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Volume 1

Environmental Assessment of the Township of North Dundas Waste Management Plan

GOLDER
MEMBER OF WSP

TOWNSHIP OF
North Dundas

Executive Summary

Introduction

This document is the environmental assessment study report (EA Study Report or EASR) for the environmental assessment (EA) of the Township of North Dundas Waste Management Plan (the EA Study) being undertaken by the Township of North Dundas (the Township). This is an individual EA completed under the provincial *Environmental Assessment Act* (EAA).

The proposed EA Study is the EA of the Township's waste management plan for a 25 year planning period.

The Township of North Dundas is the proponent for the proposed EA Study. The Township is located in eastern Ontario about 40 kilometres (km) south of Ottawa within the United Counties of Stormont, Dundas and Glengarry.

The Township, through its Waste Management department, currently provides curbside waste collection and disposal services to its ratepayers for residential and some institutional, commercial and industrial waste. It also provides waste diversion services, including recyclable materials, tire recycling, as well as the collection of household hazardous waste (HHW) and Waste Electrical and Electronic Equipment (WEEE). The Township's diversion rate in 2017 and 2018 was approximately 23 percent and similar in 2019 and 2020.The material recycling facility, the HHW and WEEE transfer station as well as the waste disposal facility are located at the Township's Boyne Road Landfill site.

The Boyne Road Landfill is located on Lot 8, Concession VI in the former Township of Winchester, along the south side of Boyne Road about 2 km east of the Village of Winchester, which is approximately mid-way between the two main population centres within the Township – the Villages of Winchester and Chesterville. The service area for the landfill is the Township of North Dundas. The site has been operating as a licensed landfill for the disposal of solid, non-hazardous waste since 1965, and is the only operational waste disposal site in the Township and receives all the residential and some of the IC&I waste from the entire Township. The landfill site is estimated to have approved disposal capacity to operate through 2023 and into 2024.

The Boyne Road Landfill operates under Environmental Compliance Approval (ECA) No. A482101 and currently has an approved disposal area of 8.1 hectares (ha). The land area that comprises the landfill property consists of the original disposal area and the addition of parcels of adjoining land, corresponding to a total land area of approximately 97.13 ha. In addition to the landfill property, the Township has acquired groundwater easements, referred to as Contamination Attenuation Zones (CAZs).

Operation of the landfill site, including its diversion facilities, is carried out by the Township in accordance with the requirements of its ECA conditions. The existing landfill site is a natural attenuation landfill, without an engineered bottom liner and leachate collection system. Compliance of the landfill with the applicable requirements for protection of off-site groundwater quality relies on natural processes in the subsurface. The results of the landfill monitoring programs show that the Boyne Road Landfill is performing acceptably and the impacts on the natural environment are deemed acceptable.

Additional detail on the site history, design, operations and performance is provided in Sections 1.3 and 2.1 of the EASR.

Overview of the Environmental Assessment Process and Environmental Assessment Study Report

In 2014/2015, the Township undertook an evaluation of long-term waste management alternatives. Using an assumed planning period of 25 years, the evaluation considered four alternatives: landfill site closure and waste export, landfill site expansion, a new landfill site and alternative waste technologies. The result of that comparative evaluation was that expansion of the existing Boyne Road Landfill was identified as the preferred long-term waste management alternative. Based on the findings of this evaluation, a Council resolution was passed in November 2015 to pursue approval to expand the landfill site via an Environmental Assessment pursuant to the Ontario *Environmental Assessment Act* (EAA).

When the Environmental Assessment commenced in late February 2017, the EA was for the expansion of the Boyne Road Landfill site. Based on comments received on the Proposed Terms of Reference (ToR) from the MECP in December 2018, it was determined that the scope of the EA should be modified to review and re-assess the waste management alternatives that are reasonable for the Township to consider within the EA process and identify the preferred alternative. To reflect this revised approach, the title of the EA Study was changed to Environmental Assessment of the Township of North Dundas Waste Management Plan.

The purpose of the proposed EA Study has been reviewed since approval of the ToR and is confirmed as:

To provide environmentally safe and cost-effective long-term waste management for the Township of North Dundas for a 25 year planning period.

The Township prepared the ToR for the EA of the Township Waste Management Plan and it was approved by the MECP on July 1, 2020.

This EASR is presented in four volumes. Volume 1 (this volume) describes the EA studies, consultation results, effects assessment of alternatives, identification of the preferred alternative and effects assessment of the preferred alternative.

Volume 2 contains the approved ToR and Technical Appendices to this EA.

Volume 3 contains supporting documents to this EA, consisting of the New Landfill Site Selection Assessment and the Waste Diversion Study.

Volume 4 contains the Consultation Record for this EA.

Methodology for the Assessment

The EA was carried out in accordance with the approach described in the approved Amended ToR, which was approved on July 1, 2020. The EA was undertaken in a series of fourteen steps as described below. Additional details about each step are further described in Section 3.0 of this EASR. Consultation with the public, Indigenous communities, GRT members, and other stakeholders was ongoing throughout the EA process.

