportation Sources – Approval and Planning (NPC-300)* (MOE 2013). The default or exclusion limits are based on a description of the acoustic environment at the receptor. The term "Class" is used to describe similar acoustic environments, where Class 3 is a very rural acoustic environment, while Class 2 has the sounds of nature and limited anthropogenic noise. The exclusion, or default, limits that would apply to the receptors are those that correspond to Class 2 or Class 3 limits. These are presented in **Table 2**. Where background sound levels are above the exclusion limits, the background sound levels become the limits.

Table 2. Receptor Sound Level Limits (dBA)

Receptor Class	Landfill Limit[b]		Ancillary Equipment Exclusion Limit (Outdoor Living Area/Façade)[a][b]		
	Day (7 AM – 7 PM)	*Night (7 PM – 7 AM)*	*Day (7 AM – 7 PM)*	*Evening (7 PM – 11 PM)*	*Night (11 PM – 7 AM)*
2	55	45	50/50	50/45	-/45
3	55	45	45/45	40/40	-/40

Source: *Landfill Guidelines* and *NPC-300*

[a] Limits presented for outdoor living area and façade of Point of Reception per *NPC-300*.

[b] Higher limits may apply when existing background sound levels are above the limits shown.

As in the case of landfill operations, for stationary sources, NPC-300 stipulates that the sound level limit at a point of reception is the higher of the default limit or the minimum background sound level. The most common driver of elevated background sound levels is traffic noise. Consequently, to accurately model background sound levels, an accounting for noise from nearby roadways will be included in the EA.

Pest Control Devices

Pest control devices can include impulsive sources (e.g., propane cannons), and quasi-steady impulsive sources (e.g., whistles). Sound level limits for pest control devices at off-site receptors are defined in *Landfill Guidelines*:

- For impulsive noise, the applicable limit is 70 dBAI for logarithmic mean impulse levels; and
- For quasi-steady impulsive noise, the applicable limit is 60 dBA for one-hour equivalent sound levels.

For quasi-steady impulsive sources, the requirements of *Publication NPC-103: Procedures* (MOE 1977b) and *Publication NPC-104: Sound Level Adjustment* (MOE 1977c) will apply. A 10 dB penalty would be applied to a source whose quasi-steady sound is audible off-site. Thus, the sound from the source would be modelled and assessed as if it is 10 dB louder than determined via measurement sound level meters.

4.2 Characterization of Existing Conditions

The characterization of existing conditions for Noise will involve data collection, as described in Section 4.1, within the study areas identified in **Figure 1**. Receptors will be chosen as described in Section 4.2 and data representing predictable worst-case existing and future conditions will be generated from modelling. Noise levels will be modeled using a computerized implementation of the internationally recognized ISO-9613 noise propagation algorithms, like the Cadna/A noise model which is produced by DataKustik GmbH. The ISO-9613 algorithms account for various noise propagation factors including:

- Distance attenuation (geometric spreading of noise);
- Reflections from structures;
- Atmospheric absorption;
- Ground attenuation; and
- Terrain effects such as shielding from perimeter berms.

The model will predict noise levels at the representative points of reception, as well as provide figures showing isopleths of equal 1-hour averaged sound levels (“noise contours”).

Modelled levels will be assessed against the applicable limits, as described in Sections 4.1.1 and 4.2.2. Changes to landfilling and ancillary facilities are being considered; therefore, the focus is placed on these activities.

4.2.1 Field Data Collection

The noise study will rely on data collected through field studies, to serve as key inputs into noise modeling of future conditions, assessments of compliance, and determination of required noise mitigation measures. Noise field evaluation will be conducted to:

- Identify noise sensitive receptors of interest within the study areas;
- Characterize background noise levels at representative receptors surrounding the site;
- Characterize adjacent industrial, commercial and non-field agricultural operations;
- Measure receptor-based noise levels from TCEC operations at representative receptors and at the property boundary; and
- Measure at-source noise emission levels at the TCEC site.

4.2.2 Background Sound Level

As described in Section 4.1.1, an understanding of background sound levels is necessary for establishment of appropriate limits at each point of reception. To determine the background sound level, road traffic noise modelling will occur per *Publication NPC-206: Sound Levels Due to Road Traffic* (MOE 1995b).

To model background noise levels, road traffic data will be needed. The traffic discipline will develop the required traffic data during their studies, through background traffic data collection, and projections of future service. The following data will be required:

- Road traffic volumes present if proposed landfill were no longer operating along the identified haul route provided by the traffic consultant, in the form of hourly traffic counts, including a breakdown into light vehicles (cars and light trucks), medium trucks (trucks with <6 wheels and vehicle weights of <12,000 kg) and heavy trucks (trucks with >6 wheels and weights >12,000 kg), as well as posted speed limits;
- Existing road traffic volumes along the identified haul route provided by the traffic consultant, in the form of hourly traffic counts, including a breakdown into light vehicles (cars and light trucks), medium trucks (trucks with <6 wheels and vehicle weights of <12,000 kg) and heavy trucks (trucks with >6 wheels and weights >12,000 kg), as well as posted speed limits. Traffic data should be split in order to obtain data regarding the current flow of traffic related to the TCEC and the other unrelated traffic; and
- Future proposed landfill related-traffic (including landfill operations, construction materials, and traffic related to ancillary sources and separately the traffic data should also split the traffic related to the TCEC and all other related traffic) volumes along the proposed off-site haul routes, in the form of hourly traffic counts, broken down into light vehicles, medium trucks and heavy trucks (recognizing that most landfill related traffic will be heavy trucks).

4.2.3 Landfilling Noise

The existing operations of the landfill will be characterized by modelling using the data sources described above and supported by on-site monitoring data. Sound levels will be modelled. The predicted sound levels will be presented over the entire study area in figures showing isopleths of equal 1-hour averaged sound levels (“noise contours”). The representative or worst-case points of reception (i.e., closest or most exposed) with respect to sound level in each cardinal direction will be considered.

4.2.4 Ancillary Facilities Noise

Sound from existing ancillary facilities will be characterized by modelling using the data sources described above. Sound levels will be modelled, with the predicted sound levels presented over the entire study area in figures showing isopleths of equal 1-hour averaged sound levels (“noise contours”). The points of reception that have representative or worst-case sound levels in each cardinal direction will be considered.

4.3 Assessment of Potential Environmental Effects

Using the evaluation criteria, indicators, rationale, and data sources from Section 4.1 and the characterization of existing conditions as described in Section 4.2, the assessment of potential environmental effects will be carried out as follows:

- describe the potential environmental effects for each alternative method using qualitative methods (Section 4.3.1);
- identify the preferred alternative based on a comparative evaluation of the potential environmental effects of each alternative method (Section 4.3.2); and
- conduct a quantitative effects assessment on the preferred alternative, including the identification of mitigation measures and monitoring programs (Sections 4.3.3).

4.3.1 Evaluation of Alternative Methods

The potential effects of each alternative method will be identified based upon application of qualitative aspects of the proposed evaluation criteria, indicators and data sources as outlined in Section 4.1. The alternative methods will be comparatively assessed and evaluated qualitatively.

Data from Modelling for Off-site Study Area

Noise impacts for three future operational periods of the preferred alternative will be modelled to ensure that predictable worst-case impacts are captured. Key model inputs will include:

- Noise emission levels for landfill equipment, in the form of sound power levels (PWL values), based on measurements of equipment at other landfill sites in the Province of Ontario, where applicable, and/or noise emission levels for similar items equipment from equipment manufacturers, regulated limits, and from previous measurement of similar or identical equipment;
- Landfill phasing data, including mapping and the conceptual design report, showing the location of activities at different times during the proposed optimization of the landfill. This will provide information on proposed landfill activities including:
    - Hours of operation;
    - Types and number of landfill heavy vehicles (e.g., bulldozers), on-site road vehicles, and on-site haul vehicle hourly distributions during construction and normal operations;
    - Types of pest (vermin) control measures to be used. If impulsive noise measures are to be used (e.g., propane cannons, “bird banger”, fireworks, etc.), the location, time and frequency of use; and
    - Plot plans and topographical mapping data, preferably in a digital format, showing the location of the existing/future landfill, and representative receptors of concern within 1000 m.

The predicted sound levels will be presented over the entire study area in figures showing isopleths of equal 1-hour averaged sound levels (“noise contours”). The worst-case sound level assessment in each cardinal direction will be further addressed in tabular form showing the change assessment and detailed quantitative analysis.

4.3.2 Identification of Preferred Alternative

As described in Section 6 of the Terms of Reference (WM 2021) document, selection of the preferred alternative to the undertaking has been completed. Alternative methods will be assessed against an ambient sound environment that does not include landfilling operations, and the change assessment will be made using ratings limited to insignificant, noticeable, significant, and very significant.

Effects Assessment of the Preferred Alternative

Following the identification of the preferred alternative, an effects assessment will be carried out on the preferred alternative considering the same evaluation criteria, indicators, and data sources, and additional studies as required, considering possible mitigation and/or management measures and cumulative effects. The potential effects of the preferred alternative will be compared to the 'do nothing' alternative.

Landfilling Noise

The future operations of the landfill will be characterized by modelling of up to three operational periods using the data sources described above. Sound levels will be modelled, with the predicted sound levels presented over the entire study area in figures showing isopleths of equal 1-hour averaged sound levels ("noise contours"). The worst-case sound level assessment in each cardinal direction will be further addressed in tabular form showing the change assessment and detailed quantitative analysis. Sound levels at the representative points of reception will be compared with the *Landfill Guidelines* described above.

Ancillary Facilities Noise

The sound levels from future activity of the ancillary facilities will be characterized by modelling using the data sources described above. Sound levels will be modelled, with the predicted sound levels presented over the entire study area in figures showing isopleths of equal 1-hour averaged sound levels ("noise contours"). Assessment will be made at points of reception (i.e., closest or most exposed) in each cardinal direction that have representative or worst-case sound levels. Sound levels at the representative points of reception will be compared with the *NPC-300* limits described above.

Change in Sound Levels

Landfilling noise and ancillary facilities noise are first assessed separately, as above, and then cumulatively. The goal of the cumulative approach is to evaluate the magnitude of change in noise levels at receptors. Changes in noise levels are calculated by comparing the environmental noise levels that would exist if the landfill were no longer operating with the expected future noise levels due to the proposed landfill, ancillary sources, and construction activities. The change is then assessed based on the increase in sound level at the point of reception from the existing condition to the proposed condition:

- A sound level increase of 1 – 3 dB is qualitatively rated as insignificant;
- A sound level increase of 3 – 5 dB is qualitatively rated as noticeable;
- A sound level increase of 5 – 10 dB is qualitatively rated as significant; and
- A sound level increase of greater than 10 dB is qualitatively rated as very significant.

Using the above qualitative scale, an effect will occur only if the sound level increase is rated as noticeable or greater.

4.4 Reporting

Two separate reports will be prepared for the noise assessment in support of the EA:

1. A report providing a characterization of Existing Conditions; and
2. A report providing the Effects Assessment.

These reports will be appended to the EA Study Report and will be available for review during the EA. A summary of the existing conditions and effects assessment will be included in the EA Study Report.

The characterization of existing conditions will include details of field measurements and observations, technical analyses, methods, results, maps of sensitive features within the Off-site Study Area, conclusions, and recommendations.

5 References

Aercoustics Engineering Limited (AEL)
2005 Proposed Expansion of WM Warwick Landfill: Predicted Noise Impact

Ministry of the Environment (MOE)
1977a Publication NPC-102: Instrumentation, originally published as part of the Model Municipal Noise Control By-Law

Ministry of the Environment (MOE)
1977b Publication NPC-103: Procedures, originally published as part of the Model Municipal Noise Control By-Law

Ministry of the Environment (MOE)
1977c Publication NPC-104: Sound Level Adjustments, originally published as part of the Model Municipal Noise Control By-Law

Ministry of the Environment (MOE)
1983 Publication NPC-207: Impulse Vibration in Residential Buildings

Ministry of the Environment (MOE)
1995a Publication NPC-205: Sound Level Limits for Stationary Sources in Class 1 & 2 Areas (Urban)

Ministry of the Environment (MOE)
1995b Publication NPC-206: Sound Levels Due to Road Traffic

Ministry of the Environment (MOE)
1995c Publication NPC-232: Sound Level Limits for Stationary Sources in Class 3 Areas (Rural)

Ministry of the Environment (MOE)
1995d Publication NPC-233: Information to be Submitted for Approval of Stationary Sources of Sound

Ministry of the Environment (MOE)

1998 Noise Guidelines for Landfill Sites (October 1998 Draft)

Ministry of the Environment (MOE)

2012 Landfill Standards: A Guideline on the Regulatory and Approval Requirements for New or Expanding Landfilling Sites

Ministry of the Environment (MOE)

2013 Publication NPC-300: Environmental Noise Guideline - Stationary and Transportation Sources - Approval and Planning

RWDI

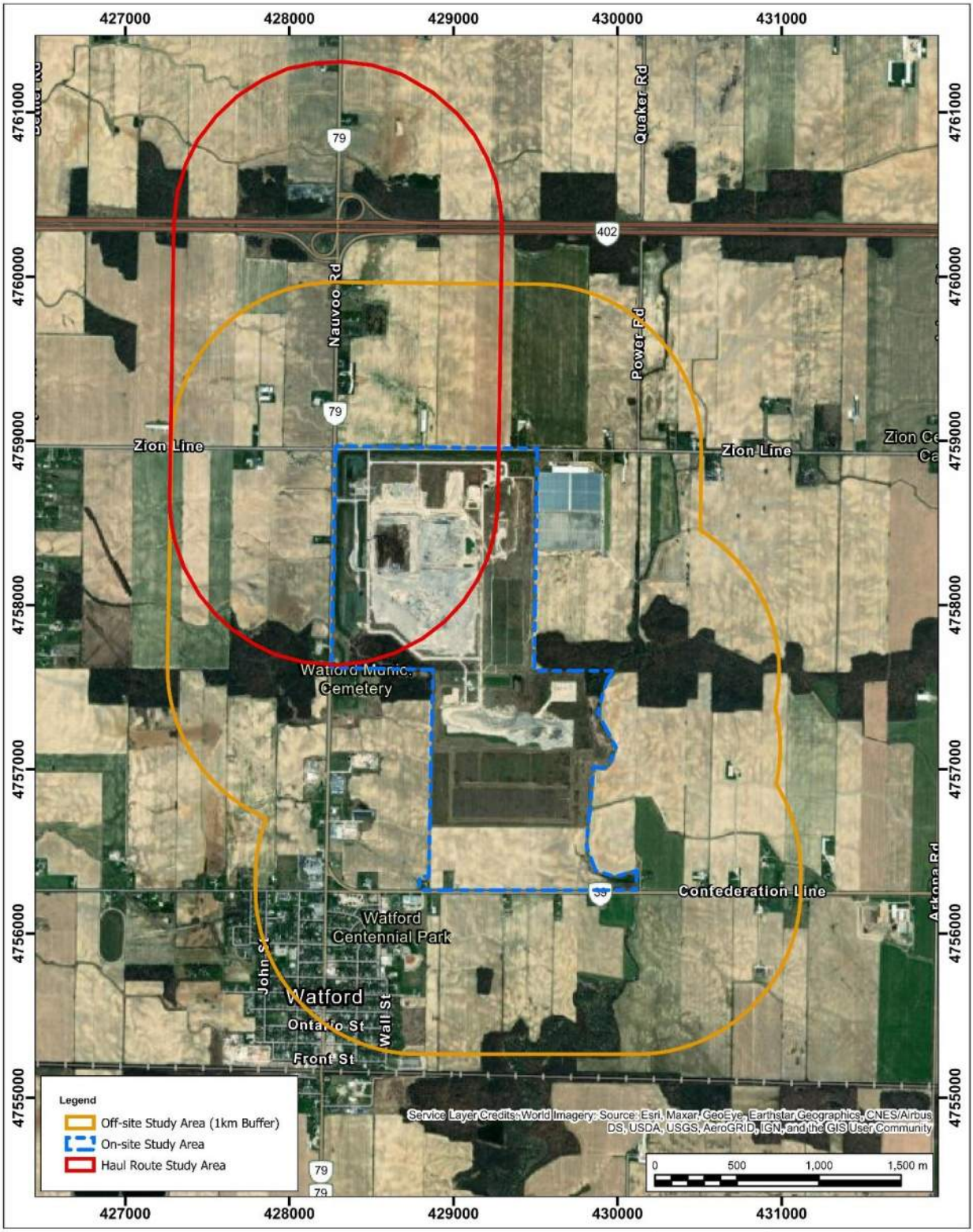
2021 Twin Creeks Environmental Centre: Acoustic Audit – Resubmission in Response to TRT Comments

Waste Management of Canada Corporation (WM)

2021 Draft Terms of Reference: Twin Creeks Environmental Centre Landfill Optimization Project Environmental Assessment

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Figure 1. On-Site and Off-Site Noise Study Areas



On-Site and Off-Site Noise Study Areas

True North

Drawn by: LRC | Figure: 1

Aprox. Scale: 1:32,000

Date Revised: Nov 12, 2021

Map Projection: NAD 1983 UTM Zone 17N

Twin Creeks Environmental Centre - Watford, Ontario

Project #: 2101750

Socio-Economic Environment Work Plan

Twin Creeks Environmental Centre Landfill Optimization Project

Waste Management of Canada Corporation

Watford, Ontario

March 30, 2022

Prepared by:

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Acronyms

Acronym	Definition
EA	Environmental Assessment
MECP	Ministry of Environment, Conservation and Parks
TCEC	Twin Creeks Environmental Centre
ToR	Terms of Reference
WM	Waste Management of Canada Corporation

1 Introduction

This Socio-Economic Environment work plan has been prepared to support the environmental assessment (EA) for the Twin Creeks Environmental Centre Landfill Optimization Project (the Project) and will be appended to the Terms of Reference (ToR) for the EA to be submitted to the Ministry of Environment, Conservation and Parks (MECP) for approval.

The Socio-Economic Environment comprises both the social and economic environments and considers the potential effects of the Project on the local community and economy. The Visual Landscape component of the Socio-Economic Environment and associated effects on the local community will be addressed under separate cover and is therefore not included in this work plan. Similarly, consultation and engagement activities to be carried out during the Terms of Reference and EA are separate from this work plan.

Waste Management of Canada Corporation (WM), the owner and operator of the Twin Creeks Environmental Centre (TCEC) in Watford, Ontario, has initiated an EA seeking approval to increase the landfill airspace capacity at the TCEC. The TCEC has approximately 13.2M m^3 of remaining approved landfill airspace, which corresponds to about 10 years of operating life (2021 to 2031). This optimization project could provide additional airspace capacity of up to approximately 14M m^3, which could extend the site life by about 12 years (from 2031 to 2043). There would be no change to the current 301 ha site area, the approved service area, or the annual fill rate.

The TCEC is a regional facility that provides safe and convenient disposal services for communities, businesses and industries serving the Province of Ontario. The landfill is approved to receive municipal, industrial, commercial, and institutional solid non-hazardous wastes generated, including non-hazardous contaminated soil.

The TCEC is engineered with environmental protection systems that meet or exceed regulatory requirements and are subject to highly regulated monitoring and reporting requirements. Systems include engineered liners and covers, leachate collection and removal, landfill gas collection and control, and on-site leachate disposal through phytoremediation. The TCEC provides landfill gas, for heating, to the 40-acre greenhouse facility adjacent to the landfill property. Prior to this, all landfill gas was flared. The intent is for the landfill to supply gas for heating to the greenhouses for 25 years.

Leachate that is generated in the waste is conveyed toward a perimeter leachate collection system. WM received approval to treat leachate through a phytoremediation system consisting of a 9.3 ha poplar system planted on the existing landfill cap in 2003. Surplus leachate is trucked off-site to approved wastewater treatment plants.

WM pays host community fees annually to the Township of Warwick (the Township). Since 2009, when the TCEC Expansion Landfill began receiving waste, WM has contributed over $24M in host community fees and municipal property taxes to the Township.

There is a need for the continued operation and development of the TCEC as it is a significant component of the provincial waste management network and infrastructure, which is lacking in sufficient and secure long-term disposal capacity. Optimizing the future

development of the TCEC allows for on-going sustainable business operations and continued provision of essential financial support for community services and programs.

The purpose of the EA is to assess the potential effects of the proposed landfill optimization on the environment. The EA will be carried out in accordance with the requirements of the *Ontario Environmental Assessment Act*.

2 Study Purpose and Objectives

This Socio-Economic Environment work plan outlines the tasks required to support the EA through the characterization of existing conditions and assessment of potential environmental effects of the project on the socio-economic environment, including the evaluation of the various alternative methods and the identification and assessment of a preferred alternative. This work plan outlines the scope of the socio-economic environment work, including protocols and/or standards to be adhered to while the work is undertaken. The specific evaluation criteria, indicators, and data sources to be used and the study areas to be considered are provided below. These items may be adjusted during the EA process.

In accordance with the *Ontario Environmental Assessment Act*, the objectives of the EA are as follows:

1. Describe the environment potentially affected by the proposed undertaking, including both the existing environment as well as the environment that would otherwise be likely to exist in the future without the proposed undertaking;
2. Carry out an evaluation of the environmental effects of the proposed undertaking, using the environmental assessment criteria and studies that have been established through the development of the ToR;
3. Undertake an evaluation of any additional actions that may be necessary to prevent, change or mitigate environmental effects;
4. Provide a description and evaluation of the environmental advantages and disadvantages of the proposed undertaking, based on the net environmental effects that will result following mitigation; and
5. Prepare monitoring, contingency and impact management plans to mitigate the environmental effects of the proposed undertaking.

3 Study Areas

During the EA, existing conditions and potential effects will be considered in the context of two study areas: on-site and off-site. The general study areas proposed for the purposes of the EA are (**Figure 1**):

- On-site Study Area: the existing TCEC.
- Off-site Study Area: the lands within the vicinity of the TCEC extending approximately 1 km out from the On-site Study Area.

For the Socio-Economic Environment, the general Off-site Study Area has been extended for the social component to include Watford, and for the economic component to include the Township of Warwick (**Figure 2**). These study areas may be further refined during the EA if necessary.

4 Scope of Work

The scope of work for the Socio-Economic Environment includes the development of evaluation criteria, indicators, and data sources, characterization of existing Socio-Economic Environment conditions, assessment of the potential environmental effects of the alternative methods and the preferred alternative, development of mitigation measures and monitoring programs, and reporting as outlined below.