1. Identify Study Areas and Characterize Existing Environmental Conditions of the Waste Management Plan Study Area
2. Confirm 'Alternatives To' and Evaluation of 'Alternatives To'
3. Update the Waste Diversion and Residual Waste Requirements
4. Characterize Study Areas and Prepare Environmental Component Work Plans and Comparative Evaluation Criteria for the Preferred 'Alternative To' – Landfill Site Expansion
5. Characterize the Existing Environmental Conditions for the Preferred 'Alternative To'
6. Identify and Develop 'Alternative Methods' of Landfill Expansion
7. Comparison and Evaluation of 'Alternative Methods' and Identification of Preferred Alternative
8. Describe the Preferred 'Alternative Method' of Landfill Expansion
9. Refine the Mitigation Measures and Determine the Net Effects of the Preferred Alternative
10. Consideration of Climate Change
11. Cumulative Impact Assessment
12. Develop Monitoring and Contingency Plans
13. Summarize Commitments
14. Preparation of the EA Study Report

Consultation Methods and Activities

The consultation program for the EA was carried out in accordance with the approved ToR. The results of the program and supporting documents are contained in Section 4 of Volume 1 and Volume 4 - Consultation Record, respectively.

Prior to commencing the ToR, the Township of North Dundas developed a Consultation Plan to support the development of the approved Amended ToR as well as support the EA process. This plan was updated prior to and during the EA. Consultation with the public, agencies, Indigenous Communities and other stakeholders was ongoing throughout the EA process.

The consultation activities carried out during the EA consisted of:

- Letter and email correspondence distributed to the public, interested stakeholders, GRT, and Indigenous communities
- Notices published in local newspapers
- Notices published on the EA website (https://www.northdundas.com/municipal-services/environmental-assessments)

- Three technical bulletins summarizing results at key milestones in the EA (Diversion Study Results; 'Alternatives To' Assessment; 'Alternative Methods' Assessment)
- An in-person and virtual Open House for the local community to present the results and conclusions of the EA
- Meetings and telephone calls between the Township, the EA consultants, and the MECP
- Meeting with the Huron-Wendat Nation
- Informal meetings, telephone calls and discussions with neighbours to the existing Boyne Road Landfill on an as needed basis throughout the EA
- The Draft EASR was made available for the GRT, Indigenous communities and public for comment for a four week review period prior to finalization and submission to the MECP.

A complete list of issues and concerns raised and responses was compiled and is included in Volume 4 – Consultation Record; a summary of these issues, responses and how each was addressed in the EA is provided in Section 4.8 of the EASR. The input received during various consultation events was carefully considered and incorporated into the EA, where applicable. The following are some of the questions and concerns raised during the EA process:

- The types of archaeological studies anticipated during the EA
- Guidance from Ministry of Heritage, Sport, Tourism and Cultural Industries (MHSTCI) regarding archaeology and cultural heritage studies
- The remaining capacity at the Boyne Road Landfill site and whether it will be sufficient until such time that the expansion is approved
- Whether the proposed landfill expansion includes waste from beyond North Dundas
- Consideration of projected population growth in the Township in view of the recent increase in demand for water and sewage services in the serviced villages
- Clarification on the rationale for selection of expansion of the Boyne Road Landfill as the preferred 'Alternative To'
- Was consideration given to establishing a new landfill on the north side of Boyne Road opposite the existing site.
- Consider allowance for an archaeology monitor periodically during expansion construction activities involving excavation.
- [Comments received on the Draft EASR to be added for the final EASR]

As part of this EA, a Stage 1 Archaeology Assessment was completed, and a Stage 1 Archaeology Assessment Report was prepared. As established in the ToR stage for this project, the Huron-Wendat Nation identified an interest in the archaeological studies at the Boyne Road Landfill site. The results of the studies along with the Stage 1 Archaeology Assessment Report were shared with the Huron-Wendat Nation, as well as the Algonquins of Ontario and the Mohawks of Akwesasne. The Huron-Wendat Nation and the Mohawks of Akwesasne indicated they had no further questions or comments about the Stage 1 Archaeology Assessment Report.

Also, detailed work plans for select environmental components (atmosphere, biology, groundwater, and surface water) were provided to the MECP, MNRF and conservation authorities for review and comment.

Waste Management Plan Study Area and Existing Conditions

The overall waste management plan Study Area is the whole of the Township of North Dundas. The Township was formed in 1998 by the amalgamation of the former Townships of Winchester and Mountain, as well as the Villages of Winchester and Chesterville. The Township is located south of the City of Ottawa, within the United Counties of Stormont, Dundas and Glengarry. The total land area comprising the Township is 503.2 km^2. The 2016 population was 11,278; approximately one-third of the population is within Winchester and Chesterville, with the remainder located in several smaller communities and spread across this largely rural municipality.

Section 5.0 of the EASR provides a description of the existing natural, social, economic, cultural and built environment that may be affected by the waste management plan. The components include atmosphere (air quality and noise), geology and hydrogeology, surface water, biology, land use planning and agriculture (population projections, labour force characteristics and activities, agriculture), cultural heritage resources (archaeology, built heritage resources and cultural heritage landscapes), socio-economic (population and labour, municipal finances and economic development trends and plans) and transportation.

The existing conditions relevant to the 'Alternatives To' assessment are detailed for each component in Sections 5.2 to 5.9 of the EASR.

Assessment of 'Alternatives To' the Undertaking

Description of and Rationale for 'Alternatives To'

The Township developed a reasonable range of 'Alternatives To' the undertaking. For the Township, the 'Alternatives To' are fundamentally different approaches for long term waste management in the Township. Previously, four waste management alternatives were proposed for the Township in the 2015 Waste Management Alternatives Evaluation. Two additional alternatives were added in this Environmental Assessment compared to the preliminary 2015 Waste Management Alternatives Evaluation. The comparative assessment of these 'Alternatives To' identifies the preferred waste management alternative.

Environmental Components, Criteria and Indicators for 'Alternatives To'

A broad set of criteria, together with rationale, indicators and data sources, were developed for comparative evaluation of the 'Alternatives To'. These were presented in the ToR and refined during the EA and are summarized in Table 6-1 of the EASR. These evaluation criteria cover the components that comprise the natural, social, economic, cultural and built environment as listed in Section 5.0 above; another component - technical considerations - was added to the list of components to be evaluated in the 'Alternatives To' assessment.

Identification and Feasibility of 'Alternatives To'

The 'Alternatives To' available to the Township consist of the following:

- Alternative 1 - Existing Landfill Site Closure and Export Waste for Disposal. Under Alternative 1, the Boyne Road Landfill would be closed. The Township would likely continue to operate waste diversion activities at the landfill site or elsewhere, and the remaining waste would be exported to an appropriately licensed landfill in Eastern Ontario for disposal.
- Alternative 2 - Landfill Site Expansion. Under Alternative 2, the process to obtain approval for an increase in the disposal capacity of the Boyne Road Landfill would be undertaken so that waste disposal would continue at this location under the ownership of the Township. An envelope that could be used to accommodate an estimated 400,000 m^3 of additional landfill airspace would be required.
- Alternative 3 - Existing Landfill Site Closure and Establish New Landfill Site in the Township. Under Alternative 3, the Township evaluated the potential to establish a disposal site at a new location within the municipality (for details, refer to Volume 3, Appendix I). This involved a screening approach using a set of general exclusionary criteria that are typically used for landfill siting, together with published information to screen out areas of the Township that are not suitable and cannot be considered for a new landfill site. Areas surviving this screening represent potential locations for siting a new landfill. A preliminary total land area required for development of a landfill having a new airspace of approximately 400,000 m^3 and following the requirements of *O.Reg.* 232/98 was determined, and the size of the potential locations assessed to determine whether they are large enough. The results of the screening exercise revealed few potential areas large enough or in accordance with the land use policies set by the Township for use as a new waste management facility site. Of the screened potential areas, the most preferred area was the parcel of land containing the existing active Boyne Road Landfill site. Although there is an area suitable for new landfill development within the Township, it was concluded that this is not an alternative that the Township should reasonably pursue. Alternative 3 was eliminated from the comparative evaluation.
- Alternative 4 - Existing Landfill Site Closure and Alternative Waste Management Technologies. Under Alternative 4, the Township evaluated the potential to use an alternative waste management technology such as an energy from waste facility (EFW), where waste is combusted at extremely high temperature, resulting in heat that can be used in a steam powered generator for example) at a new location within the municipality. The Boyne Road Landfill would therefore be closed. The use of this EFW technology would require the service to be provided by a private sector operator of this type of facility, since it is beyond the capability of the Township both financially and operationally. It is expected that a new site within the Township would have to be established for this process. It was concluded that the Township could consider establishing a new regional EFW facility with neighbouring municipalities to share the capital expenditures and financial liability with and to improve the facility's steady state processing rate.

- Alternative 5 - Enhanced Waste Diversion. This alternative would require the Township to consider and look for opportunities to increase diversion from disposal by considering public feedback, evaluating current legislation and funding mechanisms and assessing diversion opportunities in alignment with the small, rural nature of the Township. To fulfill this alternative, a Waste Diversion Study Report (refer to Volume 3 Appendix J). the following recommendations for the Township to enhance its current waste diversion program were identified: i) Develop and implement a backyard composting program for source separated organics; ii) optimize the current blue box recycling program with a dual-stream recycling program with the purchase of new split collection vehicles; iii) develop an on-site leaf and yard waste composting program at the Boyne Road Landfill site and expand the collection program for leaf and yard waste, and; iv) develop new and reinforce existing waste management policies.

  The implementation of these waste diversion program enhancement is reasonably estimated to increase the Township's residential solid waste diversion rate from the current 23% to 33%. With the exception of a zero-waste solution, this alternative does not have the ability to fully address the stated problem being assessed but can reduce the amount of post-diversion waste requiring management. This waste diversion alternative can be used to estimate the amount of residual waste requiring management over the 25 year planning period; however, it is not in itself a means of managing residual waste and cannot be compared as a standalone alternative. For this reason, Alternative 5 was not included in the comparative evaluation of waste management 'Alternatives To'.