4.1 Evaluation Criteria, Indicators, and Data Sources

The environmental assessment criteria, indicators, and data sources for the Socio-Economic Environment are provided in **Table 1**. The assessment criteria, indicators, and data sources will be used to assess the effects of the alternatives and the preferred alternative on the Socio-Economic Environment and are focused on those aspects of the environment where potential effects are anticipated. These evaluation criteria and indicators may be updated during the EA.

Table 1. Evaluation Criteria, Indicators, and Data Sources for the Socio-Economic Environment

Evaluation Criteria	Rationale	Indicators	Data Sources
Socio-Economic Environment			
Economic			
Economic effects on local community	The continued operation of the landfill could have economic effects on and/or provide economic benefits to the local community	• Employment at site (number, type, and duration) • Contributions to the host community • Opportunities for the provision and procurement of products and/or services	• Census and municipal data for Village of Watford and Township of Warwick • Municipal tax information / sources of municipal revenues • WM data on host community fee contributions • WM site employment data • WM data on types and values of goods and services procured • WM data on types and values of goods and services provided • Proposed facility characteristics • Results of other discipline assessments

Table 1. Evaluation Criteria, Indicators, and Data Sources for the Socio-Economic Environment

Evaluation Criteria	Rationale	Indicators	Data Sources
Social			
Effects on local community	Waste disposal facilities can potentially affect local residents and businesses in the vicinity of the site.	• Number of residents and residences (e.g., receptors) • Number and type of local businesses • Nuisance effects (litter, dust, noise, odour, traffic) • Predicted changes to use and enjoyment of property • Level of satisfaction with living/working in the community • Confidence in TCEC operations	• Mapping and field reconnaissance • Census information and municipal data for Village of Watford and Township of Warwick • Number and nature of nuisance complaints received related to the TCEC (e.g., odour, litter, noise) • Community survey(s) • Proposed facility characteristics • Results of other discipline assessments
Visual Impact of Facility	See Visual Landscape Work Plan		

4.2 Characterization of Existing Conditions

The characterization of existing conditions for the Socio-Economic Environment will involve the collection and analysis of data for both the economic and social components identified in **Table 1**. For the economic component, existing conditions will be characterized within the Township of Warwick and community of Watford with a focus on those businesses that have, or may have, a direct interaction with the TCEC. For the social component, the focus of the existing conditions will be the community of Watford and residents located within 1 km of the TCEC, where it is anticipated that most potential nuisance effects would be experienced.

The proposed tasks associated with the characterization of existing conditions for the Socio-Economic Environment are outlined in **Table 2**. These tasks may be further refined throughout the EA if necessary.

Table 2. Proposed Tasks for the Characterization of Existing Conditions for the Socio-Economic Environment

Evaluation Criteria	Indicators	Tasks to Characterize Existing Conditions
Economic		
Economic effects on local community	• Employment at site (number, type, and duration)	• Review latest publicly available census and municipal data for Village of Watford and Township of Warwick to determine employment characteristics within the study areas • Review employment characteristics for the TCEC to determine employment at the site (number, type, and duration)
	• Contributions to the host community	• Examine WM's host community fee contributions to the Township of Warwick (2009[1]-2020) to determine the level of contribution to the municipality • Review municipal tax information and sources of municipal revenue for the Township of Warwick as available to characterize municipal finance and determine portion attributable to the TCEC • Examine municipal expenditures (if available) to characterize existing municipal spending within the local community
	• Opportunities for the provision and procurement of products and/or services	• Review the values and types of goods and services procured by WM for the TCEC (2018-2020) to determine procurement from local businesses • Conduct survey(s) (mail out and/or online) of local businesses that provide goods and services to the TCEC to determine the importance of the TCEC to the success of their operations[2] • Review values and types of goods and services provided by the TCEC (2018-2020) to determine provision of services to the local community and businesses
Social		
Effects on local community	• Number of residences and residents	• Review latest publicly available census and municipal data for Village of Watford and Township of Warwick to determine population within the study areas
	• Number and type of local businesses	• Review latest publicly available census and municipal data for Village of Watford and Township of Warwick to determine industry characteristics within the study areas • Review mapping, municipal data such as business directories (as available), and carry out field reconnaissance (site visit if necessary) to determine the number and type of local businesses within Watford and 1 km of the TCEC
	• Nuisance effects (litter, dust, noise, odour, traffic)	• Review mapping and carry out field reconnaissance (site visit if necessary) to determine the location of residential and non-residential receptors within the off-site study area – this task will likely be conducted in conjunction with the air/noise/odour and visual assessments • Review the number and nature of nuisance complaints received related to the TCEC (e.g., odour, litter, dust, noise, traffic) (2017-2020) to determine the past and current level of complaints related to site operation • Incorporate existing conditions from Air Quality, Noise, and Transportation disciplines
	• Predicted changes to use of property	• Consider nuisance effects association with property use, level of satisfaction, and confidence in TCEC operations

Table 2. Proposed Tasks for the Characterization of Existing Conditions for the Socio-Economic Environment

Evaluation Criteria	Indicators	Tasks to Characterize Existing Conditions
	• Level of satisfaction with living/working in the community • Confidence in TCEC operations	• Consider visual landscape existing conditions association with property use, level of satisfaction, and confidence in TCEC operations • Conduct community survey(s) (mail out and/or online) to determine the following[2,3]: ○ current use of property/local area for outdoor recreation activities ○ current level of satisfaction with living/working in the community including identification of issues that may affect level of satisfaction ○ confidence in current operations at the TCEC

Note:

1. 2009 is the year that the TCEC expansion landfill began receiving waste.
2. This is the portion of the survey(s) that addresses existing conditions. Consideration of potential effects is addressed in **Table 3**. Input on the surveys will be sought from social impact assessment and economic specialists as appropriate.
3. Residents will not be asked to provide information about their medical status or conditions, nor to speculate on medical matters in relation to existing TCEC operations.

The characterization of existing conditions may also include the review of additional relevant information not listed above as and when it becomes available (e.g., other background reports or documents, municipal information, etc.).

4.3 Assessment of Potential Environmental Effects

Using the evaluation criteria, indicators, rationale, and data sources from Section 4.1 and the characterization of existing conditions as described in Section 4.2, the assessment of potential environmental effects will be carried out as follows:

- predict the potential environmental effects for each alternative method (Section 4.3.1);
- identify the preferred alternative based on a comparative evaluation of the potential environmental effects of each alternative method (Section 4.3.2); and
- conduct an effects assessment on the preferred alternative, including the identification of mitigation measures and monitoring programs (Sections 4.3.3).

4.3.1 Evaluation of Alternative Methods

The potential effects of each alternative method will be identified based upon application of the proposed evaluation criteria, indicators and data sources as outlined in Section 4.1. Potential effects can be positive or negative, direct or indirect, and short or long-term. Mitigation measures will be identified to minimize or mitigate the potential effects and then the net effects are evaluated taking into consideration the application of mitigation measures.

The proposed facility characteristics of each alternative method will be reviewed to determine potential interactions with the Socio-Economic Environment for both the social

and economic components. The criteria and indicators listed in **Table 1** will be applied to each alternative method to determine potential effects.

The proposed tasks associated with the evaluation of alternative methods for the Socio-Economic Environment are outlined in **Table 3**. These tasks may be further refined throughout the EA if necessary.

Table 3. Proposed Tasks for the Evaluation of Alternative Methods for the Socio-Economic Environment

Evaluation Criteria	Indicators	Tasks to Evaluate Alternative Methods
Economic		
Economic effects on local community	• Employment at site (number, type, and duration)	• Review proposed facility characteristics for each alternative method, such as proposed landfill capacity and resulting length of operation • Determine potential effects on employment at the site (number, type, and duration) for each alternative method based on continued TCEC operation
	• Contributions to the host community	• Review proposed facility characteristics for each alternative method, such as proposed landfill capacity and resulting length of operation • Develop an estimate of WM's future host community fee contributions to the Township of Warwick for each alternative method based on continued TCEC operation. • Characterize WM's continued host community fee contributions in the framework of continued municipal revenues for each alternative method based on continued TCEC operation • Characterize continued municipal spending within the local community resulting from each alternative method, if possible, based on available information (see Table 2) and continued TCEC operation
	• Opportunities for the provision and procurement of products and/or services	• Review proposed facility characteristics for each alternative method, such as proposed landfill capacity and resulting length of operation • Estimate WM's continued procurement from local businesses for each alternative method based on continued TCEC operation • Conduct survey(s) (mail out and/or online) of local businesses that provide goods and services to the TCEC to determine the importance of the continued operation of the TCEC to the success of their operations[1] • Characterize WM's continued provision of services to the local community and businesses for each alternative method based on continued TCEC operation
Social		
Effects on local community	• Number of residents and residences	• Review proposed facility characteristics for each alternative method, such as proposed landfill capacity and resulting length of operation • Review latest publicly available municipal data for Village of Watford and Township of Warwick (e.g., Official Plans) to determine projected population and potential future residential expansion within the study areas for each alternative method within the timeline of continued TCEC operation

Table 3. Proposed Tasks for the Evaluation of Alternative Methods for the Socio-Economic Environment

Evaluation Criteria	Indicators	Tasks to Evaluate Alternative Methods
	• Number and type of local businesses	• Review proposed facility characteristics for each alternative method, such as proposed landfill capacity and resulting length of operation • Review latest publicly available census and municipal data for Village of Watford and Township of Warwick (e.g., Official Plans) to determine any future commercial/industrial expansion within the study areas for each alternative method within the timeline of continued TCEC operation
	• Nuisance effects (litter, dust, noise, odour, traffic)	• Review proposed facility characteristics for each alternative method, such as proposed landfill capacity and resulting length of operation • Coordinate residential and non-residential receptor locations with the Air Quality, Noise, and Transportation disciplines • Review the results of the Air Quality, Noise, and Transportation effects assessments for each alternative method including mitigation measures • Predict extent of nuisance effects on residential and non-residential receptors in the off-site study area for each alternative method • Propose mitigation measures as appropriate
	• Predicted changes to use of property • Level of satisfaction with living/working in the community • Confidence in TCEC operations	• Coordinate residential and non-residential receptor locations with the Visual Landscape discipline • Incorporate results of Visual Landscape effects assessment and association with property use, level of satisfaction, and confidence in TCEC operations for each alternative method including mitigation measures • Incorporate results of nuisance effects assessment and association with property use, level of satisfaction, and confidence in TCEC operations for each alternative method • Conduct community survey(s) (mail out and/or online) to determine the following[1,2]: ○ likelihood of changes in use of property/local area for outdoor recreation activities as a result of the Project ○ likelihood of changes in level of satisfaction with living/working in the community including identification of issues that may affect level of satisfaction as a result of the Project ○ likelihood of changes in confidence in TCEC operations as a result of the Project ○ concerns regarding the Project and future TCEC operations • Predict effects on use of property, level of satisfaction with living/working in the community, and confidence in TCEC operations for each alternative method • Propose mitigation measures as appropriate

Note:

1. This is the portion of the survey(s) that addresses potential effects. Consideration of existing conditions is addressed in **Table 2**. Input on the surveys will be sought from social impact assessment and economic specialists as appropriate.
2. Residents will not be asked to provide information about their medical status or conditions, nor to speculate on medical matters in relation to the Project.

4.3.2 Identification of the Preferred Alternative

The alternative methods will be comparatively assessed and evaluated using the proposed evaluation criteria, indicators, and data sources to determine the preferred alternative. The differences in the potential environmental effects remaining following the implementation of mitigation/management measures (i.e., net effects) will be used to identify and compare the advantages and disadvantages of each alternative method. The comparison of alternative methods will include a clear rationale for the selection of the preferred alternative.

4.3.3 Effects Assessment of the Preferred Alternative

Following the identification of the preferred alternative, an effects assessment will be carried out on the preferred alternative considering the same evaluation criteria, indicators, and data sources, and additional studies as required, considering possible mitigation and/or management measures and cumulative effects. The potential effects of the preferred alternative will be compared to the 'do nothing' alternative.

4.4 Reporting

Two separate reports will be prepared for the Socio-Economic Environment in support of the EA:

1. A report providing a characterization of Existing Conditions; and
2. A report providing the Effects Assessment.

These reports will be appended to the EA Study Report and will be available for review during the EA. A summary of the existing conditions and effects assessment will be included in the EA Study Report.

The characterization of existing conditions will include details of completed field reconnaissance, analyses, methods, results, maps of receptors within the On-site and Off-site Study Areas, conclusions, and recommendations, as applicable.

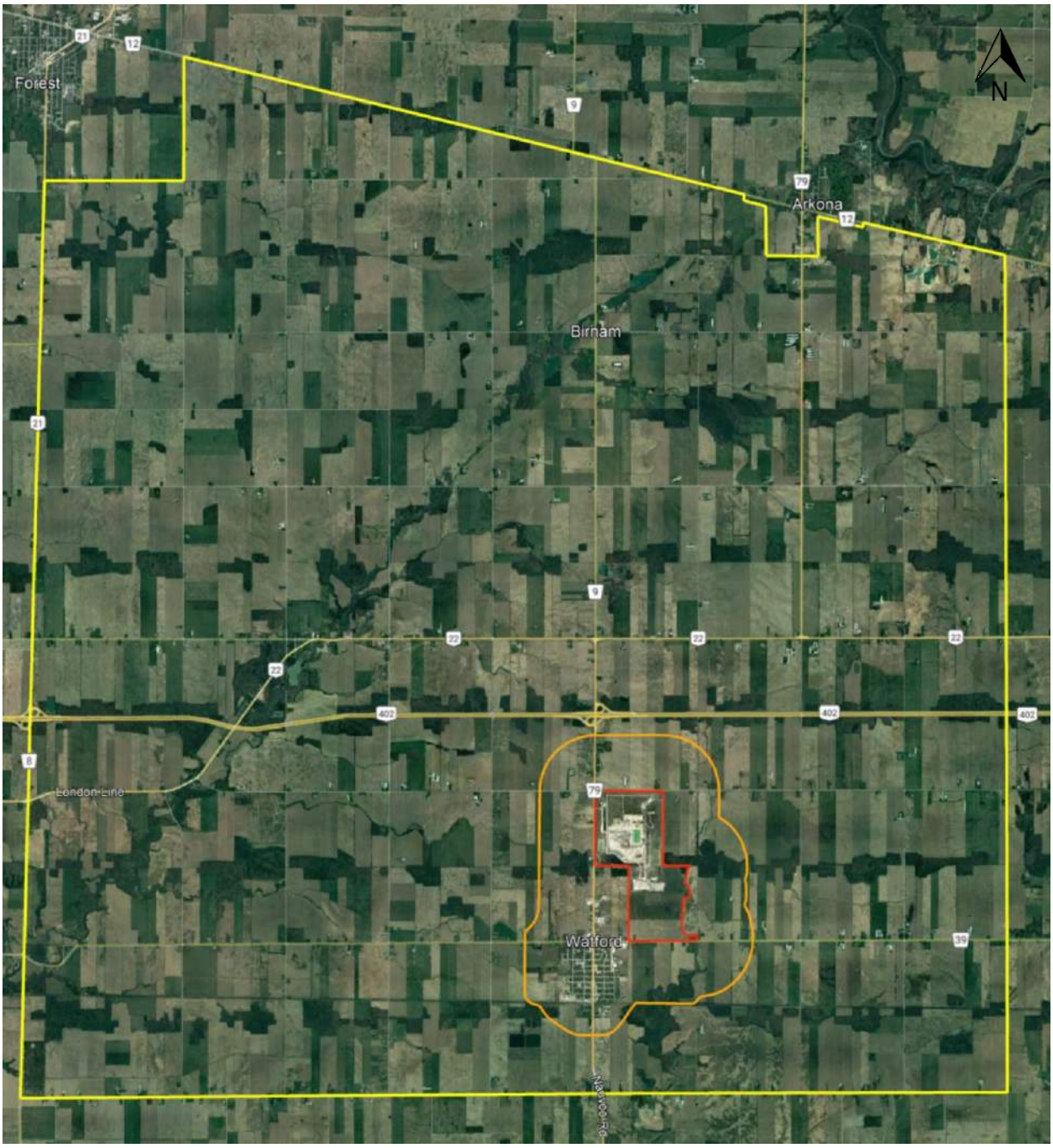
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Figures

Figure 1. General On-Site and Off-site Study Areas



Figure 2. Socio-Economic Environment Study Areas



LEGEND

On-Site Study Area

Social Off-Site Study Area

Economic Off-Site Study Area

Surface Water Quality Work Plan

Twin Creeks Environmental Centre Landfill Optimization Project

Waste Management of Canada Corporation

Watford, Ontario

March 30, 2022

Prepared by:

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Acronyms

Acronym	Definition
EA	Environmental Assessment
ECA	Environmental Compliance Approval
EMP	*Environmental Monitoring Plan* (Jagger Hims Limited, 2007)
MECP	Ministry of Environment, Conservation and Parks
PLIL	Primary Leachate Indicator List
SLIL	Secondary Leachate Indicator List
Sewage ECA	Amended ECA for an Industrial Sewage Works No. 2403-BE6LZ4, dated August 21, 2019
TCEC	Twin Creeks Environmental Centre
ToR	Terms of Reference
TSS	Total Suspended Solids
WM	Waste Management of Canada Corporation
Waste ECA	Amended Environmental Compliance Approval (ECA) No. A032203, dated December 19, 2020

1 Introduction

This surface water quality work plan has been prepared to support the environmental assessment (EA) for the Twin Creeks Environmental Centre Landfill Optimization Project (the Project) and will be appended to the Terms of Reference (ToR) for the EA to be submitted to the Ministry of Environment, Conservation and Parks (MECP) for approval.

The Surface Water Quality discipline evaluates the quality of stormwater prior to its off-Site discharge. The evaluation compares assessed surface water quality results against established provincial objectives, as well as current established site-specific criteria per MECP approval.

Waste Management of Canada Corporation (WM), the owner and operator of the Twin Creeks Environmental Centre (TCEC) in Watford, Ontario, has initiated an EA seeking approval to increase the landfill airspace capacity at the TCEC. The TCEC has approximately 13.2M m³ of remaining approved landfill airspace, which corresponds to about 10 years of operating life (2021 to 2031). This optimization project could provide additional airspace capacity of up to approximately 14M m³, which could extend the Site life by about 12 years (from 2031 to 2043). There would be no change to the current 301 ha site area, the approved service area, or the annual fill rate.

The TCEC is a regional facility that provides safe and convenient disposal services for communities, businesses and industries serving the Province of Ontario. The landfill is approved to receive municipal, industrial, commercial, and institutional solid non-hazardous wastes generated, including non-hazardous contaminated soil.

The TCEC is engineered with environmental protection systems that meet or exceed regulatory requirements and are subject to highly regulated monitoring and reporting requirements. Systems include engineered liners and covers, leachate collection and removal, landfill gas collection and control, and on-Site leachate disposal through phytoremediation. The TCEC provides landfill gas, for heating, to the 40-acre greenhouse facility adjacent to the landfill property. Prior to this, all landfill gas was flared. The intent is for the landfill to supply gas for heating to the greenhouses for 25 years.

Leachate that is generated in the waste is conveyed toward a perimeter leachate collection system. WM received approval to treat leachate through a phytoremediation system consisting of a 9.3 ha poplar system planted on the existing landfill cap in 2003. Surplus leachate is trucked off-Site to approved wastewater treatment plants.

WM pays host community fees annually to the Township of Warwick. Since 2009, when the TCEC Expansion Landfill began receiving waste, WM has contributed over $24M in host community fees to the Township.

There is a need for the continued development of the TCEC as it is a significant component of the provincial waste management network and infrastructure, which is lacking in sufficient and secure long-term disposal capacity. Optimizing the future development of the TCEC allows for on-going sustainable business operations and continued provision of essential financial support for community services and programs.

The purpose of the EA is to assess the potential effects of the proposed landfill optimization on the environment. The EA will be carried out in accordance with the requirements of the *Ontario Environmental Assessment Act*.

2 Study Purpose and Objectives

This Surface Water Quality work plan outlines the tasks required to support the EA through the characterization of existing conditions and assessment of potential environmental effects of the project on the surface water quality environment, including the evaluation of the various alternative methods and the identification and assessment of a preferred alternative. This work plan outlines the scope of the surface water quality work, including protocols and/or standards to be adhered to while the work is undertaken. The specific evaluation criteria, indicators, and data sources to be used and the study areas to be considered are provided below. These items may be adjusted during the EA process.

In accordance with the *Ontario Environmental Assessment Act*, the objectives of the EA are as follows:

1. Describe the environment potentially affected by the proposed undertaking, including both the existing environment as well as the environment that would otherwise be likely to exist in the future without the proposed undertaking;
2. Carry out an evaluation of the environmental effects of the proposed undertaking, using the environmental assessment criteria and studies that have been established through the development of the ToR;
3. Undertake an evaluation of any additional actions that may be necessary to prevent, change or mitigate environmental effects;
4. Provide a description and evaluation of the environmental advantages and disadvantages of the proposed undertaking, based on the net environmental effects that will result following mitigation; and
5. Prepare monitoring, contingency and impact management plans to mitigate the environmental effects of the proposed undertaking.

3 Study Areas

During the EA, existing conditions and potential effects will be considered in the context of two study areas: on-Site and off-Site. The general study areas proposed for the purposes of the EA are **(Figure 1)**:

- On-Site Study Area: the existing TCEC. Surface water quality at the TCEC is evaluated for compliance with established MECP-approved site-specific criteria before it is discharged to a receiver and ultimately off-Site.
- Off-Site Study Area (vicinity): the lands within the vicinity of the TCEC extending approximately 1 kilometre off WM's property boundaries. A monitoring program will be implemented off-Site for a 12-month period in concert with the current surface water quality monitoring program to establish existing conditions off-Site.

Figure 2 shows the established surface water quality system including monitoring locations, which outlines the flow path onto the Site, as well as on-Site prior to off-Site discharge.

Figure 3 shows an exploded view of the northern portion of the Site that denotes the flow path for water that discharges from each of the four sedimentation ponds up to WM's property boundary. Each sedimentation pond's discharge flow path has a unique colour for differentiation purposes.

Figure 4 shows the proposed surface water monitoring locations as part of the 12-month monitoring program, which outlines the flow paths onto the Site, on-Site prior to discharge, as well as off-Site heading away from the Site.

4 Scope of Work

The scope of work for surface water quality includes the development of evaluation criteria, indicators, and data sources, characterization of existing surface water conditions, assessment of the potential environmental effects of the alternative methods and the preferred alternative, development of mitigation measures and monitoring programs, and reporting as outlined below.

The surface water quality assessment will evaluate:

- Existing surface water quality trends with flow around the Site in context to current and proposed Site operations;
- Existing surface water quality trends in consideration of clayey soil erosional effects; and
- Surface water quality in consideration of possible effects from Automobile Shredder Residue (ASR) within the roadside ditch of the northbound lane of Nauvoo Road from the Site to Hwy 402 in the off-Site Study Area.