- Alternative 6 - Do-Nothing. In EAs, the Do-Nothing alternative is considered in the evaluation of 'Alternatives To' as a benchmark against which the potential environmental impacts and the advantages and disadvantages of the alternatives being considered can be measured and compared. For the Township of North Dundas, the Do-Nothing alternative would be to close the Boyne Road Landfill when it reaches its approved capacity and not pursue any other solution for waste management for the Township. It is noted that one of the Township's basic requirements as a municipality is to provide municipal services and infrastructure for its ratepayers. As such, the Do-Nothing alternative is not an 'Alternative To' that could be considered to resolve the long-term waste management problem.

Comparative Evaluation of 'Alternatives To'

The potential effects and/or implications of each of the remaining Alternatives 1, 2 and 4 were generally identified and described for each of the evaluation criteria. A qualitative assessment methodology was applied to complete a comparative assessment of remaining Alternatives 1, 2, and 4. The methodology consisted of assigning an overall relative rating from most preferred to least preferred for each alternative, first for each of the criteria and then for the environmental component. Qualitative comparative rating of potential impact used the descriptors most preferred, less preferred, least preferred and equally preferred. The details of the comparative assessment are presented in Tables 6-2 to 6-10 in Section 6.0 of the

EASR and included consideration of the Do-Nothing scenario. The advantages and disadvantages of each 'Alternative To' are described in Table 6-11, including Do-Nothing.

Identification of the Preferred 'Alternative To'

In determining the overall preferred 'Alternative To', key factors for the Township were maintaining control over waste management and associated costs, having the ability to operate and being able to spread the capital costs out over time and minimizing annual operating costs. Also, for any alternative, potential effects on groundwater, surface water and the natural environment, as well as mitigation of any archaeological resources, would have to be mitigated in accordance with provincial requirements to obtain the required approvals and to be able to continue operations.

Alternative 2 was Most Preferred overall. Compared to Alternatives 1 and 4, it was most preferred for air quality, transportation, built heritage resources and cultural heritage landscapes, nuisance, ability of the Township to operate and cost of implementation. It was not least preferred for any criterion.

Overall, Alternative 1 was Less Preferred and Alternative 4 was Least Preferred.

The preferred 'Alternative To' from the assessment is Alternative 2 – Boyne Road Landfill Site Expansion.

Updated Diversion and Residual Waste Disposal Requirements

As an Ontario municipality responsible for providing waste services for its ratepayers, the Township's objective in undertaking the EA is to obtain approval for a long-term solution for waste disposal while concurrently evaluating diversion opportunities to reduce the amount of waste generated for disposal over the planning period, which is a 25-year planning period, i.e., 2023 through 2048. The Waste Diversion Study (Volume 3 Appendix J) identified a combination of waste diversion options to improve diversion in the Township consisting of:

- backyard composting for source separated organics (SSO)
- dual Stream Recycling program
- curbside collection and chipping or composting of leaf and yard (L&Y) waste at the Boyne Road Landfill site
- existing and new waste management policies

Using population projections and historical information on the volume of landfill airspace consumed annually by waste disposal, and assuming that a residential diversion rate of 28% and 33% by 2025 and 2030, respectively, can be achieved and then maintained going forward, it was determined that the expansion of the Boyne Road Landfill will have to accommodate waste corresponding to the consumption of approximately 417,700 m^3 of landfill airspace (excluding final cover) beyond 2023 for the 25 year planning period.

Study Areas and Environmental Component Work Plans for Landfill Expansion

Study Areas

For the purpose of assessing the existing conditions and the potential effects from the proposed landfill expansion, the environment was defined by natural, social, economic, cultural and technical components. The natural components include atmosphere (air quality, noise) geology and hydrogeology, surface water (quality and quantity) and biology (aquatic and terrestrial ecosystems). The social and economic components include socio-economic (local economy, residents and community and visual), land use and agriculture. The cultural components include cultural heritage resources (archaeology, built heritage resources, cultural heritage landscapes). The technical components include traffic and site design and operations/financial.

The study areas were defined as follows:

- **Site Study Area** – A portion of the existing Boyne Road Landfill site where the landfill could be expanded, consisting of the existing Boyne Road Landfill waste footprint and an area 300 m to the south of the existing waste footprint.
- **Site-vicinity Study Area** – The lands in the area immediately adjacent to the Site Study Area that have the potential to be directly affected by the landfill expansion and activities with the Site Study Area. The extent of the Site-vicinity Study Area was determined for each of the environmental components. For most environmental components, a Site-vicinity Study Area of 500 metres from the Site Study Area is appropriate.
- **Wider Study Area** – An area that takes on the broader community generally beyond the immediate site vicinity and for specific environmental components may include the entirety of the Township of North Dundas, as appropriate.

Environmental Component Work Plans

Work Plans were developed for each of the environmental components. The work plans describe the general scope of technical and field studies for each of the environmental components, the way in which the comparison of ‘Alternative Methods’ of landfill expansion and prediction of environmental effects for the preferred ‘Alternative Method” of landfill expansion will be carried out, and data sources.