The aforementioned assessments will consider the current potential influences of clayey soil erosion and potential effects of landfilling operations on surface water quality on-Site, as well as possible effects from ASR on surface water quality off-Site. The findings from these assessments will enable an evaluation to be completed if the landfill optimization project will have an effect on the understood surface water quality.

4.1 Evaluation Criteria, Indicators, and Data Sources

The environmental assessment criteria, indicators, and data sources for the surface water quality environment are provided in **Table 1**. The assessment criteria, indicators, and data sources will be used to assess the effects of the alternatives and the preferred alternative on the surface water quality environment. These evaluation criteria and indicators may be modified during the EA.

Table 1. Evaluation Criteria, Indicators, and Data Sources for Surface Water Quality

Evaluation Criteria	Rationale	Indicators	Data Sources
Natural Environment			
Surface Water Quality	The landfill optimization has the potential to affect surface water quality through either possible leachate seepage through the landfill cap increased erosion of the landfill clayey soil cap or track-out of Automobile Shredder Residue (ASR) wastes off-Site.	• Predicted effects on surface water quality on-Site prior to off-Site discharge. • Predicted effects from polyaromatic hydrocarbons (PAHs) on surface water quality within the roadside ditch of the northbound lane of Nauvoo Road from the Site to Hwy 402 in the off-Site study area	• Applicable regulatory documentation (i.e. Amended Site ECAs, MECP guidelines, technical standards, etc.). • Landfill Environmental Monitoring Plan (Jagger Hims Limited, 2007) (EMP), and as amended per MECP approval. • Surface water quality monitoring data at each on-Site background, internal, and discharge (compliance) monitoring stations. • Provincial Water Quality Monitoring Network (PWQMN). • Topographic maps and aerial photos. • On-Site stormwater management system design for the Site. • Quarterly and Annual Site compliance monitoring reports. • Leachate generation and management assessments, as outlined in the Leachate Management Plan, (March 2020) (HDR, 2019). • Proposed facility characteristics. • Testing for PAHs related to potential effects of ASR on surface water within the roadside ditch of the northbound lane of Nauvoo Road from the Site to Hwy 402 in the off-Site study area.

4.2 Characterization of Existing Conditions

As part of the environmental assessment process, there is a requirement to document the existing conditions that occur at the Site. This is to develop a general baseline condition understanding so that the effects from the project can be assessed. For the surface water quality assessment, baseline conditions on-Site will be defined using the established surface water quality compliance monitoring completed at the Site.

The surface water quality monitoring program for the Site is developed to assess that surface water quality that discharges from the Site is not unacceptably degraded in

comparison to the background surface water quality that naturally/normally flows onto the Site.

Baseline conditions will be established off-Site through the implementation of a monitoring program that will be completed for a 12-month period in concert with the current surface water quality monitoring program completed for the Site.

4.2.1 On-Site Study Area Surface Water Flow Path

It is important to note that surface water flow at the Site is ephemeral in nature, where the presence of flow is precipitation or snowmelt dependent.

Since the development of the Expansion Landfill, beginning in 2008, overall Site improvements to protect the downstream watercourses have been implemented. These improvements include an extensive watercourse drainage network consisting of vegetated drainage ditches with rock-check dams, straw bale check dams, stormwater control berms, as wells as four (4) stormwater management ponds.

Stormwater from the Site flows toward either: 1) Kersey Drain (Brown Creek) to the east; or 2) drains and ditches associated with Bear Creek to the west. The locations and descriptions of the monitoring stations are detailed in the following summary table and are presented on **Figure 2**.

Task	Monitoring Station Designations	Monitoring Station Description
Surface Water Environmental Monitoring Program	SS1	Downstream of landfill on WM property, 60 m east of Lambton Road 79 (Nauvoo Road) – Compliance Point
	SS10	Off-Site flow into East Ditch of the Existing Landfill – Background Surface Water Quality
	SS16	Flow onto Site from lands located to the south – Background Surface Water Quality
	SP1	Outlet Weir of Sedimentation Pond 1 – Internal assessment location
	SP2	Outlet Weir of Sedimentation Pond 2 – Compliance Point
	SP3	Outlet Weir of Sedimentation Pond 3 – Compliance Point
	SP4	Outlet Weir of Sedimentation Pond 4 – Compliance Point
Surface Water Poplar System Monitoring Program	SS14A	On-Site flow within East Ditch of the Existing Landfill, upstream of Poplar System – Internal assessment location
	SS14B	On-Site flow within West Ditch of the Existing Landfill, downstream of Poplar System as of June 2011 – Internal assessment location
	SS15A	South Ditch of the Existing Landfill and inlet point to Sedimentation Pond 1. Downstream of Poplar System – Internal assessment location
Surface Water Poplar Plantation Monitoring Program	SS17A	On-Site flow from western portion of Poplar Plantation, northwest corner - Compliance Point when plantation is active
	SS17B	On-Site flow from western portion of Poplar Plantation, southwest corner - Compliance Point when plantation is active
	SS18A	On-Site flow from eastern portion of Poplar Plantation, north end of stormwater control berm plantation - Compliance Point when plantation is active
	SS18B	On-Site flow from eastern portion of Poplar Plantation, south end of stormwater control berm plantation - Compliance Point when plantation is active

Sedimentation Ponds 1 through 4 were fully constructed in 2009. Sampling of these ponds occurred during construction in the latter half of 2008 and beginning three-quarters of 2009, with results that showed expected incomplete treatment.

Sedimentation Pond 1 receives stormwater flow from most of the east half and the southern approximate one-quarter of the western half of the Existing Landfill. Sedimentation Pond 1 discharges water through twin culverts to an open drainage ditch on-Site, which flows westward until it enters a municipal drain (surface water monitoring station SS1) near the western Site boundary. This municipal drainage tile discharges into one of the headwater branches of the Gilliland-Geerts Drain on the east side of Lambton County Road 79 (Nauvoo Road).

Sedimentation Pond 2 receives flow from the central western portion of the Existing Site, as well as the southern two-thirds of the current footprint of the Expansion Landfill. Discharge from Sedimentation Pond 2 is through twin culverts to an open drainage ditch that flows to the western Site boundary and into one of the headwater branches of the Gilliland-Geerts Drain on the east side of Lambton County Road 79 (Nauvoo Road).

Sedimentation Pond 3 receives stormwater flow from the northern approximate one-third of the Expansion Site, as well as a large area of the undeveloped northwestern portion of the Site, and discharges through three culverts that flow to the eastern roadside ditch of Nauvoo Road, which in-turn directs the stormwater flow to two additional headwater branches of the Gilliland-Geerts Drain all to the west of Nauvoo Road.

Sedimentation Pond 4 receives stormwater flow from approximately one-quarter of the northeastern portion of the Existing Landfill, as well as a portion of land to not be developed to the east of the pond. Stormwater discharges from Sedimentation Pond 4 flows through a culvert then into an open drainage ditch that flows westward until it enters a series of culverts that direct water under a screening berm and then under Zion Line to flow into one of the headwater branches of the Gilliland-Geerts Drain.

The surface water flow paths along with outlining where the sampling locations are located and the rationale for those locations will be documented as part of the existing conditions.

4.2.2 Off-Site Study Area Surface Water Flow Path

It is important to note that surface water flow off-Site is also ephemeral in nature, where the presence of flow is precipitation or snowmelt dependent.

Stormwater from a component of the northern portion of the Site flows from the Site along the northbound roadside ditch of Nauvoo Road to Auld-Redmond Drain Branch where the water crossed under Nauvoo Road to flow west until it turns into the McKay Drain prior to entering into Bear Creek. Along the northbound ditch of Nauvoo Road, within the off-Site Study Area, are: 1) two flow paths that form part of the Auld-Redmond Drain Branch to the west; and 2) one flow path that form part of the Morris Drain to the west. The locations and descriptions of the monitoring stations are detailed in the following summary table and are presented on **Figure 3**.

Task	Monitoring Station Designations	Monitoring Station Description
Proposed 12-month Surface Water Environmental Monitoring Program	SW1	Downstream of landfill at the intersection of Zion Line and Nauvoo Road, at the culvert heading northbound under Zion Line.
	SW2	North and downstream of landfill, within the roadside ditch upstream of the flow at the first culvert facing westward under Nauvoo Road that forms part of the Auld-Redmond Drain Branch.
	SW3	North of landfill, within the roadside ditch upstream of the flow at the first culvert facing westward under Nauvoo Road that forms part of the Morris Drain (close to Hwy 402).

4.2.3 Existing Site Surface Water Quality

Surface water quality data collected from the Site since late 2003 for the established existing environmental monitoring program serve as a strong baseline comprehensive database in order to document existing conditions, as well as to be assessed to evaluate potential effects from the landfill optimization project on surface water quality prior to its discharge from the Site. Documentation of the mechanics of the monitoring program will be completed. This will document the rational for the development of the monitoring program to evaluate for possible landfill leachate effects on surface water quality, which will include what parameters are assessed, where sampling locations are located, when is sampling initiated, and how the quality results are assessed to evaluate existing conditions.

Presented below are the assessments that will completed to document existing conditions and to evaluate potential effects from the landfill optimization project on surface water quality prior to its discharge from the Site.

Evaluation of Existing Surface Water Quality Trends

Existing water quality trends with flow around the Site will be evaluated to understand existing conditions. The available surface water quality for the primary leachate indicator list (PLIL) parameters obtained from the established monitoring locations will be evaluated for potential chemical trends such as seasonal patterns. The PLIL parameters (chloride, boron, unionized ammonia, phenols, chromium, nickel, and zinc) are the parameters that would most readily show a landfill leachate effect on surface water. Of these PLIL parameters, not all parameters together, but more than one parameter is usually needed to be observed in elevated concentrations compared to background concentrations to be indicative of a possible landfill leachate effect on surface water quality. This work will be competed for the background surface water that flows on the Site, internal assessment locations, as well as discharge locations. Assessments of trends for the PLIL parameters will be completed to understand the quality of water that flows onto the Site, the quality of water onSite, as well as the quality of water prior to its discharge from the Site.

Existing Surface Water Quality and Clayey Soil Erosional Effects

The surface water quality for the PLIL parameters will be evaluated for chemical concentration trends in consideration of clayey soil erosional effects. Clayey soils naturally have metals within their mineralogical make-up. Upon erosion the clayey soils can remain in suspension in the surface water column for an extended period of time and are consequently tested as part of collected surface water samples. An evaluation will be completed to see if there is a trend of surface water chemical quality for the PLIL

parameters assessed to total suspended solids (TSS) concentrations. This assessment will be used to evaluate if the TSS concentrations have a relationship between natural/normal clayey soil erosional effects to potential Site operations effects.

In addition, a review of the stormwater management system, including the four existing facilities/ponds, will be completed for each alternative to confirm that the ponds are properly sized to manage sediment.

4.2.4 Off-Site Surface Water Quality

Baseline conditions for polyaromatice hydrocarbons (PAHs) will be established off-Site through the implementation of a monitoring program for a 12-month period, which will be completed in concert with the current quarterly surface water quality monitoring program for the Site.

This monitoring program will be implemented to determine the predicted possible effects from ASR on surface water quality within the roadside ditch of the northbound lane of Nauvoo Road from the Site to Hwy 402 in the off-Site study area.

At the three proposed surface water monitoring locations, for evaluating existing conditions for ASR, the locations will be evaluated for PAHs per method EPA 8270M.

If PAHs are detected above their respective PWQO, then confirmation monitoring will be completed consistent with the EMP for the current surface water quality monitoring program.

4.3 Assessment of Potential Environmental Effects

Using the evaluation criteria, indicators, rationale, and data sources from Section 4.1 and the characterization of existing conditions as described in Section 4.2, the assessment of potential environmental effects will be carried out as follows:

- predict the potential environmental effects for each alternative method (Section 4.3.1);
- identify the preferred alternative based on a comparative evaluation of the potential environmental effects of each alternative method (Section 0); and
- conduct an effects assessment on the preferred alternative, including the identification of mitigation measures and monitoring programs (Sections 4.3.3).

4.3.1 Evaluation of Alternative Methods

The potential effects of each alternative method will be identified based upon application of the proposed evaluation criteria, indicators, and data sources as outlined in Section 4.1. Potential effects can be positive or negative, direct or indirect, and short or long-term. Mitigation measures will be identified to minimize or mitigate the potential effects and then the net effects are evaluated taking into consideration the application of mitigation measures.

The proposed facility characteristics of each alternative method will be reviewed to determine potential interactions with surface water quality. The criteria and indicators listed in **Table 1** will be applied to each alternative method to determine potential effects.

For the evaluation of surface water quality for the PLIL parameters as outlined above, the characterization of the existing conditions outlined in Section 4.2 will be used to assess potential effects that each of the alternative methods of the landfill optimization project may have on stormwater prior to its discharge from the Site.

4.3.2 Identification of the Preferred Alternative

The alternative methods will be comparatively assessed and evaluated using the proposed evaluation criteria, indicators, and data sources to determine the preferred alternative. The differences in the potential environmental effects remaining following the implementation of mitigation/management measures (i.e., net effects) will be used to identify and compare the advantages and disadvantages of each alternative method. The comparison of alternative methods will include a clear rationale for the selection of the preferred alternative.

4.3.3 Effects Assessment of the Preferred Alternative

Following the identification of the preferred alternative, an effects assessment will be carried out on the preferred alternative considering the same evaluation criteria, indicators, and data sources, and additional studies as required, considering possible mitigation and/or management measures and cumulative effects. The potential effects of the preferred alternative will be compared to the 'do nothing' alternative.

Details regarding the operations and design of the preferred alternative will be based on data provided by WM as to planned operations.

Climate change has affected the frequency and intensity (less frequent and more intense) of precipitation events that are occurring globally, as well as at the Site. On-Site monitoring of precipitation began during 2003, with the first full year in 2004. The available on-Site precipitation data will be evaluated and compared to the two most relevant (closest with sufficient data) Environment Canada climatic stations in consideration of year to year patterns since 2004, as well as in consideration of relevant historical 30-year normal amounts (as measured at the Environment Canada climatic stations). A review of the current surface water monitoring program will be completed. The evaluation will enable an establishment of precipitation patterns to consider the appropriateness of the sampling trigger mechanism ($\geq$ 10 mm/24 hrs) as these smaller intensity precipitation events may not reliably generate stormwater flow. Also, these smaller intensity precipitation events may not represent the average intensity precipitation event, and as such would represent stormwater flow that has better than average potential to erode less soils. The landfill optimization project has the potential to cause increased erosional effects within the stormwater runoff from the steeper and/or larger clayey soil cap; and as Climate Change has intensified the magnitude of precipitation events, the culmination of these two potential effects to add to the possibility of increased soil erosion affecting stormwater at the Site. This assessment will be complete for the Preferred Alternative.

In addition, a review of the stormwater management system, including the four existing facilities/ponds, will be completed for the preferred alternative to confirm that the ponds are properly sized for use.

4.4 Reporting

Two separate reports will be prepared for surface water quality in support of the EA:

1. A report providing a characterization of Existing Conditions; and
2. A report providing the Effects Assessment.

These reports will be appended to the EA Study Report and will be available for review during the EA. A summary of the existing conditions and effects assessment will be included in the EA Study Report.

The characterization of existing conditions will include details of completed field investigations to date, technical analyses of available data, assessment methods, interpretation of results for compliance with the Waste and Sewage ECAs, as well as provide a summary of conclusions and recommendations.

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RWDI AIR Inc.

2021 2020 Fourth Quarter and Annual Monitoring Report, Twin Creeks Environmental Centre, Township of Warwick, Ontario, Prepared for Waste Management of Canada Corporation