Detailed work plans for biology, groundwater, surface water and atmospheric components were developed in consultation with the MECP, Conservation Authorities and MNRF as relevant and submitted for review and concurrence. The summary table of all work plans was shared on the EA website with Indigenous communities and the public and they were invited to view the work plans and submit comments.

Description of the Environment Potentially Affected for Landfill Expansion

Section 9.0 of the EASR provides a description of the natural, social, economic, cultural and technical components, which together are defined as the existing environment that may be affected by the proposed landfill expansion.

The existing conditions relevant to assessment of potential effects from the proposed 'Alternative Methods' of landfill expansion are detailed for each component in Sections 9.1 to 9.10 of the EASR.

Description of and Rationale for the 'Alternative Methods' of Landfill Expansion

'Alternative Methods' are the different ways that the proposed expansion of the Boyne Road Landfill could be implemented to gain an additional 25 years of disposal capacity. Due to the physical constraints associated with the configuration of the existing waste footprint and its location on the existing landfill site property, the 'Alternative Methods' are limited to vertical expansion above the existing waste footprint and/or lateral expansion to the south within the landfill property and the Site Study Area.

Design of Expansion Alternatives

A number of factors were considered in designing the expansion alternatives. The major factors were as follows:

- The geometry of the landfill expansion is to follow the requirements of *O.Reg*. 232/98, i.e. landfill sideslopes of 4 Horizontal : 1 Vertical (4H:1V, 25 %) or flatter and landfill top area slopes not flatter than 20H:1V (5 %).
- The existing landfill footprint of 8.1 hectares is not large enough to accommodate the required landfill airspace of 417,700 m^3 for waste and daily cover beyond 2023 above the existing footprint. Therefore, all 'Alternative Methods' will require a horizontal expansion of the waste footprint.
- The existing Boyne Road Landfill operates as a natural attenuation site, where leachate generated by the landfill is allowed to enter into the groundwater below the disposal area and the leachate-impacted groundwater then moves in the direction of groundwater flow. The MECP Reasonable Use Guideline (RUG) B-7 (MOE, 1994) and *O.Reg*. 232/98 Landfill Standards define the allowable effects of leachate on off-site groundwater quality. Due to high capital and operating costs associated with an engineered leachate collection and treatment system; constraints on the available capacity of Winchester and Chesterville communal sewage treatment systems in the Township; and in the absence of a receiving watercourse for treated effluent from an on-site leachate treatment facility that has year round flow, the only economically viable approach for the Township is to continue operating an expanded Boyne Road Landfill as a natural attenuation site.

- Stormwater runoff from the expanded landfill will be managed by a stormwater management system to be provided at the northeast corner of the landfill property and discharging to the roadside ditch on the north side of Boyne Road.
- It is proposed to install a culvert in the roadside ditch along the north side of Boyne Road (Volks Municipal Drain) opposite the landfill site frontage. This measure would isolate and convey surface water past the landfill site from upstream (west) to downstream (east) and prevent leachate-impacted groundwater from seeping into the surface water in the ditch.
- Waste diversion activities related to recycling, WEEE and HHW are expected to continue operating at their current location near the site entrance, in the north central part of the site.

‘Alternative Methods’ for Landfill Expansion

Based on the above factors, three ‘Alternative Methods’ for expansion of the Boyne Road Landfill were developed. These alternatives are referred to as:

- Alternative 1 – Combined horizontal and vertical expansion with larger east and west buffers
- Alternative 2 – Combined horizontal and vertical expansion with larger south buffer
- Alternative 3 – Primarily horizontal expansion

Alternative 1 consists of a combination of raising the elevation over the current disposal area and tying this into the capacity achievable above an expanded footprint to the south, with the geometry satisfying the slope angle requirements of *O.Reg*. 232/98. The height of Alternative 1 (and all three ‘Alternative Methods’) is about 15 m above typical ground level on the southern part of the property. This is about 2.5 m higher than the existing landfill. The horizontal expansion to the south provides a 100 m buffer to the east, 50 m to the west, approximately 44 m to the southeast end of the property and approximately 300 m to the southwestern end of the property. The design includes the construction of an approximately 1 m thick pad of imported permeable fill material (for example, sandy material) above the ground surface to provide a base for waste disposal. The lateral expansion footprint for this Alternative is approximately 3.9 ha.

Alternative 2 also consists of a combination of raising the elevation over the current disposal area and tying this into the capacity achievable above an expanded footprint to the south. The buffer to the south was increased compared to Alternative 1 at the expense of the east buffer for the horizontal expansion. The horizontal expansion to the south still provides a 71 m buffer to the east, 34 m to the west, approximately 52 m to the southeast end of the property and approximately 309 m to the southwestern end of the property. The lateral expansion footprint for this Alternative is approximately 4.5 ha. The 1 m thick pad of imported permeable fill material is also required for this alternative.

Alternative 3 has the vertical expansion above the approved top of waste contours limited to the southern half of the current footprint, tying it with the horizontal expansion to the south and its more elevated crest (the maximum height) is reached approximately 220 m south of Boyne Road (compared to less than 70 m for Alternatives 1 and 2). The horizontal expansion to the south provides a 100 m buffer to the east, 30 m to the west, approximately 57 m to the southeast end of the property and approximately 314 m to the southwestern end of the property. The lateral expansion footprint for this Alternative is approximately 3.8 ha. The 1 m thick pad of imported permeable fill material is also required for this alternative.