Figures

Figure 1. General On-Site and Off-Site Study Areas

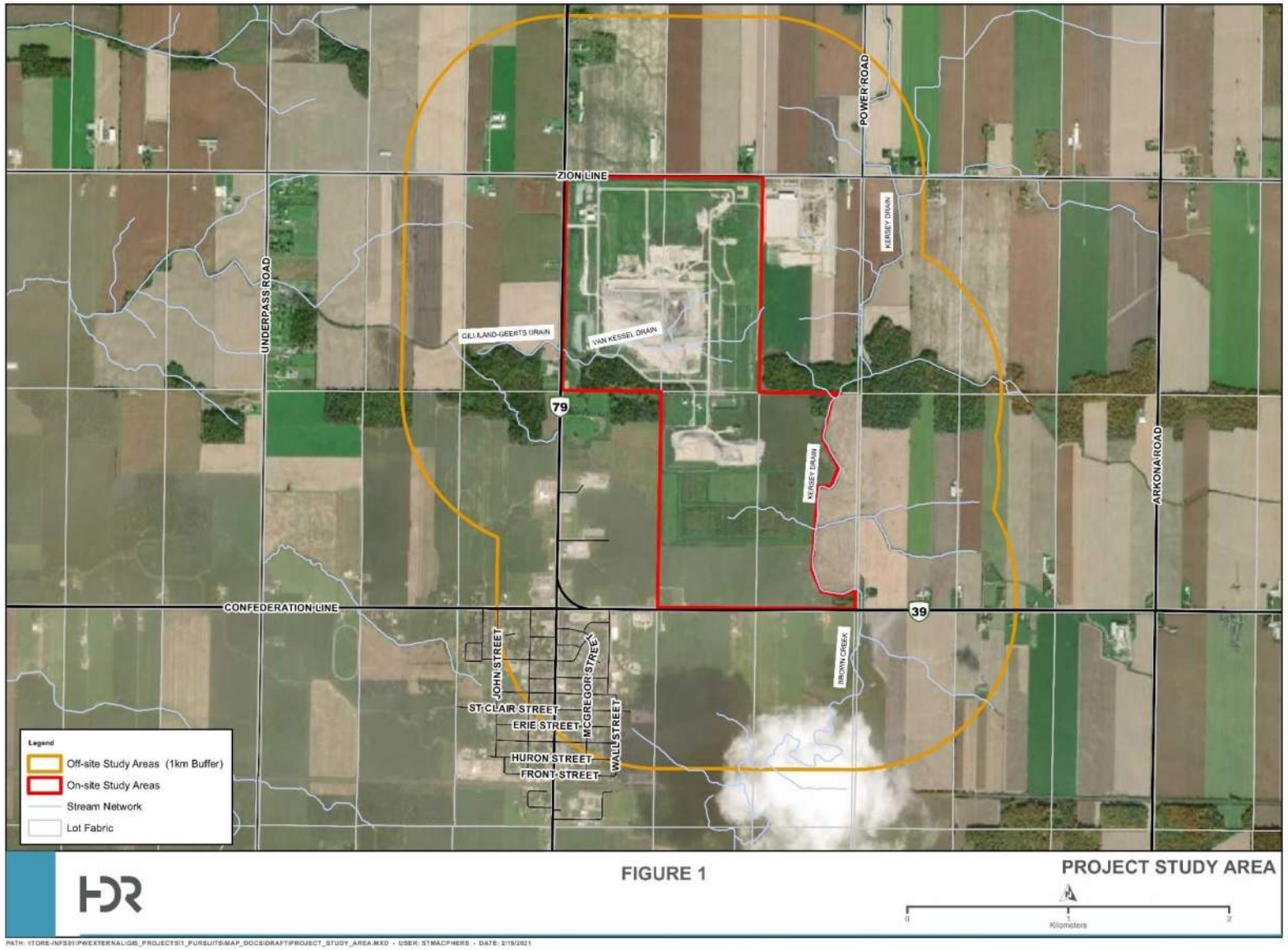


Figure 2. Surface Water Quality System

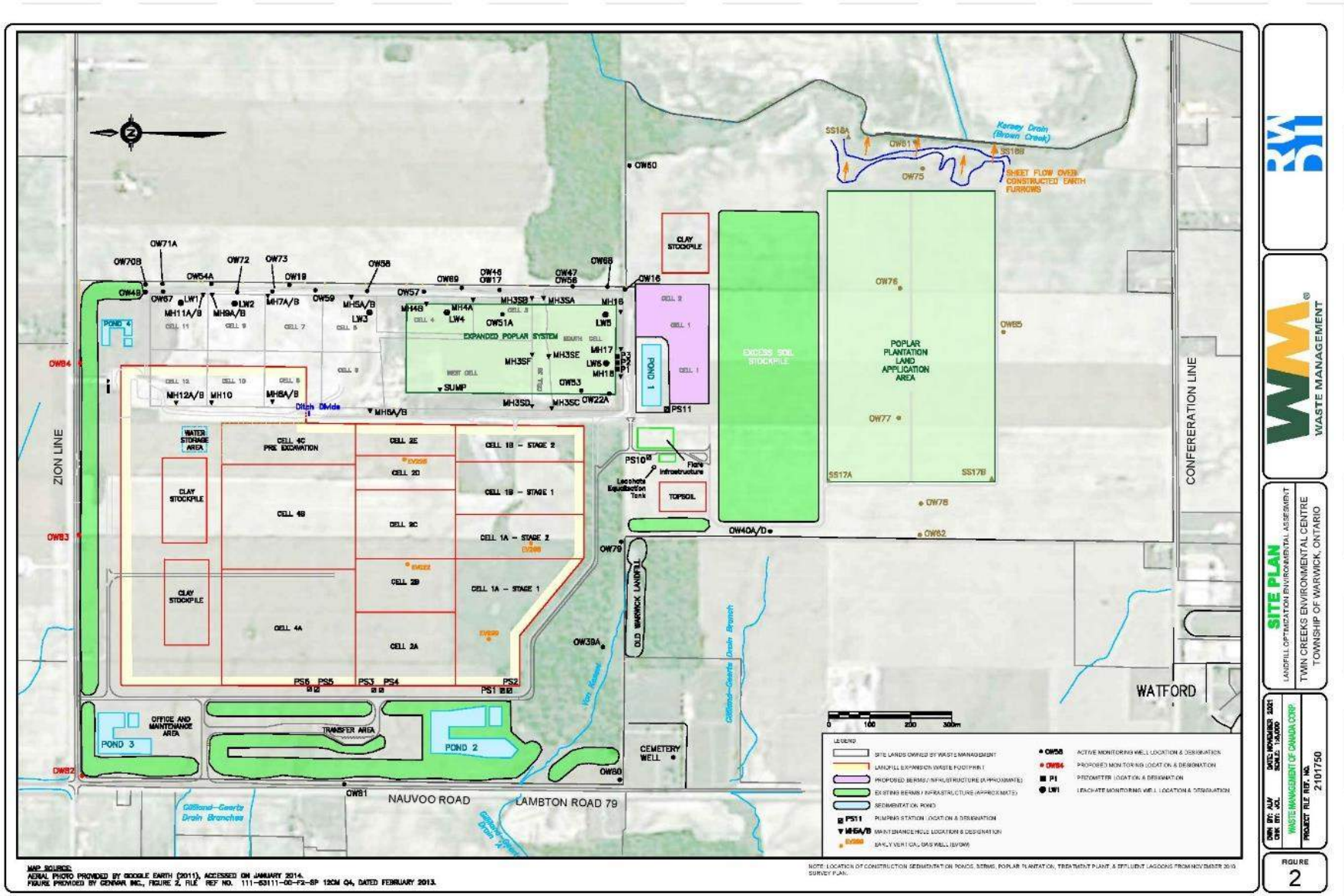


Figure 3. Expanded View of Surface Water Quality System

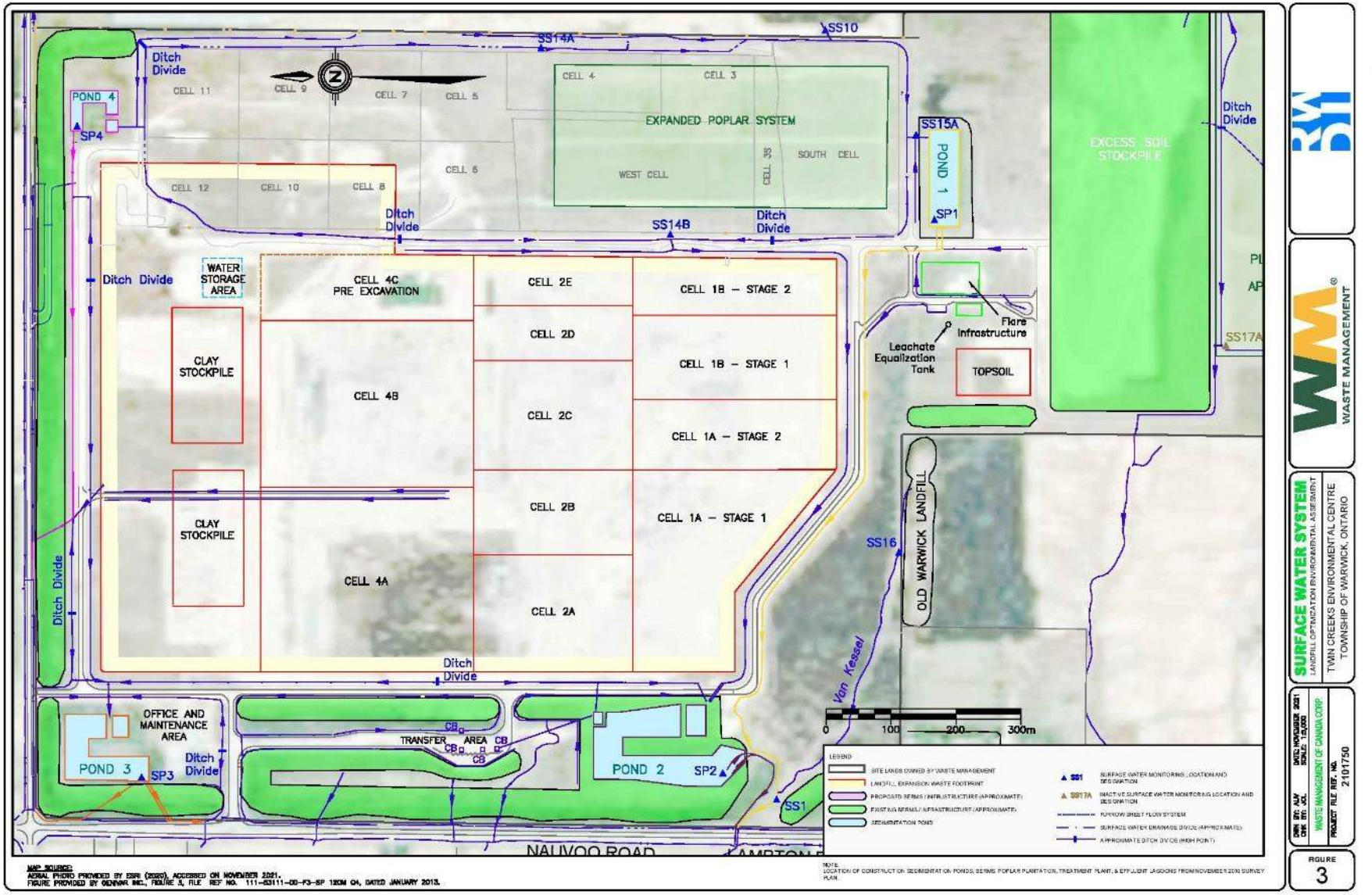
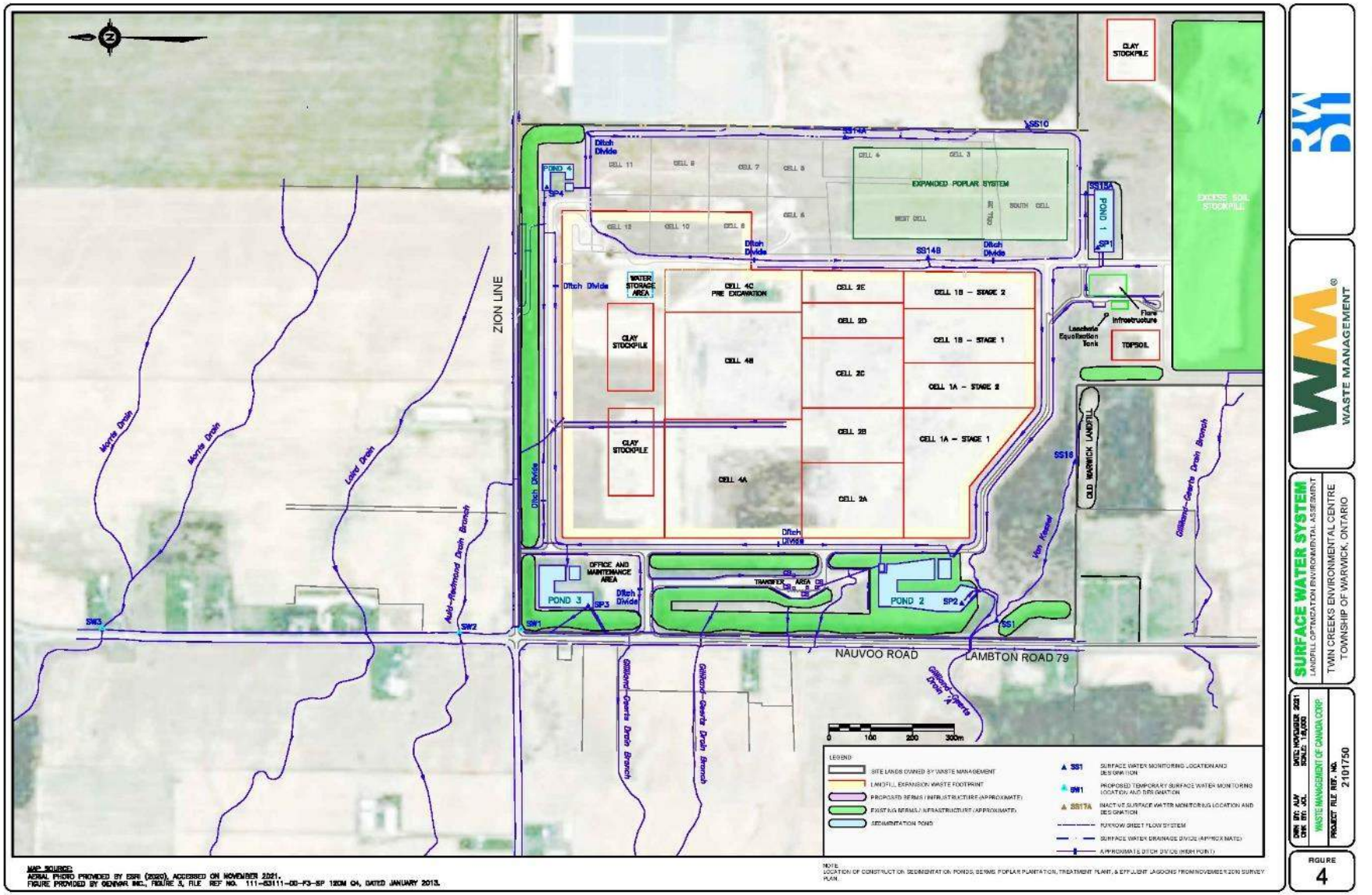


Figure 4. Proposed Surface Water Monitoring Locations



Surface Water Quantity (Hydrology) Work Plan

Twin Creeks Environmental Centre Landfill Optimization Project

Waste Management of Canada Corporation

Watford, Ontario

March 30, 2022

Prepared by:

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Acronyms

Acronym	Definition
EA	Environmental Assessment
MECP	Ministry of Environment, Conservation and Parks
MNRF	Ministry of Natural Resources and Forestry
TCEC	Twin Creeks Environmental Centre
ToR	Terms of Reference
WM	Waste Management of Canada Corporation
SCRCA	St. Clair Region Conservation Authority

1 Introduction

This Surface Water Quality (Hydrology) work plan has been prepared to support the environmental assessment (EA) for the Twin Creeks Environmental Centre Landfill Optimization Project (the Project) and will be appended to the Terms of Reference (ToR) for the EA to be submitted to the Ministry of Environment, Conservation and Parks (MECP) for approval.

The Surface Water Quality (Hydrology) assessment will predict change in runoff volumes and peak flows resulting from steeper slopes and longer side slopes and predicted degree of on-site and off-site drainage systems effects. Based on the findings, determine the mitigation measures required. Although the landfill footprint will remain the same, surface water quantity is expected to change slightly as the area of steeper slopes of the waste footprint will increase. Surface water quality is addressed under a separate work plan.

Waste Management of Canada Corporation (WM), the owner and operator of the Twin Creeks Environmental Centre (TCEC) in Watford, Ontario, has initiated an EA seeking approval to increase the landfill airspace capacity at the TCEC. The TCEC has approximately 13.2M m^3 of remaining approved landfill airspace, which corresponds to about 10 years of operating life (2021 to 2031). This optimization project could provide additional airspace capacity of up to approximately 14M m^3, which could extend the site life by about 12 years (from 2031 to 2043). There would be no change to the current 301 ha site area, the approved service area, or the annual fill rate.

The TCEC is a regional facility that provides safe and convenient disposal services for communities, businesses and industries serving the Province of Ontario. The landfill is approved to receive municipal, industrial, commercial, and institutional solid non-hazardous wastes generated, including non-hazardous contaminated soil.

The TCEC is engineered with environmental protection systems that meet or exceed regulatory requirements and are subject to highly regulated monitoring and reporting requirements. Systems include engineered liners and covers, leachate collection and removal, landfill gas collection and control, and on-site leachate disposal through phytoremediation. The TCEC provides landfill gas, for heating, to the 40-acre greenhouse facility adjacent to the landfill property. Prior to this, all landfill gas was flared. The intent is for the landfill to supply gas for heating to the greenhouses for 25 years.

Leachate that is generated in the waste is conveyed toward a perimeter leachate collection system. WM received approval to treat leachate through a phytoremediation system consisting of a 9.3 ha poplar system planted on the existing landfill cap in 2003. Surplus leachate is trucked off-site to approved wastewater treatment plants.

WM pays host community fees annually to the Township of Warwick. Since 2009, when the TCEC Expansion Landfill began receiving waste, WM has contributed over $24M in host community fees to the Township.

There is a need for the continued development of the TCEC as it is a significant component of the provincial waste management network and infrastructure, which is lacking in sufficient and secure long-term disposal capacity. Optimizing the future development of

the TCEC allows for on-going sustainable business operations and continued provision of essential financial support for community services and programs.

The purpose of the EA is to assess the potential effects of the proposed landfill optimization on the environment. The EA will be carried out in accordance with the requirements of the *Ontario Environmental Assessment Act*.

2 Study Purpose and Objectives

This Surface Water (Hydrology) work plan outlines the tasks required to support the EA through the characterization of existing conditions and assessment of potential environmental effects of the project on the Surface Water (Hydrology) environment, including the evaluation of the various alternative methods and the identification and assessment of a preferred alternative. This work plan outlines the scope of the Surface Water (Hydrology) work, including protocols and/or standards to be adhered to while the work is undertaken. The specific evaluation criteria, indicators, and data sources to be used and the study areas to be considered are provided below. These items may be adjusted during the EA process.

In accordance with the *Ontario Environmental Assessment Act*, the objectives of the EA are as follows:

1. Describe the environment potentially affected by the proposed undertaking, including both the existing environment as well as the environment that would otherwise be likely to exist in the future without the proposed undertaking;
2. Carry out an evaluation of the environmental effects of the proposed undertaking, using the environmental assessment criteria and studies that have been established through the development of the ToR;
3. Undertake an evaluation of any additional actions that may be necessary to prevent, change or mitigate environmental effects;
4. Provide a description and evaluation of the environmental advantages and disadvantages of the proposed undertaking, based on the net environmental effects that will result following mitigation; and
5. Prepare monitoring, contingency and impact management plans to mitigate the environmental effects of the proposed undertaking.

3 Study Areas

During the EA, existing conditions and potential effects will be considered in the context of two study areas: on-site and off-site. The general study areas proposed for the purposes of the EA are (refer to Figure 1):

- On-site Study Area: the existing TCEC.
- Off-site Study Area: the lands within the vicinity of the TCEC extending approximately 1 km out from the On-site Study Area and along the Gilliland-Geerts Drain between Nauvoo Road and Underpass Road.

Drawing SP1 shows the watershed divide within the On-Site Study Area between Bear Creek and Brown Creek. For Surface Water (Hydrology) the Off-site Study Area includes those portions of the Bear Creek and Brown Creek watersheds within 1 km of the On-site Study Area.

4 Scope of Work

The scope of work for Surface Water (Hydrology) includes the development of evaluation criteria, indicators, and data sources, characterization of existing hydrologic conditions, assessment of the potential environmental effects of the alternative methods and the preferred alternative, development of mitigation measures and monitoring programs, and reporting as outlined below.

4.1 Evaluation Criteria, Indicators, and Data Sources

The environmental assessment criteria, indicators, and data sources for Surface Water (Hydrology) are provided in Table 1. The assessment criteria, indicators, and data sources will be used to assess the effects of the alternatives and the preferred alternative on Surface Water (Hydrology). These evaluation criteria and indicators will be finalized during the EA.

Table 1. Evaluation Criteria, Indicators, and Data Sources for Surface Water (Hydrology)

Evaluation Criteria	Rationale	Indicators	Data Sources
Surface Water Quantity and Flow	Construction of physical works may disrupt natural surface drainage patterns and may alter runoff and peak flows. The presence of the expanded landfill may also affect base flow to surface water.	• Change in runoff volumes and peak flows resulting from steeper and longer side slopes. • Changes to drainage areas on-site and off-site. • Predicted occurrence and degree of off-site effects to surface water flows.	• On-site stormwater management system design for expanded landfill. • Landfill design and operations data. • Hydrologic modelling. • Annual monitoring reports. • Published flow information and hydrology design standards from MECP, MNRF, Environment Canada and SCRCA. • Site reconnaissance. • Topographic surveys. • Air photos. • Drainage maps. • Watershed mapping areas including municipal water supply sources within the off-site study area from St. Clair Conservation Area. • Typical stream channel geometry within the off-site study area, to the extent accessible. • Water well survey within the off-site study area. • PTTW records. • Liaison with MECP, SCRCA, downstream riparian landowners along Gilliland-Geerts Drain between Nauvoo Road and Underpass Road, Township of Warwick.

4.2 Characterization of Existing Conditions

The study area for the Surface Water (Hydrology) will focus on the on-site ditches and Stormwater Ponds 1, 2, 3 and 4 and will extend to the Off-Site Study Area within the vicinity of the TCEC extending 1 km out from the On-site Study Area. The off-site study area involves the Kersey Drain to the east, Van Kessel Drain to the west and municipal drainage tile at catch basin (SS1). The municipal drainage tile ultimately flows to the Gilliland-Geerts Drain, beneath Nauvoo Road (County Road 79), as shown on Drawing SP1.

This will enable a more comprehensive characterization of baseline conditions at a watershed scale to assist in the assessment of potential surface water effects. A desktop review of background data will be completed to enable an understanding and synthesis of recently completed studies and relevant supporting information.

The on-site stormwater management ponds are an unnatural feature design to hold water for the purpose of water quality treatment, water flow control and for on site usage as per rates indicated in the Permit To Take Water.

The investigations will include the following tasks:

- A desktop review of background data to understand the baseline conditions;
- A site reconnaissance to corroborate existing conditions;
- Confirmation of overland flow routes, drainage boundaries and outlet locations;
- Inventory of existing hydraulic structures (i.e., location, size, material);
- Measurements of typical stream channel geometry within WM property (i.e., bottom width, side slopes, depth);
- Climate and stream flow monitoring (initiated in the fall of 2015) to collect:
    - Rainfall data and ambient temperature data;
    - Water temperature and water levels data; and
    - Stream flow gauging measurements.

Although the landfill footprint is not proposed to change, surface water quantity is expected to change slightly as the area of steeper slopes of the waste footprint will increase. The drainage catchment areas will likely be modified, thereby slightly changing the drainage area to each of the on-site stormwater ponds. Mitigation measures associated with sediment control to maintain flows and having hydraulic structures design with enough capacity to manage major storm events and prevent flooding will likely be required.

4.3 Assessment of Potential Environmental Effects

Using the evaluation criteria, indicators, rationale, and data sources from Section 4.1 and the characterization of existing conditions as described in Section 4.2, the assessment of potential environmental effects will be carried out as follows:

- predict the potential environmental effects for each alternative method (i.e., leachate seeps) (Section 4.3.1);
- identify the preferred alternative based on a comparative evaluation of the potential environmental effects of each alternative method (Section 4.3.2); and
- conduct an effects assessment on the preferred alternative, including the identification of mitigation measures and monitoring programs (Sections 4.3.3).

4.3.1 Evaluation of Alternative Methods

The potential effects of each alternative method will be identified based upon application of the proposed evaluation criteria, indicators and data sources as outlined in Section 4.1.

Potential effects can be positive or negative, direct or indirect, and short or long-term. Mitigation measures will be identified to minimize or mitigate the potential effects and then the net effects are evaluated taking into consideration the application of mitigation measures.

The potential for each site development alternative to have an impact on surface water quantity and flow will be assessed based on the established baseline water quantity and flow conditions.

The assessment of surface water flow conditions will involve a combination of technical analyses to determine baseline conditions and potential impacts for each of the indicators (e.g., upstream/downstream flood levels, hydrograph timing/duration, changes in baseflow, and stream-bank erosion potential). Tasks that will be completed as part of the flow condition assessment include:

- Predict effect of each alternative on hydrologic modelling results;
- Water Balance Assessment; and
- Hydraulic Analyses and Flood Hazard Delineation.

4.3.2 Identification of the Preferred Alternative

The alternative methods will be comparatively assessed and evaluated using the proposed evaluation criteria, indicators, and data sources to determine the preferred alternative. The differences in the potential environmental effects remaining following the implementation of mitigation/management measures (i.e., net effects) will be used to identify and compare the advantages and disadvantages of each alternative method. The comparison of alternative methods will include a clear rationale for the selection of the preferred alternative.

4.3.3 Effects Assessment of the Preferred Alternative

Following the identification of the preferred alternative, an effects assessment will be carried out on the preferred alternative considering the same evaluation criteria, indicators, and data sources, and additional studies as required, considering possible mitigation and/or management measures and cumulative effects. The potential effects of the preferred alternative will be compared to the ‘do nothing’ alternative.

Consideration for the potential of climate change on the operation of the proposed TCEC expansion will be made. The Surface Water Assessment will identify mitigation measures as well as potential contingency plans to address future extreme weather events.

4.4 Reporting

Two separate reports will be prepared for Surface Water (Hydrology) in support of the EA:

1. A report providing a characterization of Existing Conditions; and
2. A report providing the Effects Assessment.

These reports will be appended to the EA Study Report and will be available for review during the EA. A summary of the existing conditions and effects assessment will be included in the EA Study Report.

Surface water quantity assessment will be undertaken to corroborate the post-development runoff quantity considerations in accordance with the criteria outlined in the Landfill Standards: A Guideline on the Regulatory and Approval Requirements for New or Expanding Landfilling Site (January 2012) document.

The characterization of existing and proposed conditions (considering the most critical expansion alternative) will include a recent site plan of existing and proposed conditions, historical discharge of water quantity data, hydrologic assessment, potential impacts to surface water quantity and flow conditions due to steep side slopes and peak flows due to shorter time of concentrations resulting from steeper side slopes within the site surface water system and municipal drains, conclusions, and recommendations.