Comparison and Evaluation of Landfill Expansion Alternatives

For each of the three proposed expansion alternatives, the potential for environmental effects was assessed based on the broad definition of the environment, using a set of evaluation criteria. The evaluation criteria consist of components, sub-components and indicators; the components represent a high level aspect of the environment, each of the sub-components represents a specific aspect of the environment, and the indicators represent a potential effect of the proposed landfill expansion.

For each sub-component, the potential effects associated with each expansion alternative were identified and comparatively evaluated using either qualitative, quantitative or a combination of each method; as well, an assessment of advantages and disadvantages of each alternative was completed. Within this assessment, the Do-Nothing scenario was considered to document the advantages or disadvantages of the proposed undertaking. Based on the results, for each indicator the alternative methods were ranked as one of ‘most preferred’, ‘less preferred’, ‘least preferred’, and ‘equally preferred’. The next step was to compile the individual component comparative evaluations of the ‘Alternative Methods’ and select the overall preferred method of landfill expansion.

The detailed comparative assessment for each indicator is provided in Section 11.2, subsections 11.2.1 through 11.2.10 of the EASR; the rationale for the selection of the overall preferred method of landfill expansion is provided in Section 11.4 of the EASR.

The comparative evaluation of ‘Alternative Methods’ of expanding the Boyne Road Landfill identified Alternative 3 – primarily horizontal expansion – as the overall preferred method of expansion.

Of the 17 sub-components that were comparatively assessed, 13 were ranked as equally preferred for the three expansion alternatives. These included components or sub-components that are often considered to be most important such as geology and hydrogeology and surface water quality. The high number of equally preferred rankings reflects the similarity among the available expansion alternative designs in terms of location on the landfill property, physical dimensions to provide the required airspace and considerable distance from potential off-site sensitive receptors.

Of the four sub-components where there are differences in preference, Alternative 3 was most preferred for all four. Alternative 1 was most preferred for two sub-components (ranked the same as Alternative 3) and less preferred for the other two. Alternative 2 was ranked as less preferred for two of the sub-components and least preferred for the other two.

Alternative 3 was identified as the preferred expansion alternative for the Boyne Road landfill. The advantages of Alternative 3 are that it has the least potential for disruption/adverse effects on the natural environment (both aquatic and terrestrial), the least potential for impacts on surface water quantity and the lowest capital cost for implementation of the expansion.

Description of the Preferred Undertaking

Following the identification of Alternative 3 as the proposed expansion, the expansion design concept was further refined at an EA level of detail to provide the basis to carry out a detailed impact assessment. Details of the refined concept design are provided in Section 12.0 of the EASR and summarized as follows and shown on Figure ES-1.

The horizontal expansion adds an additional 3.8 ha of footprint, for a total landfill footprint of 11.9 ha. The total expanded landfill capacity for waste and daily cover, including the additional 450,000 m^3 beyond 2020 (or 417,700 m^3 beyond 2023) provided by the expansion, is 1,060,750 m^3. The maximum elevation of the landfill will be along its peak at elevation 89.75 masl, which is approximately 15 m above the average ground surface elevation in the vicinity of the landfill expansion and approximately 2.5 m higher than the existing approved landfill.

The landfill site property is currently 97.13 ha. It is proposed to add the 16.21 ha of Township-owned property to the east and southeast to the landfill property, resulting in a proposed total landfill property area of 113.3 ha. The proposed landfill property and expanded landfill footprint are shown on Figure ES-2. The landfill expansion will have a 30 m buffer within the landfill property on the west side (followed by the Contaminant Attenuation Zone (CAZ) lands), and with the addition of the Township-owned lands to the east and southeast a 257 m wide buffer on the east side and a 313 m wide buffer on the south side.

It is proposed that the expanded Boyne Road Landfill will continue to operate as a natural attenuation site, noting that it may be necessary for the Township to acquire additional property and/or CAZ easement agreements to protect off-site groundwater quality in compliance with the Reasonable Use Guideline. The need for any additional CAZ lands and their location will be determined from the results of predictive modelling to be carried out as part of the detailed groundwater impact assessment for the proposed expansion.

The design of the expansion will include an approximately 1 m thick pad of imported permeable fill material (for example, sandy material) above the existing ground surface to provide a base for waste disposal. The base will be constructed in sections prior to waste placement in accordance with the site development plan for the expanded landfill cells/phases.

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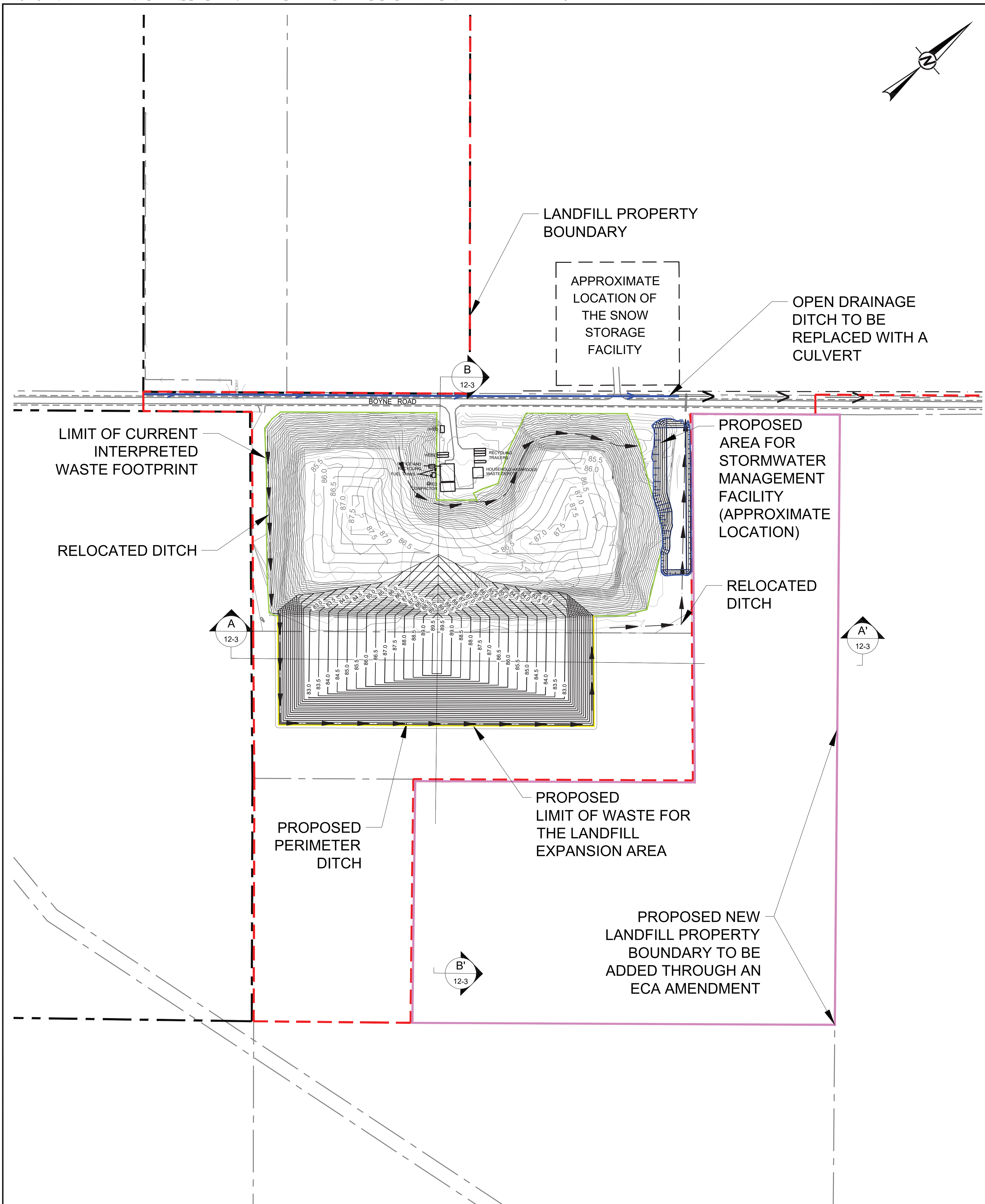

LEGEND

85.0	GROUND SURFACE CONTOURS (MASL), BASED ON RESULTS OF THE SURVEYS CONDUCTED IN 2008, 2010, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019 AND 2020
89.5	PROPOSED EXPANSION TOP OF WASTE ELEVATION CONTOURS (MASL)
	APPROXIMATE PROPERTY BOUNDARY OF LANDFILL SITE
	APPROXIMATE BOUNDARY OF EXISTING CONTAMINANT ATTENUATION ZONE EASEMENT LANDS
	PROPOSED PERIMETER DITCH
	EXISTING ROADSIDE DITCH TO BE REPLACED WITH A CULVERT (APPROXIMATE LOCATION)
	PROPOSED NEW LANDFILL PROPERTY BOUNDARY TO BE ADDED THROUGH AN ECA AMENDMENT

NOT FOR CONSTRUCTION

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REFERENCE(S)

1. BASE PLAN SUPPLIED IN ELECTRONIC FORMAT BY STANTEC CONSULTING LTD.
2. 2008 AND 2010 SURVEYS COMPLETED BY STANTEC CONSULTING LTD.
3. MAY 2012, JULY 2013, NOVEMBER 2014, DECEMBER 2015, NOVEMBER 2016, DECEMBER 2017, DECEMBER 2018 AND NOVEMBER 2019, APRIL 2020 AND DECEMBER 2020 SURVEYS COMPLETED BY GOLDER ASSOCIATES LTD.
4. COORDINATES SYSTEM: MTM ZONE 9 NAD83 DATUM CGVD28