5 References

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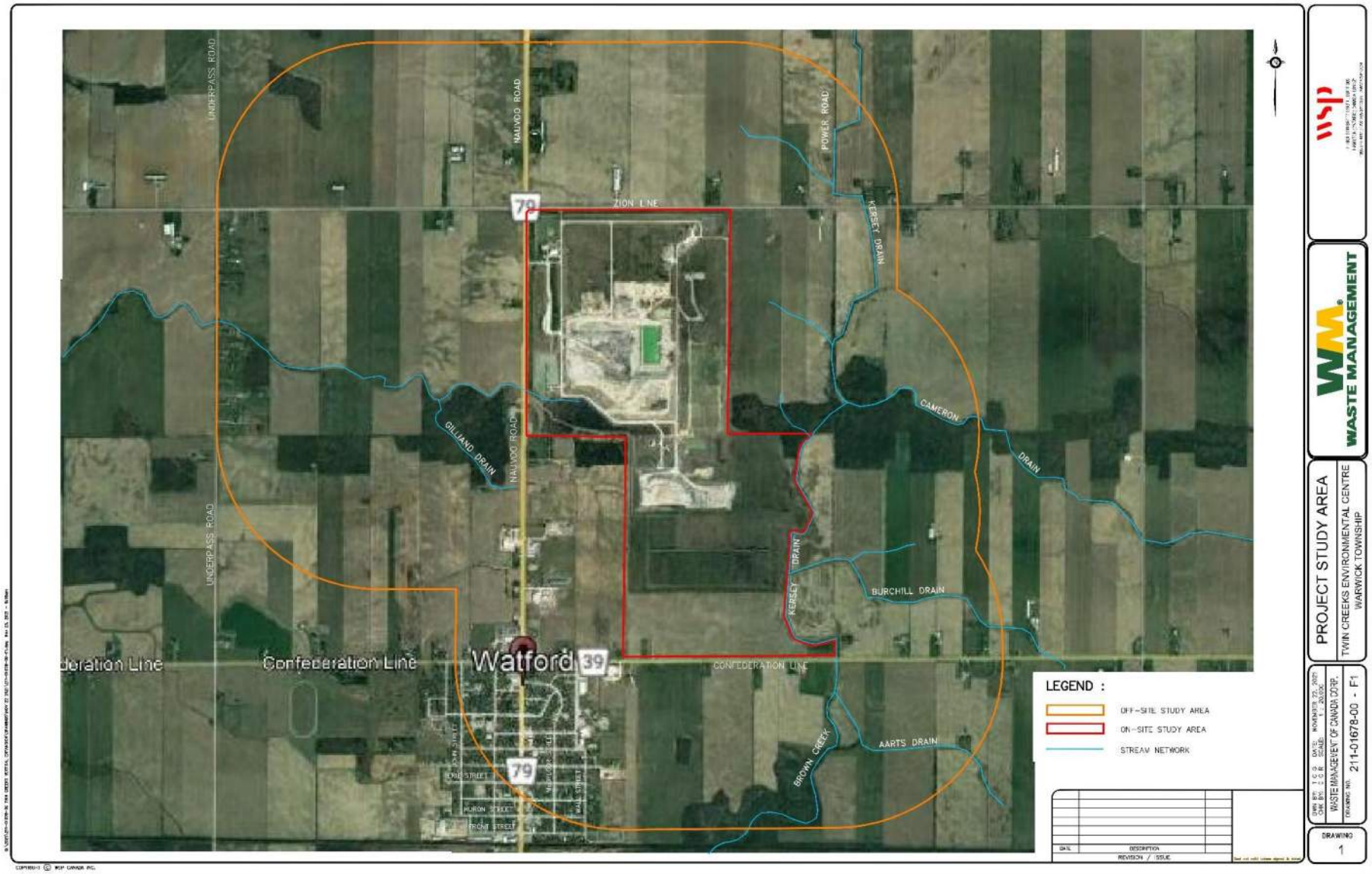
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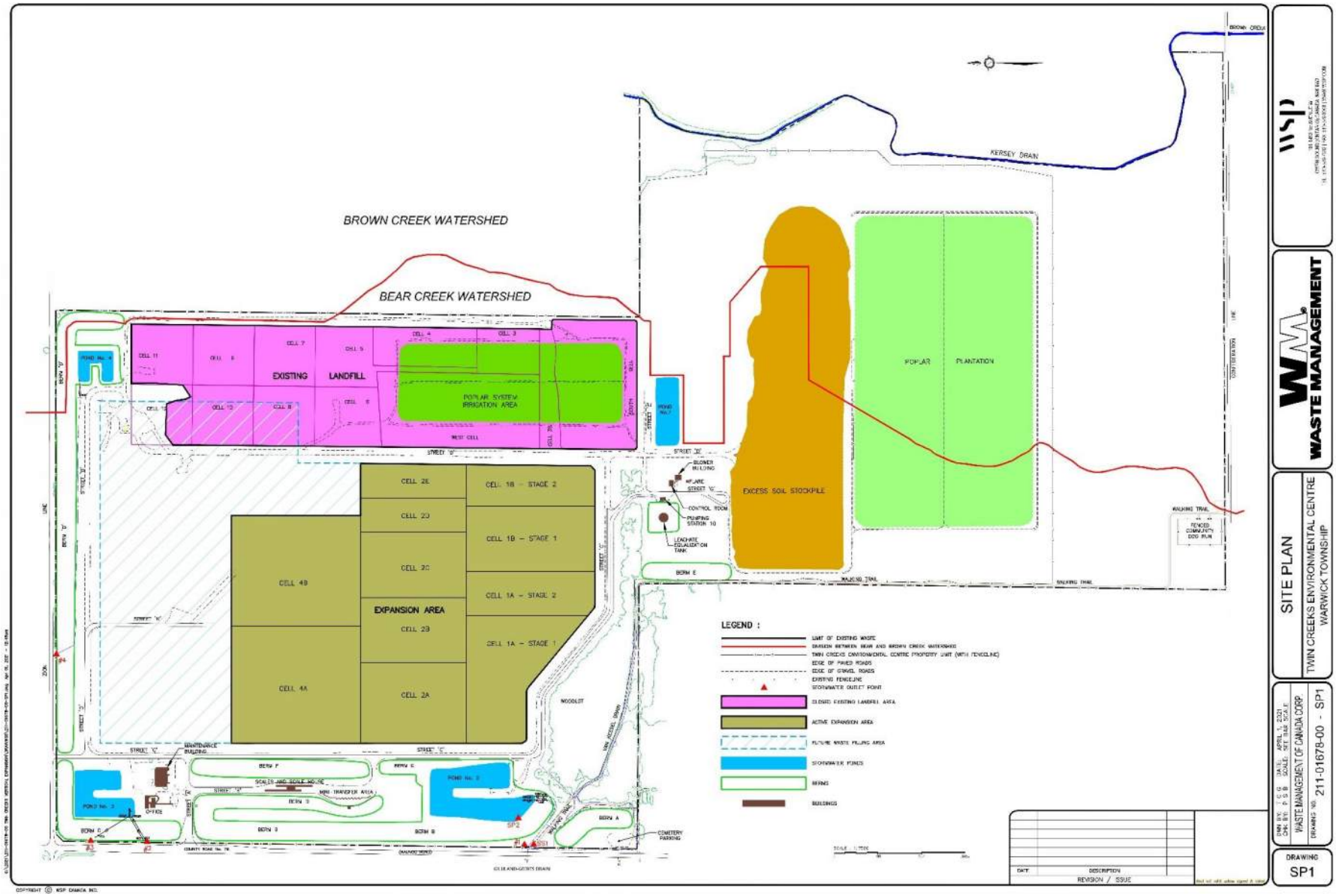
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Figures

Figure 1. Project Study Area



Drawing SP1. Site Plan



Transportation Work Plan

Twin Creeks Environmental Centre Landfill Optimization Project

Waste Management of Canada Corporation

Watford, Ontario

March 30, 2022

Prepared by:

HDR Corporation

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Acronyms

Acronym	Definition
EA	Environmental Assessment
MECP	Ministry of Environment, Conservation and Parks
TCEC	Twin Creeks Environmental Centre
ToR	Terms of Reference
WM	Waste Management of Canada Corporation
TMC	Turning Movement Count
ATR	Automatic Traffic Recorder Count
AADT	Average Annual Daily Traffic
SADT	Summer Average Daily Traffic
DHV	Design Hourly Volume

1 Introduction

This Transportation work plan has been prepared to support the environmental assessment (EA) for the Twin Creeks Environmental Centre Landfill Optimization Project (the Project) and will be appended to the Terms of Reference (ToR) for the EA to be submitted to the Ministry of Environment, Conservation and Parks (MECP) for approval.

The transportation scope of work will include an operational assessment of study intersections under future conditions. The operational analysis will be based on forecast traffic volumes which include the landfill generated traffic volumes, general background traffic growth, as well as traffic generated by any future planned developments within the study area. The operational analysis will use the standard measures of effectiveness including demand and capacity calculations (volume-to-capacity ratios), level of service (delays), and queuing. Safety for all vehicle types including vulnerable road uses (i.e. cyclists) will also be reviewed by analyzing collision history along study area roadways to identify repeating collision causes, or collision 'hotspots' which will lead to a more focused review and development of mitigative measures. The external study roadways and access point along Nauvoo Road will be reviewed for safety and functional requirements relating to truck movements and impacts from truck activities.

Waste Management of Canada Corporation (WM), the owner and operator of the Twin Creeks Environmental Centre (TCEC) in Watford, Ontario, has initiated an EA seeking approval to increase the landfill airspace capacity at the TCEC. The TCEC has approximately 13.2M m^3 of remaining approved landfill airspace, which corresponds to about 10 years of operating life (2021 to 2031). This optimization project could provide additional airspace capacity of up to approximately 14M m^3, which could extend the site life by about 12 years (from 2031 to 2043). There would be no change to the current 301 ha site area, the approved service area, or the annual fill rate.

The TCEC is a regional facility that provides safe and convenient disposal services for communities, businesses and industries serving the Province of Ontario. The landfill is approved to receive municipal, industrial, commercial, and institutional solid non-hazardous wastes generated, including non-hazardous contaminated soil.

The TCEC is engineered with environmental protection systems that meet or exceed regulatory requirements and are subject to highly regulated monitoring and reporting requirements. Systems include engineered liners and covers, leachate collection and removal, landfill gas collection and control, and on-site leachate disposal through phytoremediation. The TCEC provides landfill gas, for heating, to the 40-acre greenhouse facility adjacent to the landfill property. Prior to this, all landfill gas was flared. The intent is for the landfill to supply gas for heating to the greenhouses for 25 years.

Leachate that is generated in the waste is conveyed toward a perimeter leachate collection system. WM received approval to treat leachate through a phytoremediation system consisting of a 9.3 ha poplar system planted on the existing landfill cap in 2003. Surplus leachate is trucked off-site to approved wastewater treatment plants.

WM pays host community fees annually to the Township of Warwick. Since 2009, when the TCEC Expansion Landfill began receiving waste, WM has contributed over $24M in host community fees to the Township.

There is a need for the continued development of the TCEC as it is a significant component of the provincial waste management network and infrastructure, which is lacking in sufficient and secure long-term disposal capacity. Optimizing the future development of the TCEC allows for on-going sustainable business operations and continued provision of essential financial support for community services and programs.

The purpose of the EA is to assess the potential effects of the proposed landfill optimization on the environment. The EA will be carried out in accordance with the requirements of the *Ontario Environmental Assessment Act*.

2 Study Purpose and Objectives

This Transportation work plan outlines the tasks required to support the EA through the characterization of existing conditions and assessment of potential environmental effects of the project on the Transportation environment, including the evaluation of the various alternative methods and the identification and assessment of a preferred alternative. This work plan outlines the scope of the Transportation work, including protocols and/or standards to be adhered to while the work is undertaken. The specific evaluation criteria, indicators, and data sources to be used and the study areas to be considered are provided below. These items may be adjusted during the EA process.

In accordance with the *Ontario Environmental Assessment Act*, the objectives of the EA are as follows:

1. Describe the environment potentially affected by the proposed undertaking, including both the existing environment as well as the environment that would otherwise be likely to exist in the future without the proposed undertaking;
2. Carry out an evaluation of the environmental effects of the proposed undertaking, using the environmental assessment criteria and studies that have been established through the development of the ToR;
3. Undertake an evaluation of any additional actions that may be necessary to prevent, change or mitigate environmental effects;
4. Provide a description and evaluation of the environmental advantages and disadvantages of the proposed undertaking, based on the net environmental effects that will result following mitigation; and
5. Prepare monitoring, contingency and impact management plans to mitigate the environmental effects of the proposed undertaking.

3 Study Areas

During the EA, existing conditions and potential effects will be considered in the context of two study areas: on-site and off-site. The general study areas proposed for the purposes of the EA are (**Figure 1**):

- On-site Study Area: the existing TCEC.
- Off-site Study Area: the lands within the vicinity of the TCEC extending approximately 1 km out from the On-site Study Area.

For Transportation, the general Off-site Study Area has been extended to include external study area intersections that will be used by facility vehicles to serve the local and broader areas based on known haul routes and typical origin-destinations for site traffic. Background information informing this decision was extracted from the report entitled *Twin Creeks Landfill Annual Fill Rate Increase Traffic Impact Study* (February 2017, HDR). Based on knowledge of the site operations, the primary haul routes are to and from Highway 402, with approximately 80% of site traffic going to the north to Highway 402 and the remainder of site traffic heading to the south towards Watford. The same traffic patterns are expected to continue in the future.

Critical intersections will be reviewed in detail, including data collection and analysis of traffic operations, as determined based on the magnitude of traffic and critical traffic movements. Study area intersections included in the Transportation scope of work include the following 5 locations which are consistent with the February 2017 Traffic Impact Study, and will be analyzed to assess traffic operations:

1. Highway 402 and Nauvoo Road Eastbound Off-ramp Terminal;
2. Highway 402 and Nauvoo Road Westbound Off-ramp Terminal;
3. Nauvoo Road and Confederation Line;
4. Nauvoo Road and Zion Line; and,
5. Primary facility access along Nauvoo Road.

The Highway 402 interchange includes two stop-control intersections, as well as free-flow ramps which would not be analyzed since there are no critical (controlled) movements. However, the free-flow on-ramps will be included within the analysis of collision history if there are documented collisions at these locations. The employee-only secondary access along Zion Line is generally closed to facility traffic and would not be included in the analysis, although it is acknowledged that it may be used under some conditions when the primary access on Nauvoo Road is inaccessible. Study area intersections are shown in **Figure 2**.

There are no changes or alternatives to the current haul route being proposed as part of the undertaking. Intersections at the interchanges with Kerwood Road or Forest Road will not be included since facility related traffic traveling through these interchanges will be free-flow and will not exit or enter Highway 402 via the interchanges.

Only local traffic arrives at the site from the south. The study area will also capture the southerly limits of Watford, approximately 280 metres south of Bond Street and collision

history will be requested and reviewed up to these southerly limits of the Town to confirm if facility truck traffic contributes to collisions within the Town.

4 Scope of Work

The scope of work for Transportation includes the development of evaluation criteria, indicators, and data sources, characterization of existing Transportation conditions, assessment of the potential environmental effects of the alternative methods and the preferred alternative, development of mitigation measures and monitoring programs, and reporting as outlined below.

4.1 Evaluation Criteria, Indicators, and Data Sources

The environmental assessment criteria, indicators, and data sources for the Transportation environment are provided in **Table 1**. The assessment criteria, indicators, and data sources will be used to assess the effects of the alternatives and the preferred alternative on the Transportation environment. These evaluation criteria and indicators will be finalized during the EA. The study will adhere to the MTO requirements for the preparation of Traffic Impact Studies. The site is located within the Township of Warwick, within Lambton County. Neither the Township nor the County have traffic impact study guidelines. However, the MTO requirements should result in an adequate scope of work for this study.

Table 1. Evaluation Criteria, Indicators, and Data Sources for Transportation

Criteria	Indicators	Data Sources
Traffic Operations	• Change in daily truck traffic volume and AADT along all study area road segments • Intersection performance – capacity, delay, queues (based on HCM 2010 and generated by Synchro 9) – for all study area intersections	• Turning Movement Count • Traffic Model
Road Safety Assessment	• Collisions per million vehicles at all study area intersections (severity, involving pedestrians, cyclists, autos, trucks, school buses, and agricultural vehicles) • Collisions per million vehicle-km along all study area road segments (severity, involving pedestrians, cyclists, autos, trucks, school buses, and agricultural vehicles) • Collisions by environmental conditions for segments and intersections • Sight distance at the primary access	• Collision History • Aerials • Land Survey • Stopping and Turning Sight Distance Review • Field inventory/investigation: Clear Zone, Conflicts, Visual Obstructions, Signage, Pavement Condition, Linework Condition

The following guidelines and standards will be referenced:

- General Guidelines for the Preparation of Traffic Impact Studies, Ministry of Transportation;
- Geometric Design Guide for Canadian Roads, Transportation Association of Canada;

- Geometric Design Standards for Ontario Highways, Ministry of Transportation of Ontario;
- Ontario Traffic Manuals, Ministry of Transportation of Ontario;
- Manual of Uniform Traffic Control Devices for Canada, Transportation Association of Canada;
- Roadside Safety Manual, Ministry of Transportation of Ontario;
- Highway Safety Manual, American Association of State Highway and Transportation Officials;
- Trip Generation, Institute of Transportation Engineers;
- Highway Capacity Manual, Transportation Research Board, National Research Council;
- Road design criteria for the Warwick Township and Lambton County; and
- Official Plans of the Warwick Township and Lambton County.

Secondary source data that will be referenced and will be supplemental to the primary data collected for the study, is as follows:

- Traffic data from MTO, Warwick Township, and Lambton County, and adjacent municipalities:
    - Existing and historical traffic counts (intersection turning movement counts and 24-hour automatic traffic recorder counts);
    - AADT, SADT, DHV data;
    - Vehicle classification data;
    - Traffic growth rates;
    - Traffic control signal timings; and
    - Trail crossings and use.
- To the extent that data and planning studies for the Township's Industrial Park area is available, it will be included in the background traffic forecasts.

Collision data from MTO, the Warwick Township, Lambton County and adjacent municipalities:

- Collision statistics / history along the haul route over the past five years;
- Detailed collision reports for collisions along the haul route over the past five years; and
- Typical collision rates within Warwick Township, Lambton County and adjacent municipalities.

Trip generation data from Waste Management:

- Existing land uses;
- Typical site-generated trip distribution and traffic patterns by season and day of week; and
- Weight scale Data (multiple years).

Studies and reports from MTO, the Warwick Township, Lambton County, and local municipalities:

- Traffic impact studies;
- Traffic planning studies;
- Pavement conditions studies;
- Official plans;
- Transportation and traffic master plans (provincial and municipal);
- Road needs studies;
- Environmental assessment studies for municipal roads and provincial highways;
- Development applications; and
- Safety reviews and corridor studies.

Base mapping and drawings from MTO, Lambton County and the Warwick Township:

- Topographic base mapping;
- Aerial photography; and
- Roadway design drawings.

Information from other agencies and organizations:

- School bus routes from the Lambton Kent District School Board;
- Data from local organizations such as trail, cycling or horse-riding clubs;
- Comments received via the consultation process.
- From MTO, information will be obtained on Emergency Detour Routes including the frequency of closures of Highway 402 as background information to the study.

Listed below is a description of the field data that will be collected. Following a review of air photography, site visits will be conducted to characterize the preferred haul routes and catalogue its characteristics and conditions, including:

- Horizontal and vertical alignment;
- Road cross-section travel way width;
- Roadside clear zone width;
- Road cross-section shoulder width and shoulder condition (paved, gravel, or partially paved);
- Intersection configurations and storage lane lengths;
- Rail crossings, including type (at-grade, overpass, underpass), crossing treatment, and number of tracks;
- Potential conflict points with trucks, pedestrians, cyclists, trail users and farm vehicles;
- Pavement structure conditions;
- Existing signs, signals, pavement markings and illumination;
- Residential and commercial driveways;

- Sensitive land uses along the route, including facilities where groups of people can gather, such as churches, schools, day care facilities, parks, hospitals, cemeteries, senior citizen centres, community centres, etc.;
- Turning and minimum sight distance / visibility deficiencies; and
- Length of route (km).

The existing traffic conditions will be established through the collection of current traffic data in the form of traffic data at study intersections as well most recent available weight scale data. Standard Turning Movement Counts (TMCs) will be commissioned at all external study intersections and will capture the volume of regular vehicles, medium size trucks, and large trucks, as well as pedestrian and cyclists volumes. The external study intersection TMCs will capture the following time periods:

- Weekday AM (7:00am to 9:00am);
- Weekday midday time period (11:00am to 2:00pm); and
- Weekday PM (4:00pm to 6:00pm).

Daily weight scale data will be requested for one full year of operation. The weight scale data is anticipated to include:

- Vehicle Arrival Time;
- Load Weight (kg); and,
- Vehicle Type.

The weight scale data will be used to identify monthly and daily variations by vehicle types.

Available bi-directional ATR (Automatic Traffic Recorder) count data will be used to identify external magnitude and classification of traffic volumes, and variations throughout the day, week, and year on the adjacent study roadways of Zion Line and Nauvoo Road. If necessary, the ATR data will be used to modify available TMC data according to the daily, weekly, and monthly trends.

The locations for the counts cannot be determined until all background information is gathered, because existing counts may be available. To the best extent possible, any traffic counts will be carried out such that the presence of the personnel and equipment does not itself influence the data or traffic behaviour. The dates and times for counts will be chosen to ensure a normal, representative traffic pattern during non-summer months. Seasonal variations based on average annual daily traffic (AADT) from adjacent roadways will be applied to the traffic data to ensure the data is representative of typical conditions and generally of higher volume months. The above peak time periods may be adjusted as necessary once the background data has been analyzed. Covid-19 impacts will be considered in the review of historical traffic data. Collection of current data may not be appropriate due to the changes to magnitude of traffic and traffic patterns resulting from Covid-19 and historical data may be relied upon and adjusted (using growth rates or other modifications to traffic volumes or count details) to develop representative traffic conditions without Covid-19 impacts, as appropriate.

4.2 Characterization of Existing Conditions

Both the weight scale data as well as the TMCs will be used in traffic operations software (Synchro and SimTraffic) to estimate queue lengths, delays, and volume-to-capacity ratios at study intersections, the primary site access, and at the weight scales. The analysis will be performed following the requirements of the MTO as well as using Highway Capacity Manual (2000) outputs. The established baseline conditions will be used as the basis of further forecasting and comparisons of alternatives. Weight scale operations will be emulated using Synchro and SimTraffic traffic operations analysis software and calibrated to reflect actual field observations and weight scale processing times. The traffic models will be used as the basis for the assessment of future conditions.

As previously mentioned, the traffic data may be adjusted using historical traffic data to develop a dataset of representative current year conditions without Covid-19 impacts. This representative traffic data will be developed through a review of historical traffic data, historical growth rates, and historical shifts in traffic patterns, to identify predominant trends independent of the Covid-19 pandemic.

A Road Safety Assessment will be performed. Collision history will be requested for Nauvoo Road and Zion Line in the vicinity of the site at intersections and midblock locations, inclusive of the study area intersections at Confederation Line and Highway 402, and extending southerly to the southern limits of the Town of Watford, approximately 280 metres south of Bond Street. The collision history will be reviewed to determine trends or patterns in collision severity and causes which may be used to identify locations of existing safety concerns of deficiencies in the network. The collision history review will include vulnerable user (truck-cyclists and truck-pedestrian) safety impacts. Pedestrian and vulnerable road user impacts will be assessed by correlating collision history rates with truck rates, and extrapolated to future conditions. The frequency and location of collisions involving vulnerable road users (pedestrians and cyclists) will be reviewed for potential causes and mitigation. If problem areas are identified based on collision rates being greater than the Provincial average or 'hotspots' within the study area, the data will undergo a more focused review to identify causes and mitigation.

A field inventory will be performed to determine the condition of existing pavement, painted lines, signage, and generally confirm the transportation environment and infrastructure within the study area (mode of control, lane configurations, posted speeds). Sightlines will be assessed for the site access in-field and substantiated with desktop reviews using available aerial imagery, surveys, and topographic surveys. The field investigation will identify obstructions within the clearway along Nauvoo Road and along Zion Line along the site frontage which is where truck traffic is anticipated based on existing and future haul routes.

Storage and turn lane requirements for traffic movements impacted by truck activity will be reviewed to confirm adherence to MTO Design Supplement for TAC Geometric Design Guide (GDG) for Canadian Roads – April 2020.

4.3 Assessment of Potential Environmental Effects

Using the evaluation criteria, indicators, rationale, and data sources from Section 4.1 and the characterization of existing conditions as described in Section 4.2, the assessment of potential environmental effects will be carried out as follows:

- predict the potential environmental effects for each alternative method (Section 4.3.1);
- identify the preferred alternative based on a comparative evaluation of the potential environmental effects of each alternative method (Section 4.3.2); and
- conduct an effects assessment on the preferred alternative, including the identification of mitigation measures and monitoring programs (Sections 4.3.3).

4.3.1 Evaluation of Alternative Methods

The potential effects of each alternative method will be identified based upon application of the proposed evaluation criteria, indicators and data sources as outlined in Section 4.1. Potential effects can be positive or negative, direct or indirect, and short or long-term. Mitigation measures will be identified to minimize or mitigate the potential effects and then the net effects are evaluated taking into consideration the application of mitigation measures.

For each potential alternative, the following indicators will be developed and compared to the existing conditions. Traffic operations will produce the following outputs for direct comparison of each option:

- Volume-to-Capacity (v/c) Ratios;
- Estimated 50^{th} and 95^{th} percentile queues at study intersections, the primary site driveway, and at the weight scales.

Other criteria and indicators established for existing conditions such as the safety related items including the collision history review and the sightline assessment will be used to guide the development of alternative options.

For internal site operations, the same measures of effectiveness will be used to evaluate alternatives to reduce queuing times and queue lengths. On-site observations will supplement the Synchro/SimTraffic model. Queuing will also be assessed using first principle approaches (spreadsheet methods) which will estimate queues based on dwell times, weigh-scale times, vehicle types and vehicle lengths.

Turn lane requirements, acceleration lane requirements (including the northbound acceleration lane at the site driveway on Nauvoo Road), and deceleration lane requirements at study intersections will be assessed based on Synchro operation as well as the MTO Design Supplement for TAC Geometric Design Guide (GDG) for Canadian Roads – April 2020.

Signal warrant analysis will be undertaken based on the OTM Book 12 Signal Warrants. Assessment of intersections under roundabout control will be tested using Arcady. Warrant criteria will be confirmed with review agencies.

The following horizon years are proposed for the transportation impact assessment:

- Existing (2022)

- Future Background/Total 2032 (10-year horizon)
- Future Background/Total 2043 (20-year horizon + 1 year to meet projected operating life)

4.3.2 Identification of the Preferred Alternative

The alternative methods will be comparatively assessed and evaluated using the proposed evaluation criteria, indicators, and data sources to determine the preferred alternative. The differences in the potential environmental effects remaining following the implementation of mitigation/management measures (i.e., net effects) will be used to identify and compare the advantages and disadvantages of each alternative method. The comparison of alternative methods will include a clear rationale for the selection of the preferred alternative.

4.3.3 Effects Assessment of the Preferred Alternative

Following the identification of the preferred alternative, an effects assessment will be carried out on the preferred alternative considering the same evaluation criteria, indicators, and data sources, and additional studies as required, considering possible mitigation and/or management measures and cumulative effects. The potential effects of the preferred alternative will be compared to the 'do nothing' alternative. The Do Nothing alternative only applies to analysis horizon years beyond 2032 since the existing facility is expected to operate until 2032. Beyond 2032, the Do Nothing will reflect removal of all site traffic and operations.

4.4 Reporting

A Traffic Impact Study report will be prepared for Transportation in support of the EA, including:

1. A characterization of Existing Conditions; and
2. The Effects Assessment.

This report will be appended to the EA Study Report and will be available for review during the EA. A summary of the existing conditions and effects assessment will be included in the EA Study Report.

The characterization of existing conditions will include details of completed field investigations, technical analyses, methods, results, maps of sensitive features within the On-site and Off-site Study Areas, conclusions, and recommendations.

Figures

Figure 1. General On-Site and Off-site Study Areas

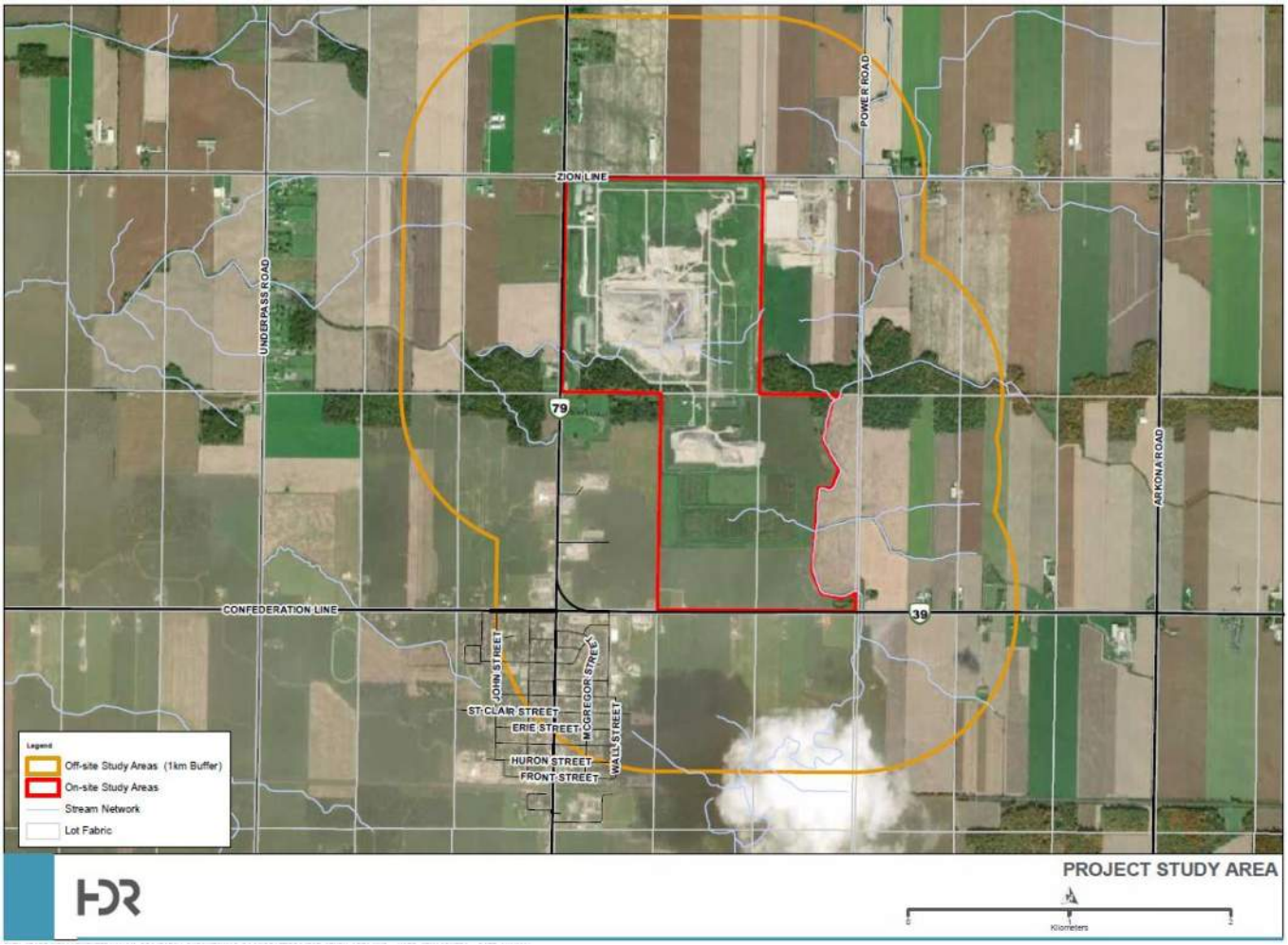


Figure 2. Transportation Study Area Intersections



Visual Landscape Work Plan

Twin Creeks Environmental Centre Landfill Optimization Project

Waste Management of Canada Corporation

Watford, Ontario

March 30, 2022

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Acronyms

Acronym	Definition
CEV	Combined Effect Value
EA	Environmental Assessment
MECP	Ministry of Environment, Conservation and Parks
TCEC	Twin Creeks Environmental Centre
ToR	Terms of Reference
VACF	Visual Absorption Capacity Factor
WM	Waste Management of Canada Corporation

1 Introduction

This Visual Landscape work plan has been prepared to support the environmental assessment (EA) for the Twin Creeks Environmental Centre Landfill Optimization Project (the Project) and will be appended to the Terms of Reference (ToR) for the EA to be submitted to the Ministry of Environment, Conservation and Parks (MECP) for approval.

The objective of the Visual Landscape assessment is to describe the potential changes in views from viewpoints (receptors) in the vicinity of the TCEC and assess the potential visual impact of the landfill optimization proposal. The process for conducting the Visual Landscape Assessment will include the characterization of the existing visual landscape conditions, the identification of receptors from which the proposed modifications to the TCEC might be visible, a description and assessment of the anticipated changes in views and a determination of the degree of potential change in the visual landscape. The assessment will enable a comparison between the existing condition and the anticipated visual landscape condition over the duration of the TCEC landfill optimization project.

Waste Management of Canada Corporation (WM), the owner and operator of the Twin Creeks Environmental Centre (TCEC) in Watford, Ontario, has initiated an EA seeking approval to increase the landfill airspace capacity at the TCEC. The TCEC has approximately 13.2M m^3 of remaining approved landfill airspace, which corresponds to about 10 years of operating life (2021 to 2031). This optimization project could provide additional airspace capacity of up to approximately 14M m^3, which could extend the site life by about 12 years (from 2031 to 2043). There would be no change to the current 301 ha site area, the approved service area, or the annual fill rate.

The TCEC is a regional facility that provides safe and convenient disposal services for communities, businesses and industries serving the Province of Ontario. The landfill is approved to receive municipal, industrial, commercial, and institutional solid non-hazardous wastes generated, including non-hazardous contaminated soil.

The TCEC is engineered with environmental protection systems that meet or exceed regulatory requirements and are subject to highly regulated monitoring and reporting requirements. Systems include engineered liners and covers, leachate collection and removal, landfill gas collection and control, and on-site leachate disposal through phytoremediation. The TCEC provides landfill gas, for heating, to the 40-acre greenhouse facility adjacent to the landfill property. Prior to this, all landfill gas was flared. The intent is for the landfill to supply gas for heating to the greenhouses for 25 years.

Leachate that is generated in the waste is conveyed toward a perimeter leachate collection system. WM received approval to treat leachate through a phytoremediation system consisting of a 9.3 ha poplar system planted on the existing landfill cap in 2003. Surplus leachate is trucked off-site to approved wastewater treatment plants.

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There is a need for the continued development of the TCEC as it is a significant component of the provincial waste management network and infrastructure, which is lacking in

sufficient and secure long-term disposal capacity. Optimizing the future development of the TCEC allows for on-going sustainable business operations and continued provision of essential financial support for community services and programs.

The purpose of the EA is to assess the potential effects of the proposed landfill optimization on the environment. The EA will be carried out in accordance with the requirements of the *Ontario Environmental Assessment Act*.

2 Study Purpose and Objectives

This Visual Landscape work plan outlines the tasks required to support the EA through the characterization of existing conditions and assessment of potential environmental effects of the project on the visual environment, including the evaluation of the various alternative methods and the identification and assessment of a preferred alternative. This work plan outlines the scope of the Visual Landscape work, including protocols and/or standards to be adhered to while the work is undertaken. The specific evaluation criteria, indicators, and data sources to be used and the study areas to be considered are provided below. These items may be adjusted during the EA process.

In accordance with the *Ontario Environmental Assessment Act*, the objectives of the EA are as follows:

1. Describe the environment potentially affected by the proposed undertaking, including both the existing environment as well as the environment that would otherwise be likely to exist in the future without the proposed undertaking;
2. Carry out an evaluation of the environmental effects of the proposed undertaking, using the environmental assessment criteria and studies that have been established through the development of the ToR;
3. Undertake an evaluation of any additional actions that may be necessary to prevent, change or mitigate environmental effects;
4. Provide a description and evaluation of the environmental advantages and disadvantages of the proposed undertaking, based on the net environmental effects that will result following mitigation; and
5. Prepare monitoring, contingency and impact management plans to mitigate the environmental effects of the proposed undertaking.

3 Study Areas

During the EA, existing conditions and potential effects will be considered in the context of two study areas: on-site and off-site. The general study areas proposed for the purposes of the EA are (**Figure 1**):

- On-site Study Area: the existing TCEC.
- Off-site Study Area: the lands within the vicinity of the TCEC extending approximately 1 km out from the On-site Study Area.

For the Visual Landscape discipline, the general Off-site Study Area will be extended beyond this defined 1.0 km distance based upon the sensitivity of the land use and the visual relationship between the land use and the TCEC.

4 Scope of Work

The scope of work for the Visual Landscape assessment includes the development of evaluation criteria, indicators, and data sources, characterization of existing Visual Landscape conditions, assessment of the potential environmental effects of the alternative methods and the preferred alternative, development of mitigation measures and monitoring programs, and reporting as outlined below.

4.1 Evaluation Criteria, Indicators, and Data Sources

The environmental assessment criteria, indicators, and data sources for the visual environment are provided in **Table 1**. The assessment criteria, indicators, and data sources will be used to assess the effects of the alternatives and the preferred alternative on the visual environment. These evaluation criteria and indicators will be finalized during the EA.

Table 1. Evaluation Criteria, Indicators, and Data Sources for Visual Landscape

Evaluation Criteria	Rationale	Indicators	Data Sources
Socio-Economic Environment			
Social			
Visual Impact of Facility	The contours of the waste disposal facility may affect the visual appeal of a landscape.	• Predicted changes in perceptions of landscapes and views.	• Site grading plans • Aerial mapping and field reconnaissance • Proposed facility characteristics • Existing landfill design and operations data • Regional topographic mapping • Results of other discipline assessments

4.2 Characterization of Existing Conditions

The following tasks will be completed to characterize the existing Visual Landscape conditions.

4.2.1 Background Data Collection

Relevant background information will be compiled including, but not limited to the following:

- Topographic base maps that illustrate the existing conditions;
- Aerial photography of the site and the vicinity;
- Natural heritage features inventory data and maps;

- Cultural heritage features inventory and mapping;
- Local and regional official plans and land use maps; and
- Data and background information from the original EA.

This data will be reviewed and summarized. A composite base plan will be prepared.

4.2.2 Field Data Collection

An initial visit to the site and the vicinity will be conducted during a period when the trees are in a defoliated condition to assess the visual landscape. The purpose of this initial site visit is to identify key visual receptors and to document the existing visual landscape condition utilizing photographs. Potential photographic inventory locations are illustrated in **Figure 2**. Actual photograph locations will be confirmed as a component at the field data collection exercise. Existing visual screening measures will be assessed including the types of vegetation, rate of survival and rate of growth in comparison with the original landscape plans. Receptors are locations where viewpoints to the TCEC are available and where there is a potential for a change in the visual landscape as a result of the implementation and/or operation of the landscape optimization project. Candidate receptors may include residences businesses, public amenities (such as parks and recreational facilities), cemeteries and other land uses that may be sensitive to changes in the visual environment.

Throughout the course of the study, additional field visits will be conducted to assess views throughout the various seasons. Views from receptors will be documented using photographs that are cross-referenced to a key plan.

The limits of the study area for the visual landscape will be confirmed in response to the findings of the field reconnaissance. This refined study area may extend beyond the defined 1.0 km Off-site Study Area based upon the sensitivity of the land use and its respective visual relationship with the facility.

4.2.3 Data Analysis

Potential receptors will be assessed and confirmed based on the following criteria.

A. Visible landfill area
B. Distance from the landfill optimization site within the TCEC
C. Horizontal angle of view
D. Visual Absorption Capacity Factor (VACF)

Based upon the values related to each of the above recorded for each potential receptor utilizing a scale ranging from 1 to 5, a combined effect evaluation will be calculated that will determine the Combined Effect Value (CEV) for each receptor. The CEV will determine the magnitude of the visual effect related to each receptor. The following **Table 2** sets out scale of the relative magnitude of visual effect based on the range of CEV values.

Table 2. Combined Effect Value Scale

Combined Effect Value Scale	Visual Effect
13 – 20	High Effect
9 – 12	Moderate Effect
4 - 8	Low Effect

The combined effect values will be applied to address the 'Visual Impact of Facility' evaluation criterion related to each receptor based upon the following:

- For receptors that are determined to experience a 'High Effect', the proposed landfill optimization project would demand the viewer's attention.
- For receptors that are determined to experience a 'Moderate Effect', the view of the landfill optimization project would be reduced in scale as a result of the following existing conditions:
    - Distance from the site.
    - Extent and location of existing screening elements, including woodlands, topography and/or existing buildings/structures. Although the landfill optimization area would be visible, it would not dominate views. Overall shapes, patterns and details would be discernable when viewed from the receptor.
- For receptors that are determined to experience a 'Low Effect', the proposed landfill optimization project would be expected to blend into the existing landscape and would not be identifiable when viewed from the receptor.

Existing available topographic maps, aerial photographs and ground-level photographs will be used to measure the visible landfill area, horizontal angle of view and distance from the landfill. AutoCAD Civil 3D software will be utilized to calculate the VACF by determining the topographic slope ranges. The VACF vegetation percent coverage factor will be determined using G.I.S. software and current or the aerial photography.

4.2.4 Summarization of Existing Conditions

The findings of the field data collection exercise will be combined with data analysis to identify the receptors and determine the anticipated sensitivity of each in comparison with the Visual Landscape Evaluation criterion.

4.3 Assessment of Potential Environmental Effects

Using the evaluation criteria, indicators, rationale, and data sources from Section 4.1 and the characterization of existing conditions as described in Section 4.2, the assessment of potential environmental effects will be carried out as follows:

- Predict the potential environmental effects for each alternative method (Section 4.3.1);
- Identify the preferred alternative based on a comparative evaluation of the potential environmental effects of each alternative method (Section 4.3.4); and
- Conduct an effects assessment on the preferred alternative, including the identification of mitigation measures and monitoring programs (Sections 4.3.5).

4.3.1 Evaluation of Alternative Methods

The potential effects of each alternative method will be identified based upon application of the proposed evaluation criteria, indicators and data sources as outlined in Section 4.1. Potential effects can be positive or negative, direct or indirect, and short or long-term. Mitigation measures will be identified to minimize or mitigate the potential effects and then the net effects are evaluated taking into consideration the application of mitigation measures.

The purpose of the assessment of potential effects is to provide a detailed analysis of visual exposure for the receptors that could potentially be impacted by the proposed landfill optimization initiative, including increased height, operational changes and post-closure conditions. The effects assessment methodology relies upon measurable data, resulting in a quantifiable outcome. The effects assessment methodology relies upon the data and parameters that have been utilized to characterize the existing conditions, supplementary by tasks that are required to define the visual characteristics of the proposed landfill optimization initiative. The methodology for understanding the effect assessment is described in the following sections.

4.3.1.1 Visual Characterization of the Proposed Landfill Optimization Project

A review of the design drawings, implementation plan and optimization strategy for the TCEC will be completed. This review will be focused on defining and assessing the elements of the proposed project that could potentially affect the visual landscape including the following:

- Alternative methods for vertical expansion;
- Staging/timing of the landfill operation; and,
- Operational implications including hours of operation, sequencing of restoration and revegetation.

This exercise will identify the components and characteristics of the project that could potentially have implications on views from the receptors that were identified in the process of characterizing the existing conditions. This exercise will also include a comparison of potential views between the currently permitted and approved landfill and the proposed landfill optimization project at full build-out.

4.3.1.2 Modelling of Proposed Landfill Optimization Project

Utilizing the design drawings and implementation plan, the topography of the proposed landfill optimization project will be generated for each stage of the project. The shape size and form of the optimized landfill area will be generated using AutoCAD Civil 3D software. This model will be utilized in the subsequent task to generate receptor-based visual impact values for the various stages of implementation of the landfill optimization project.

4.3.1.3 Generation of Receptor Based Visual Impact Values

For each receptor, the methodology that was applied to identify the receptors in the process of characterizing the existing condition will be utilized to determine visual impact values for each stage of implementation. This process will comprise the steps as outlined below.

A. Determination of Visible Landfill Area

The height and width of the landfill at each receptor point will be multiplied to obtain the potential landfill area that would be visible from each receptor. As the area of landfill that is exposed to view increase, the potential effect on the receptor increases.

The existing perimeter berming and screening as well as existing woodland areas and structures that perform a screening function will be taken into account in this calculation.

To account for the effect of diminishing scale over the distance, the landfill area determined for each receptor point will be divided by the distance of the receptor from the landfill (in metres). Diminishing scale refers to the phenomenon of an object's mass decreasing in size the farther it is fromthe viewer. Effect values for the perceived area that is visible are indicated in **Table 3**.

Table 3. Perceived Visible Area and Relative Effect Levels

Perceived Area Index	Effect Level	Value
>23.0	Very high	5
18.1 – 23.0	High	4
13.1 – 18.0	Moderate	3
7.51 – 13.0	Low	2
0 – 7.5	Very low	1

B. Distance to the Landfill Optimization Site

The distance to the landfill optimization site from each receptor will be measured in metres. As distance from the landfill increases, the potential visual effect decreases due to the effect of diminishing scale.

The distance in metres equates to a value scale which relates to the limits of foreground, middleground and background as defined by focal perception. The following **Table 4** illustrates the values associated with the distance ranges.

Table 4. Distance in Relation to Relative Effect Levels

Distance in Metres	Effect Level	Value
0 – 600	Very high	5
601 – 800	High	4
801 – 1500	Moderate	3
1501 – 2200	Low	2
2201 - 3500	Very low	1

C. Determination of Horizontal Angle of View

The horizontal angle of view is the measure of the unobstructed view angle from each receptor point to the proposed landfill optimization area. As the horizontal angle of view increases, potential effects increase. Horizontal angles of view are divided into the following ranges and will be assigned visual effect values as indicated in **Table 5**.

Table 5. Angle of View and Relative Effect Levels

Angle of View	Effect Level	Value
>90°	Very high	5
50° - 90°	High	4
31° - 50°	Moderate	3
16° - 30°	Low	2
0° - 15°	Very low	1

Visual research has concluded that the central region of human vision, the region with the greatest clarity or the 'visual cone of clarity', is 124 degrees. Therefore the visual effect ranges for the horizontal angle of view have been established so that the measured angles which are greater than approximately one half of the human visual cone of clarity are classified as having a high effect. Those angles which are greater than one quarter of the visual cone of clarity are defined as having a moderate effect level. The overall visual impact defined as a moderate effect level based upon the horizontal angle of view will be informed by the overall Combined Effect Value calculation.

D. Determination of Visual Absorption Capability Factor (VACF)

Surrounding landscape character is taken into consideration in the assessment. The Visual Absorption Capability is defined as the relative capacity of a landscape to absorb visual alterations and still maintain its visual integrity. VACF parameters include slope and vegetation cover. Existing vegetation and landform determine the extent to which the alternation to the landscape can be visually absorbed. To determine the VACF, the average slope of the land and percent of significant vegetative cover will be calculated based on an analysis utilizing aerial photography and topographic mapping in order to discern slope gradients and vegetation type and cover for each 500m x 500m grid square within the angle of view and a numerical value will be assigned in accordance with the scales that are set out in **Table 6** below.

Table 6. VACF Parameters

Factor	Range	Value	Description	Rationale
Slope	0 percent > 0-5 percent 6-20 percent > 20 percent	(0) (1) (2) (3)	Water Flat Rolling Rugged	No absorption Less absorptive More absorptive
Vegetation (percent coverage)	0 percent 1-10 percent 11-40 percent > 40 percent	(0) (1) (2) (3)	Open Sparse Moderate Dense	Less absorptive More absorptive

The two values for each grid square will be added together to yield the absorption capability value for that square.

The VACF value for each receptor point is the average of the visual absorption capability values for all grid squares within the horizontal viewing angle. The possible spread of averaged VACF values from one to six will be divided evenly into five ranges and will be assigned a visual effect value as set out in **Table 7**.

Table 7. VACF Values

Range	Description	Effect Level	Value
≤ 1.2	very low VACF	Very high	5
1.21 – 2.4	low VACF	High	4
2.41 – 3.6	moderate VACF	Moderate	3
3.61 – 4.8	high VACF	Low	2
4.81 – 6.0	very high VACF	Very low	1

E. Determination of Combined Effect Evaluation Scale

Effect values from the four aforementioned factors will be added together to obtain the combined visual effect value associated with each receptor point. **Table 8** sets out the scale of combined visual effect values accounts for the maximum range of value sums (4 through 20) and defines the moderate and low effect upper limits by multiplying their respective values (3,2) by the total number of factors (4).

Table 8. Combined Effect Values Scale

Combined Effect Value Scale	Visual Effect
13 – 20	High Effect
9 – 12	Moderate Effect
4 - 8	Low Effect

The combined effect values will be used to prepare the figures that will define the potential visual impact zones.

4.3.1.4 Documentation of Visual Effects Assessment

The calculations that will have been utilized to determine the visual effect for each receptor will be tabulated in a matrix format. The findings of the effects assessment will be documented using maps and photo-realistic simulations of potential views from the receptors that have been determined to be subject to High Visual Effect or Moderate Visual Effect. The matrices and illustrative figures will be generated to address each alternative option as well as each stage of implementation of the landfill optimization project.

The documentation materials will also address operational considerations.

4.3.2 Basis for Mitigation Measures

Options to mitigate adverse visual impacts will be explored with the objective of reducing the visual effect value at the receptors for which a 'High' or 'Moderate' effect value had been defined. Mitigation measures will be aimed at reducing the visual prominence of the landfill optimization project utilizing screening elements or other initiatives that will address the specific anticipated effects related to each alternative.

4.3.3 Basis for Monitoring Measures

Recommendations for monitoring will be made with the objective of determining the effectiveness of proposed visual impact mitigation initiatives. Recommendations will be provided to direct the implementation of additional mitigation, where feasible, to address adverse visual effects, as required.

4.3.4 Identification of the Preferred Alternative

The alternative methods will be comparatively assessed and evaluated using the proposed evaluation criteria, indicators, and data sources to determine the preferred alternative. The differences in the potential environmental effects remaining following the implementation of mitigation/management measures (i.e., net effects) will be used to identify and compare the advantages and disadvantages of each alternative method. The comparison of alternative methods will include a clear rationale for the selection of the preferred alternative.

4.3.5 Effects Assessment of the Preferred Alternative

Following the identification of the preferred alternative, an effects assessment will be carried out on the preferred alternative considering the same evaluation criteria, indicators, and data sources, and additional studies as required, considering possible mitigation and/or management measures and cumulative effects. The potential effects of the preferred alternative will be compared to the 'do nothing' alternative.

4.4 Reporting

Two separate reports will be prepared for Visual Landscape in support of the EA:

1. A report providing a characterization of Existing Conditions; and
2. A report providing the Effects Assessment.

These reports will be appended to the EA Study Report and will be available for review during the EA. A summary of the existing conditions and effects assessment will be included in the EA Study Report.

The characterization of existing conditions will include details of completed field investigations, technical analyses, methods, results, maps of sensitive features within the On-site and Off-site Study Areas, conclusions, and recommendations.

5 References

Baker Turner Inc.

2005 Warwick Landfill Expansion Project – Visual Impact Assessment Report

Province of British Columbia

2001 Visual Impact Assessment Guidebook – 2nd Edition

Smardon Palmer and Felleman

1986 Foundations for Visual Project Analysis

Figures

Figure 1. General On-site and Off-site Study Areas

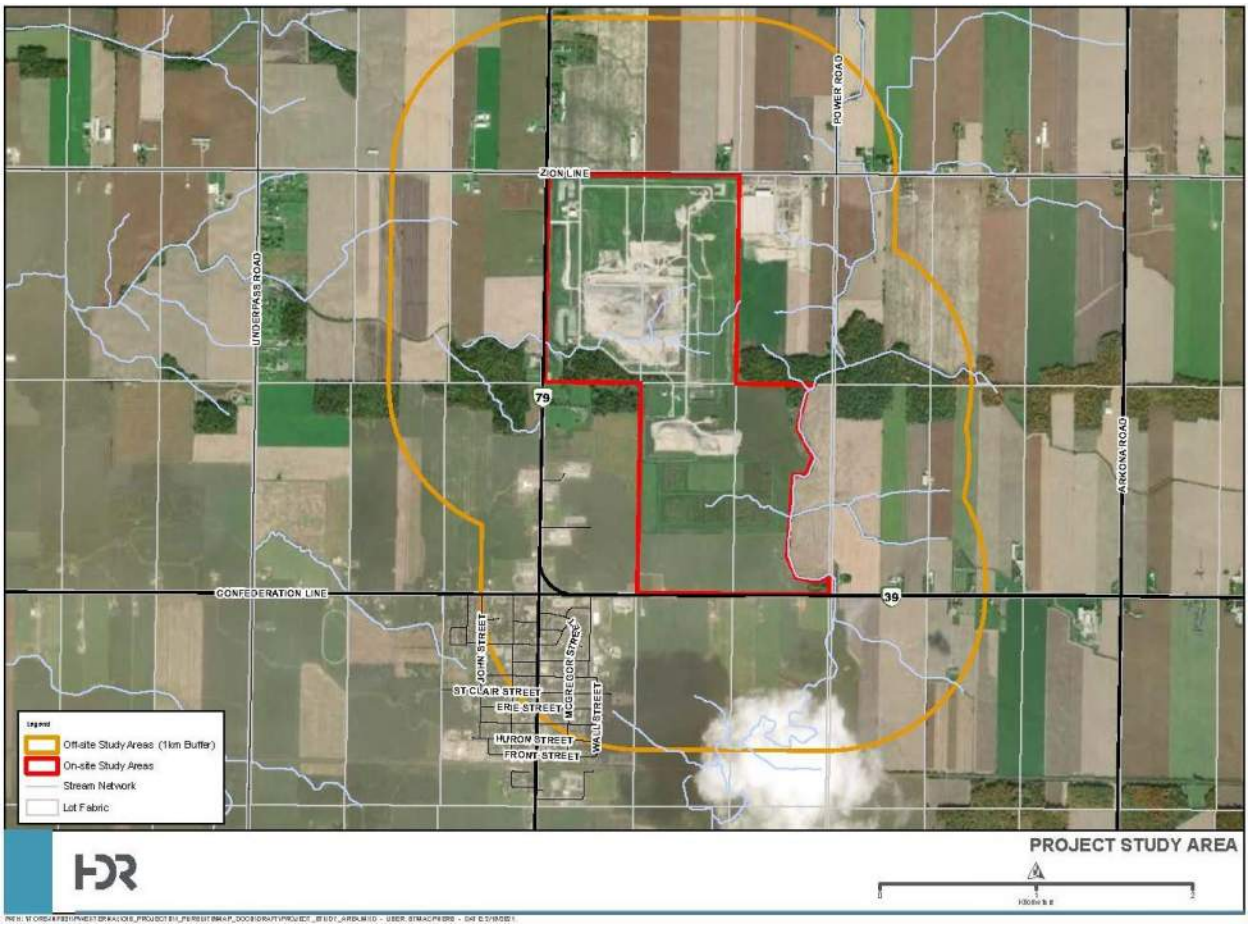
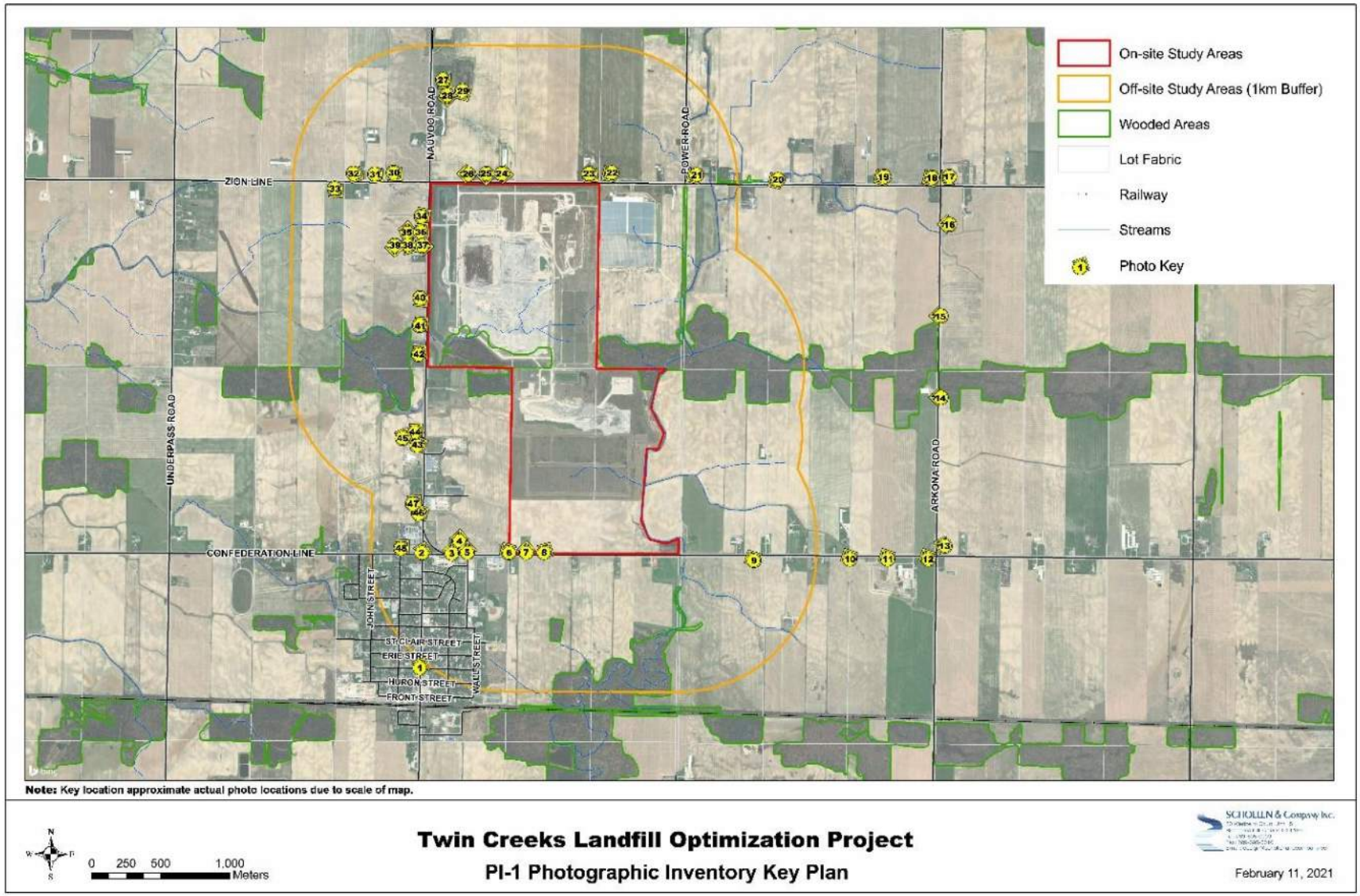


Figure 2. Potential Photographic Inventory Locations Key Plan



B

Terms of Reference Commitments Table

Table B-1. Terms of Reference Commitments Table

Commitment in Approved Terms of Reference	How was the Commitment Addressed	Where was the Commitment Addressed in the EA
The final description of the proposed undertaking and rationale for the Project will be confirmed during the Environmental Assessment (EA). *Section 3.1, page 4 of the Terms of Reference (ToR)*	A description of the purpose of the undertaking is provided in the EA Study Report. The undertaking will provide approximately 14.3 million cubic metres (m^3) of additional landfill disposal capacity which could extend the site life by approximately 12 years (from 2031 to 2043) within the existing 301 hectares (ha) Twin Creeks Environmental Centre (TCEC) site area. The rationale for undertaking is that there is a need for additional landfill capacity at the TCEC as it is a significant component of the provincial waste management network and infrastructure, and WM Canada (WM) is providing waste management services that support Ontario's climate change strategy and are consistent with provincial legislation.	• Section 3 – Overview of the Undertaking
The 'Do Nothing' alternative will be carried into the EA and considered against the preferred undertaking for assessing potential effects. *Section 3.1, page 4 of the ToR*	The 'Do Nothing' Alternative was considered as the existing conditions and future background conditions in the EA against which the effects were assessed along with the advantages and disadvantages of the Preferred Alternative.	• Section 6 – Net Effects of the Alternative Methods • Section 8 – Net Effects Assessment of the Preferred Alternative • Supporting Document 3 – Effects Assessment Reports
The ToR further identifies the 'alternative methods' that will be considered in the EA. These 'alternative methods' will be reviewed during the EA and modified if appropriate. Additional alternatives may be identified if warranted. *Section 3.1, page 5 of the ToR*	The alternative methods were further developed and refined during the EA and documented in a Conceptual Design Report. A geotechnical feasibility study was conducted for the alternative methods and is included as part of the Conceptual Design Report.	• Section 5 – Alternative Methods of Carrying Out the Undertaking • Supporting Document 2 – Conceptual Design Report

Commitment in Approved Terms of Reference	How was the Commitment Addressed	Where was the Commitment Addressed in the EA
If approved by the Minister of Environment, Conservation and Parks (the Minister), this ToR will provide the framework for preparing the EA Study Report. The ToR is not intended to present every detail of all the activities that will occur when preparing the EA. It is possible that, in carrying out the work described in this ToR, minor variations to methodologies may be necessary. These variations may include, but are not limited to: • modifications to the local study area to suit the requirements of each environmental component; • modifications to the alternatives, or identification of additional alternatives, considered; • modifications to studies or additional/expanded studies due to variations in the degree of environmental impact assumed at the time of preparation of this ToR or due to content and quality of information available; • modifications/refinements to the work plans for the technical studies; • modifications to the consultation and engagement plan; and • any other modifications required or available through changes to Acts or Regulations. These examples are not intended to be exhaustive; rather, they are meant to set out the types of changes that may be considered minor and that could be accommodated within the framework of the ToR. The Ministry of Environment, Conservation and Parks (MECP) will be consulted in the event of uncertainty as to whether a proposed change should be considered minor and accommodated within the approved ToR. *Section 3.2, page 5 of the ToR*	Modifications to the general study areas were required for some environmental components to appropriately assess the potential environmental effects of the future development. The conceptual designs of the alternative methods were developed as part of the EA to confirm feasibility, constructability and approvability under the *Environmental Protection Act*.	• Modifications to the study areas are described in Section 4 – Description of the Environment Potentially Affected. • The conceptual designs for the alternative methods are described in Section 5 – Alternative Methods of Carrying Out the Undertaking and in Supporting Document 2 – Conceptual Design Report

Commitment in Approved Terms of Reference	How was the Commitment Addressed	Where was the Commitment Addressed in the EA
Following approval of the ToR by the Minister, WM will prepare the EA in accordance with the requirements of the approved ToR and EAA and submit to the Minister for review and approval. The EA will include: • a description of the purpose of the undertaking, as described in Section 4 of this ToR; the rationale for the undertaking, as described in Section 5 of this ToR; a description of the undertaking based on the consideration of alternative methods, as described in Section 6 of this ToR; a description of the environment potentially affected by the undertaking (the description in Section 7 of the ToR will be expanded); an assessment of the alternative methods of carrying out the undertaking based on the method outlined in Section 8 of this ToR. WM intends to consider the alternatives described in Section 6 including: • a description of the effects that will be caused or that might reasonably be expected to be caused on the environment by the undertaking or the alternative methods; • a description of the mitigation measures that are necessary to prevent or reduce significant adverse effects on the environment; • an evaluation of the advantages and disadvantages to the environment as a result of the undertaking; and a description of the consultation and engagement process undertaken by WM for the EA following the plan described in Section 9 of this ToR. *Section 3.3, page 5 of the ToR*	The EA was prepared in a manner that includes the items listed, as well as the requirements in the approved ToR and the *Ontario Environmental Assessment Act*.	• Section 3 – Overview of the Undertaking • Section 4 – Description of the Environment Potentially Affected by the Undertaking • Section 5 – Alternative Methods of Carrying Out the Undertaking • Section 6 – Net Effects of the Alternative Methods • Section 7 – Comparative Evaluation of the Net Effects and Identification of the Preferred Alternative • Section 8 – Net Effects of the Preferred Alternative • Section 9 – Consultation and Engagement
The purpose of the undertaking may be refined during the EA process and will be included in the EA Study Report. *Section 4, page 6 of the ToR*	A description of the purpose of the undertaking is provided in the EA Study Report. The undertaking will provide approximately 14.3 million m³ of additional landfill disposal capacity which could extend the site life by approximately 12 years (from 2031 to 2043) within the existing 301 ha TCEC site area.	• Section 3 – Overview of the Undertaking

Commitment in Approved Terms of Reference	How was the Commitment Addressed	Where was the Commitment Addressed in the EA
The rationale for and description of the undertaking may evolve during the preparation of the EA and will be included in the EA Study Report. *Section 5, page 7 of the ToR*	A description of the purpose of and rationale for the undertaking is provided in the EA Study Report. The undertaking will provide approximately 14.3 million m³ of additional landfill disposal capacity which could extend the site life by approximately 12 years (from 2031 to 2043) within the existing 301 ha TCEC site area. The rationale for undertaking is that there is a need for additional landfill capacity at the TCEC as it is a significant component of the provincial waste management network and infrastructure, and WM is providing waste management services that support Ontario's climate change strategy and are consistent with provincial legislation.	• Section 3 – Overview of the Undertaking
In consideration of Policy 6.8 of the Food and Organic Waste Policy Statement, which directs that "proponents of new or expanded waste management systems for disposal should consider resource recovery opportunities for food and organic waste", WM will examine options for food and organic waste resource recovery and/or diversion opportunities as part of the EA. *Section 5.1.2, page 9 of the ToR*	WM has examined options for food and organic waste resource recovery and/or diversion opportunities for its municipal and IC&I customers in the context of the undertaking and the services provided by the company.	• Section 3 – Overview of the Undertaking
The "do nothing" alternative will be carried forward in the EA for comparison against the preferred undertaking to assess its potential effects on the existing environment. *Section 6.1, page 16 of the ToR*	The 'Do Nothing' alternative was considered as the existing conditions and future background conditions in the EA against which the effects were assessed along with the advantages and disadvantages of the Preferred Alternative.	• Section 6 – Net Effects of the Alternative Methods • Section 8 – Net Effects Assessment of the Preferred Alternative

Commitment in Approved Terms of Reference	How was the Commitment Addressed	Where was the Commitment Addressed in the EA
Based on a qualitative consideration of the potential vertical and horizontal expansion methods available within the site area, in addition to potentially locating waste in close proximity to the Village, the horizontal alternatives result in significant additional costs and do not optimize the use of the available and constructed infrastructure at the site to the extent possible. Given the financial, technological, and community risks and concerns associated with the horizontal alternative methods, WM has identified a preference for a vertical alternative method. A screening of the vertical and horizontal alternative methods will be carried out in the EA to confirm this conclusion. *Section 6.2, page 17 of the ToR*	A screening of one vertical and two horizontal alternative methods within the existing 301 ha TCEC site area was completed as part of the EA.	• Section 5 – Alternative Methods of Carrying Out the Undertaking
Based on the preference for a vertical alternative method, four preliminary vertical alternative methods have been identified which may be refined and confirmed, as appropriate, during the EA. The preliminary vertical alternative methods include the following modifications to the expansion landfill final contours: 4:1 side slopes to an elevation of 300 metres above sea level (masl), then 20:1 slope to a peak elevation of 304 masl; 3:1 side slopes to an elevation of 300 masl, then 20:1 slope to a peak elevation of 307 masl; 4:1 side slopes to a peak elevation of 320 masl; and 3:1 side slopes to an elevation of 320 masl, then 20:1 slope to a peak elevation of 324 masl. *Section 6.2, page 17 of the ToR*	The screening level comparison completed as part of the EA shows that the Vertical Alternative Method is preferred over the Horizontal Alternative Methods. The four (4) preliminary vertical Alternative Methods identified in the ToR were refined down to three (3) vertical Alternative Methods for the purposes of the EA.	• Section 5 – Alternative Methods of Carrying Out the Undertaking
The requirement for a more detailed geotechnical assessment for the assessment of the preferred alternative will be determined once it is identified. *Section 6.2, page 18 of the ToR*	An additional geotechnical feasibility assessment was conducted for the Preferred Alternative.	• Section 8 – Net Effects Assessment of the Preferred Alternative • Supporting Document 5 – Geotechnical Feasibility Review for the Preferred Alternative

Commitment in Approved Terms of Reference	How was the Commitment Addressed	Where was the Commitment Addressed in the EA
WM will qualitatively predict the effects for each alternative method on the environment. The assessment will be completed for each component based on the locations and conceptual designs for each alternative, including mitigation and the existing environmental conditions. *Section 6.2, page 18 of the ToR*	Existing environmental conditions were described, and the effects of the alternative methods were predicted and assessed as part of the EA and mitigation measures were identified as necessary.	• Section 4 – Description of the Environment Potentially Affected by the Undertaking • Section 6 – Net Effects of the Alternative Methods • Section 8 – Net Effects Assessment of the Preferred Alternative • Supporting Document 3 – Effects Assessment Reports
A more detailed description of the existing environmental conditions will be prepared as part of the EA. *Section 7, page 18 of the ToR*	Additional investigative studies were carried out to generate a more detailed description of the existing natural, cultural, socio-economic, and built environments for use in the assessment of the effects of the alternative methods for the Project during the EA.	• Section 4 – Description of the Environment Potentially Affected by the Undertaking • Supporting Document 1 – Existing Conditions Reports
The existing conditions will be used to assess the potential effects of the alternatives on the environment. The actual determination of the anticipated potential environmental effects of the undertaking, potential mitigation/management measures, and net effects [...] will be identified in the EA Study Report. *Section 7, page 18 of the ToR*	Additional investigative studies were carried out to generate a more detailed description of the existing natural, cultural, socio-economic, and built environments for use in the assessment of the effects of the alternative methods for the Project during the EA.	• Section 4 – Description of the Environment Potentially Affected by the Undertaking • Section 6 – Net Effects of the Alternative Methods • Section 7 – Comparative Evaluation of Net Effects and identification of the Preferred Alternative • Section 8 – Net Effects Assessment of the Preferred Alternative • Supporting Document 1 – Existing Conditions Reports • Supporting Document 3 – Effects Assessment Reports

Commitment in Approved Terms of Reference	How was the Commitment Addressed	Where was the Commitment Addressed in the EA
During the EA, existing conditions and potential effects will be considered in the context of two study areas: on-site and off-site. *Section 7, page 18 of the ToR*	The existing conditions and potential effects were considered in the context of On-site and Off-site Study Areas. Modifications to the general study areas were required for some environmental components to appropriately characterize existing conditions and assess the potential environmental effects of the future development.	• Section 4 – Description of the Environment Potentially Affected by the Undertaking • Section 6 – Net Effects of the Alternative Methods • Section 7 – Comparative Evaluation of Net Effects and identification of the Preferred Alternative • Section 8 – Net Effects Assessment of the Preferred Alternative • Supporting Document 1 – Existing Conditions Reports • Supporting Document 3 – Effects Assessment Reports
The EA Study Report will include more detailed descriptions of existing environmental conditions. The characterization of the existing environment for the EA will incorporate the results of past studies, field reconnaissance, additional baseline studies, and information from the data sources outlined in Appendix B [of the ToR], as applicable. *Section 7, page 18 of the ToR*	Additional investigative studies were carried out to generate a more detailed description of the existing natural, cultural, socio-economic, and built environments for use in the assessment of the effects of the alternative methods for the Project during the EA.	• Section 4 – Description of the Environment Potentially Affected by the Undertaking • Supporting Document 1 – Existing Conditions Reports
A review of existing reports, online resources, and wildlife atlases was undertaken to identify species that are reported from the study area. A total of 17 Species at Risk (SAR) and Species of Conservation Concern (SCC) have suitable habitat within the study area. Field work to be completed will confirm which species are present within the study area and may identify additional species. *Section 7.2.1.4, page 30 of the ToR*	Additional investigative studies were carried out to confirm the presence of SAR and SAR habitat within the study areas.	• Section 4 – Description of the Environment Potentially Affected by the Undertaking • Supporting Document 1-6 – Ecological Environment Existing Conditions Report

Commitment in Approved Terms of Reference	How was the Commitment Addressed	Where was the Commitment Addressed in the EA
The proposed method to be followed in the EA will be a qualitative comparison of the 'alternative methods' using criteria, indicators and data sources to identify the preferred alternative. An effects assessment will be carried out on the preferred alternative using the same criteria, indicators and data sources, and additional studies as required. *Section 8, page 37 of the ToR*	The potential effects of the alternative methods were predicted, and a comparative evaluation was conducted to identify the Preferred Alternative. An effects assessment was then carried out on the Preferred Alternative using the same criteria, indicators and data sources.	• Section 6 – Net Effects of the Alternative Methods • Section 7 – Comparative Evaluation of Net Effects and identification of the Preferred Alternative • Section 8 – Net Effects Assessment of the Preferred Alternative • Supporting Document 1 – Existing Conditions Reports • Supporting Document 3 – Effects Assessment Reports
The existing environment within the on-site and off-site study areas (Section 7.1) will be characterized in the EA Study Report. The characterization of the existing environment will address the five aspects of the environment as defined in the *Ontario Environmental Assessment Act* (*OEAA*), specifically: • natural environment; • built environment; • cultural environment; • social environment; and • economic environment. For the purposes of the EA, the social and economic environments have been combined into the socio-economic environment. *Section 8.1, page 37 of the ToR*	The existing conditions and potential effects were considered in the context of On-site and Off-site Study Areas for the five aspects of the environment as defined in the *OEAA*. For the purposes of the EA, the social and economic environments were combined into the socio-economic environment. Modifications to the general study areas were required for some environmental components to appropriately characterize existing conditions.	• Section 4 – Description of the Environment Potentially Affected by the Undertaking • Supporting Document 1 – Existing Conditions Reports
The potential environmental effects of the alternative methods will be qualitatively compared against the existing environmental conditions. *Section 8.1, page 38 of the ToR*	The potential effects of each alternative method were identified as part of the EA based upon application of the proposed evaluation criteria, indicators and data sources as outlined in Appendix B of the ToR. Potential effects were determined assuming the maximum allowable waste receipt level for the TCEC landfill. Mitigation measures were identified as appropriate.	• Section 6 – Net Effects of the Alternative Methods • Section 8 – Net Effects Assessment of the Preferred Alternative • Supporting Document 3 – Effects Assessment Reports

Commitment in Approved Terms of Reference	How was the Commitment Addressed	Where was the Commitment Addressed in the EA
Preliminary concepts for the potential vertical and horizontal expansion methods will be developed. A screening of the vertical and horizontal alternative methods will be carried out in the EA to confirm this conclusion. *Section 8.2, page 38 of the ToR*	A screening of one vertical and two horizontal alternative methods within the existing 301 ha TCEC site area was completed as part of the EA. The screening level comparison completed as part of the EA shows that the Vertical Alternative Method is preferred over the Horizontal Alternative Methods.	• Section 5 – Alternative Methods of Carrying Out the Undertaking
Based on the preference for a vertical alternative method, WM has preliminarily identified four vertical expansion alternative methods for the future development of the landfill [...]. The alternative methods will be described in further detail in the EA Study Report. *Section 8.2, page 38 of the ToR*	The four (4) preliminary vertical Alternative Methods identified in the ToR were refined down to three (3) vertical Alternative Methods for the purposes of the EA. The alternative methods were further developed and refined during the EA and documented in a Conceptual Design Report.	• Section 5 – Alternative Methods of Carrying Out the Undertaking • Supporting Document 2 – Conceptual Design Report
The description of the alternative methods will outline future leachate management requirements for the landfill. The long-term leachate management requirements will be described consistent with the approved Leachate Management Plan for the TCEC including a combination of on-site phytoremediation, trucking off-site to approved wastewater treatment plants and consideration of the future construction of an on-site treatment plant. *Section 8.2, page 38 of the ToR*	The alternative methods were further developed and refined during the EA and documented in a Conceptual Design Report. Leachate generation and management was identified for each alternative method as part of the EA.	• Section 5 – Alternative Methods of Carrying Out the Undertaking • Supporting Document 2 – Conceptual Design Report
The effects of climate change on the design approach and the effect of the conceptual design on climate change for the alternative methods will be included. *Section 8.2, page 38 of the ToR*	An effects assessment was conducted on the Preferred Alternative and included climate change considerations.	• Section 5 - Alternative Methods of Carrying Out the Undertaking • Section 6 – Net Effects of the Alternative Methods • Section 8 – Net Effects Assessment of the Preferred Alternative • Supporting Document 2 – Conceptual Design Report • Supporting Document 3 - Effects Assessment Reports

Commitment in Approved Terms of Reference	How was the Commitment Addressed	Where was the Commitment Addressed in the EA
The potential effects of each alternative method will be identified based upon application of the proposed evaluation criteria, indicators and data sources as outlined in Appendix B [of the ToR]. *Section 8.3, page 38 of the ToR*	The potential effects of each alternative method were identified as part of the EA based upon application of the proposed evaluation criteria, indicators and data sources as outlined in Appendix B of the ToR.	• Section 6 – Net Effects of the Alternative Methods • Section 8 – Net Effects Assessment of the Preferred Alternative • Supporting Document 3 – Effects Assessment Reports
The analysis of potential effects will be based on the maximum allowable waste receipt level for the landfill. *Section 8.3, page 38 of the ToR*	Potential effects were determined assuming the maximum allowable waste receipt level for the TCEC landfill.	• Section 6 – Net Effects of the Alternative Methods • Section 8 – Net Effects Assessment of the Preferred Alternative • Supporting Document 3 – Effects Assessment Reports
Actions necessary, or that may reasonably be expected to be necessary, to prevent or mitigate the potential effects will be identified, as appropriate. *Section 8.3, page 38 of the ToR*	Mitigation measures were identified as appropriate as part of the effects assessment in the EA.	• Section 6 – Net Effects of the Alternative Methods • Section 8 – Net Effects Assessment of the Preferred Alternative • Supporting Document 3 – Effects Assessment Reports
The alternative methods will be assessed in a qualitative comparative process to determine the preferred alternative, using the criteria and indicators provided in Appendix B. These evaluation criteria and indicators will be finalized during the EA. *Section 8.4, page 39 of the ToR*	A comparative evaluation of the net effects of the three alternative methods was conducted as part of the EA using the criteria and indicators provided in Appendix B of the ToR, which were finalized during the EA.	• Section 7 – Comparative Evaluation of Net Effects and Identification of the Preferred Alternative
The differences in net effects (the potential effect remaining following implementation of mitigation and/or management measures) will be used to identify and compare the advantages and disadvantages for each alternative. The comparison of alternatives will include a clear rationale for the selection of the preferred alternative. *Section 8.4, page 39 of the ToR*	As part of the comparative evaluation in the EA, the differences in the net effects were used to provide a clear rationale for the selection of the Preferred Alternative.	• Section 7 – Comparative Evaluation of Net Effects and Identification of the Preferred Alternative

Commitment in Approved Terms of Reference	How was the Commitment Addressed	Where was the Commitment Addressed in the EA
Following the identification of the preferred alternative, an effects assessment will be carried out on the preferred alternative considering the same criteria, indicators and data sources, and additional studies as required, considering possible mitigation and/or management measures and cumulative effects. *Section 8.5, page 39 of the ToR*	An effects assessment was conducted on the Preferred Alternative using the same criteria, indicators, etc. and consideration of mitigation measures. Additional studies were completed for geotechnical and solar exposure (shadowing). Cumulative effects were also considered.	• Section 8 – Net Effects Assessment of the Preferred Alternative • Supporting Document 5 – Geotechnical Feasibility Review for the Preferred Alternative • Supporting Document 6 – Solar Exposure Assessment
A human health assessment review will be completed for the preferred alternative based on the criteria and indicators provided in Appendix B and the work plan included in Appendix C [of the ToR]. *Section 8.5, page 39 of the ToR*	A human health assessment review was completed as part of the EA.	• Supporting Document 1-7 – Human Health Existing Conditions Report • Supporting Document 3-7 – Human Health Effects Assessment Report
The potential effects of the preferred alternative will be compared to the 'do nothing' alternative. *Section 8.5, page 39 of the ToR*	The potential effects of the Preferred Alternative were compared to the "do nothing" alternative using the same criteria, indicators, etc. and consideration of mitigation measures.	• Section 8 – Net Effects Assessment of the Preferred Alternative
The EA will also include a description of the preferred alternative's contribution to reducing greenhouse gas (GHG) emissions and climate change, and the potential effect of climate change on the preferred alternative. *Section 8.5, page 39 of the ToR*	Climate change considerations in the design of the alternative methods are provided in the EA and Conceptual Design Report. An effects assessment was conducted on the Preferred Alternative including cumulative effects as well as climate change considerations.	• Section 5 – Alternative Methods of Carrying Out the Undertaking • Supporting Document 2 – Conceptual Design Report • Section 8 – Net Effects Assessment of the Preferred Alternative
By consulting with interested people, WM will provide opportunities for input before decisions are made and then respond by making changes as appropriate. The input received through the EA consultation and engagement process will be considered in the preparation of the EA and studies, and how this input is incorporated into the EA will be documented. *Section 9.2, page 42 of the ToR*	Notices were distributed to participant groups via letters, email and newspaper advertisements at key stages of the EA process. Agencies, Indigenous communities and groups, and members of the public, including neighbouring property owners, were notified of the commencement of the EA, Public Information Sessions (PISs), and review periods of the Draft Existing Conditions Reports, Effects Assessment Reports and EA Study Report.	• Section 9 – Consultation and Engagement • Supporting Document 4 – Record of Consultation and Engagement

Commitment in Approved Terms of Reference	How was the Commitment Addressed	Where was the Commitment Addressed in the EA
Consultation and engagement will be undertaken at key points in the process, as well as on an on-going basis, through the following activities as conditions permit: • Notice of Commencement for the EA: by mail, email, newspapers, and on the project website, including details on the project, the EA process and contact information, as a minimum. *Section 9.2, page 42 of the ToR*	The Notice of Commencement for the EA was provided by mail, email, published in local newspaper, and provided on the project website.	• Section 9 – Consultation and Engagement • Supporting Document 4 – Record of Consultation and Engagement
• Notification: notification will be provided by direct mail, email, newspapers (digital and/or print), and via the project website at key milestones during the EA. Key milestones may include the Notice of Commencement of EA, Existing Conditions/Alternative Methods, Identification of the Preferred Alternative, Draft EA Study Report review, and submission of the Final EA Study Report to the MECP. WM will provide notification by direct mail to all addresses within the local postal code surrounding the TCEC (e.g., through Canada Post neighbourhood mail or similar). *Section 9.2, page 42 of the ToR*	Notices were distributed to participant groups via letters, email and newspaper advertisements at key stages of the EA process. Agencies, Indigenous communities and groups, and members of the public, including neighbouring property owners, were notified of the commencement of the EA, PISs, and review periods of the Draft Existing Conditions Reports, Effects Assessment Reports and EA Study Report.	• Section 9 – Consultation and Engagement • Supporting Document 4 – Record of Consultation and Engagement
• Public Open House(s): likely in the form of Virtual Consultation and Engagement Event(s) due to the COVID-19 pandemic, to present the 'alternative methods', a description of the existing environmental conditions, the comparative evaluation criteria, the results of the assessment and comparative evaluation of the alternative methods, and the identification of the preferred alternative. The format of the Public Open House(s) will be determined based on social gathering restrictions due to the pandemic. *Section 9.2, page 42 of the ToR*	Four PISs were held in-person during the EA. PIS 1 covered the Project's purpose and need, alternatives considered, and the EA process and planned consultation. PIS 2 presented the three representative Alternative Methods and their screening, the approved Evaluation Criteria, and related Existing Conditions Reports. PIS 3 focused on the results of the Effects Assessment Reports and comparative evaluation to identify a Preferred Alternative. PIS 4 is planned to present the Preferred Alternative and cumulative effects and present an overview of the Draft EA Study Report.	• Section 9 – Consultation and Engagement • Supporting Document 4 – Record of Consultation and Engagement

Commitment in Approved Terms of Reference	How was the Commitment Addressed	Where was the Commitment Addressed in the EA
• Meetings/Tours: if possible, depending on social gathering restrictions due to the pandemic. *Section 9.2, page 42 of the ToR*	Eight site tours at the TCEC were held between September 2023 and September 2025.	• Section 9 – Consultation and Engagement, Section 9.3.7 • Supporting Document 4 – Record of Consultation and Engagement
• Consultation and Engagement Report: summarizing the results of the open house(s) as well as comments received via fax, email, or post will be prepared, including a record of comments and responses. *Section 9.2, page 43 of the ToR*	PIS Summary Reports were prepared following each PIS and made available on the project website. In addition, the EA Study Report includes a Record of Consultation and Engagement, which provides details of the consultation and engagement and comments/responses received during the EA.	• Supporting Document 4 – Record of Consultation and Engagement • Supporting Document 4 – Record of Consultation and Engagement
• Website: established by WM during the development of the Draft ToR, the project website will be maintained during the EA to provide information, inform the public of consultation and engagement events, and provide a means for feedback. *Section 9.2, page 43 of the ToR*	A Project specific website (https://www.wm.com/ca/en/twin-creeks-landfill/landfill-optimization-project) was launched as part of the commencement of the ToR and maintained during the EA process.	• Section 9 – Consultation and Engagement • Supporting Document 4 – Record of Consultation and Engagement
• Contact Person: provided for a WM staff member to receive enquiries from interested parties for information and submit comments. *Section 9.2, page 43 of the ToR*	A WM staff contact person was established to receive comments and questions from participants.	• Section 9 – Consultation and Engagement • Supporting Document 4 – Record of Consultation and Engagement
• Draft EA Study Report: provided to the public, agencies, and Indigenous communities who have submitted comments on the ToR and/or wish to receive a copy. Written comments on the draft report will be requested within 45 days of its submission to the MECP. Notice of the draft report availability will be provided by newspaper notice, mail, email, and on the project website. *Section 9.2, page 43 of the ToR*	The Draft EA Study Report is currently being distributed for review. Notice of the draft report availability has been provided by newspaper notice, mail, email, and on the project website. Comments are being requested within an extended time period of over 70 days.	• Section 9 – Consultation and Engagement

Commitment in Approved Terms of Reference	How was the Commitment Addressed	Where was the Commitment Addressed in the EA
• Final EA Study Report: provided to the public, agencies and Indigenous communities who have submitted comments on the Draft EA and/or wish to receive a copy. Notice of the final report availability will be provided by newspaper notice, mail, email, and on the project website. *Section 9.2, page 43 of the ToR*	The Final EA Study Report will be provided along with the required notice.	• Section 9 – Consultation and Engagement
A Record of Consultation and Engagement will be prepared as part of the EA which will include information about the EA consultation program, including copies of correspondence from and to the Proponent, information about and received at the public open houses and copies of comments, questions, issues, and concerns from stakeholders and members of the public, and how those questions, issues, and concerns were addressed. Comments received during the preparation of the EA will be recorded and tabulated. A response will be provided to each comment indicating how it has been addressed in the EA, as appropriate *Section 9.2, page 43 of the ToR*	A Record of Consultation and Engagement has been prepared and a description of the consultation and engagement program carried out during the EA is provided in the EA Study Report.	• Supporting Document 4 – Record of Consultation and Engagement
In accordance with Section 6.1(2)(e) of the EAA, a description of the consultation and engagement program carried out by WM during the EA, along with the results of the consultation and engagement, will be documented in the EA Study Report. *Section 9.2, page 43 of the ToR*	A Record of Consultation and Engagement has been prepared and a description of the consultation and engagement program carried out during the EA is provided in the EA Study Report.	• Section 9 – Consultation and Engagement • Supporting Document 4 – Record of Consultation and Engagement

Commitment in Approved Terms of Reference	How was the Commitment Addressed	Where was the Commitment Addressed in the EA
The list of potentially-affected Indigenous communities was developed in consultation with the MECP. The MECP identified the following Indigenous communities for engagement: • Aamjiwnaang First Nation; • Walpole Island First Nation – Bkejwanong Territory; • Caldwell First Nation; • Chippewas of Kettle and Stony Point First Nation; • Chippewas of the Thames First Nation; • Delaware Nation at Moraviantown; • Munsee Delaware Nation; • Oneida Nation of the Thames; • Métis Nation of Ontario – Windsor-Essex Métis Council; and • Métis Nation of Ontario – Lands, Resources & Consultations Branch. During the EA, WM will continue to engage with these Indigenous communities and organizations in a manner consistent with any requests that might be received from each community. WM is committed to working with these Indigenous communities and organizations to address any comments or concerns they may have. This includes providing any specific engagement activities, such as meetings, at the request of the community. WM will provide written notification to the Indigenous communities and organizations consistent with the consultation and engagement program for the EA. *Section 9.3, page 43 of the ToR*	During the EA, WM continued to engage with the Indigenous communities and organizations identified in the approved ToR. No additional Indigenous communities and organizations were identified with a potential interest in the project. Written notification was provided for each PIS and for the Draft EA Study Report review.	• Section 9 – Consultation and Engagement • Supporting Document 4 – Record of Consultation and Engagement
The EA will contain a list of commitments made by WM during the ToR process and indicate how such commitments have been addressed in the EA. *Section 10, page 44 of the ToR*	A list of commitments made by WM during the ToR process has been developed along with a description of how the commitments have been addressed in the EA.	• Appendix B – Terms of Reference Commitments Table

Commitment in Approved Terms of Reference	How was the Commitment Addressed	Where was the Commitment Addressed in the EA
A list of commitments made by WM during the preparation of the EA will also be included in the EA along with a framework for monitoring when and how all commitments will be fulfilled. *Section 10, page 44 of the ToR*	A list of commitments made by WM during the ToR process has been developed along with a description of how the commitments have been addressed in the EA. A list of commitments made during the preparation of the EA is included in the EA Study Report.	• Appendix B – Terms of Reference Commitments Table • Section 10 – Monitoring and Commitments for the Undertaking
A strategy and schedule for compliance and effects monitoring will be developed and included in the EA. The monitoring plan will consider all relevant project phases: planning, detailed design, tendering, construction, establishment, and post-establishment. *Section 10, page 44 of the ToR*	A list of commitments made during the preparation of the EA is included in the EA Study Report. Commitments for monitoring and the schedule for monitoring compliance are also included in the EA Study Report.	• Section 10 – Monitoring and Commitments for the Undertaking
For the purposes of preparing this ToR, flexibility is defined to include a minor variation or modification to the ToR itself, such as a change in consultation and engagement methods, existing conditions study methods, effects assessment methods, and to allow for refinement to things such as study areas, environmental criteria, indicators, and data sources. Therefore, the ToR has not established detailed existing conditions or a full suite of potential effects of the undertaking, for example; these will be determined during the EA and presented in the EA Study Report. It is noted that proposed minor modifications to the ToR will be discussed with the MECP prior to proceeding with the changes. *Section 11, page 45 of the ToR*	The requirement for environmental effects monitoring has been identified and is listed in the EA Study Report.	• Section 10 – Monitoring and Commitments for the Undertaking
A list of the specific approvals required for the proposed undertaking will be provided in the EA. *Section 12, page 45 of the ToR*	A list of approvals required for the proposed undertaking is provided in the EA Study Report.	• Section 11 – Approvals