0 100 200
1:4,000 METRES

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

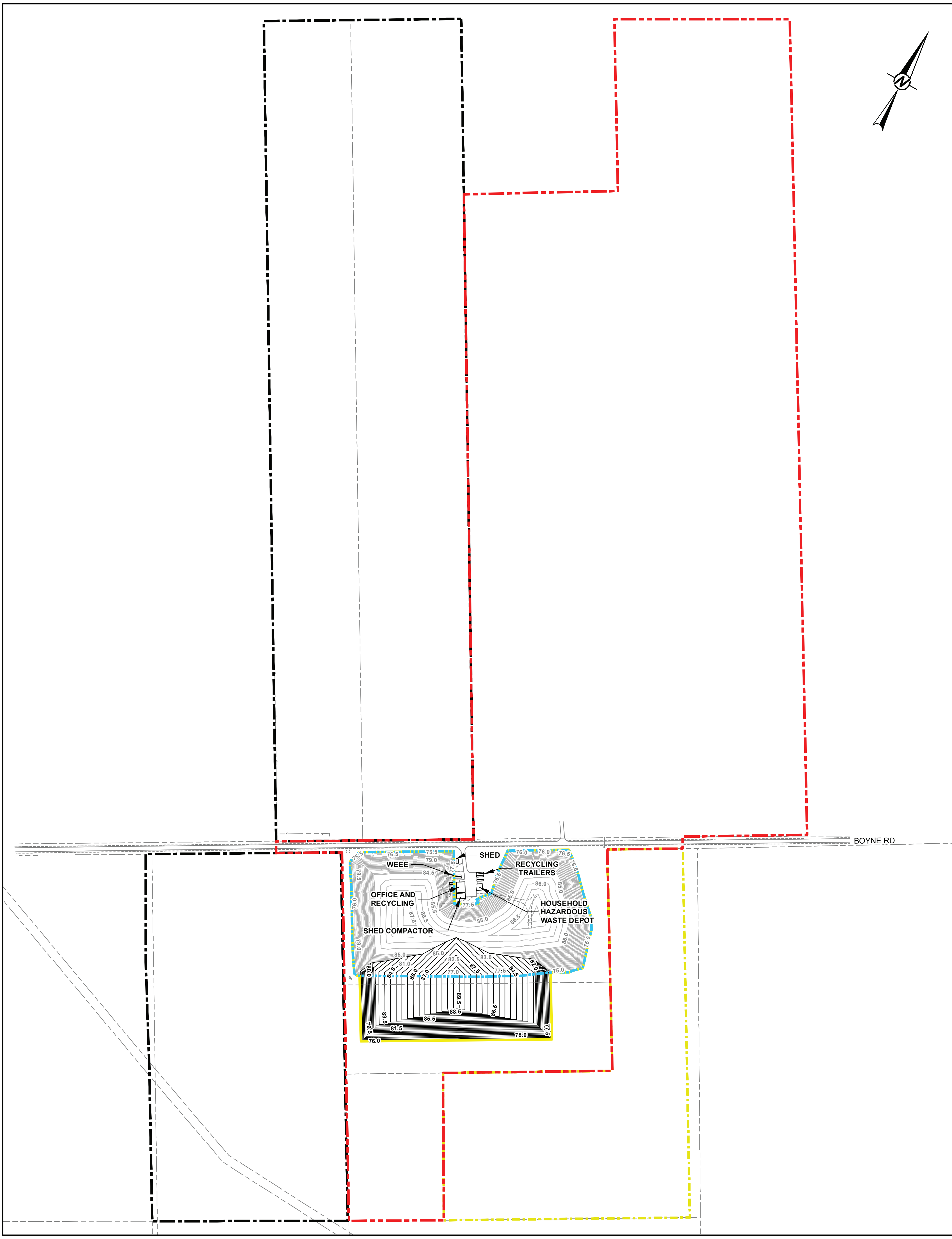
CONSULTANT
wsp GOLDER

YYYY-MM-DD	2021-11-16
DESIGNED	YJM
PREPARED	ABD
REVIEWED	PLE
APPROVED	PAS

TITLE
SITE PLAN OF PROPOSED EXPANSION

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0\2.2.0.	0	ES-1

25 mm
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B



LEGEND

- EXISTING LANDFILL FILL AREA
- PROPOSED LIMIT OF WASTE FOR THE LANDFILL EXPANSION AREA
- APPROXIMATE BOUNDARY OF CONTAMINATION ATTENUATION ZONE
- PROPOSED NEW LANDFILL PROPERTY BOUNDARY TO BE ADDED THROUGH AN ECA AMENDMENT
- APPROXIMATE LANDFILL SITE PROPERTY BOUNDARY
- GROUND SURFACE CONTOURS (mASL), BASED ON RESULTS OF THE SURVEYS CONDUCTED IN 2008, 2010, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019 AND 2020
- PROPOSED EXPANSION TOP OF WASTE ELEVATION CONTOURS (mASL)

REFERENCES

1. BASE PLAN SUPPLIED IN ELECTRONIC FORMAT BY STANTEC CONSULTING LTD.
2. 2008 AND 2010 SURVEYS COMPLETED BY STANTEC CONSULTING LTD.
3. MAY 2012, JULY 2013, NOVEMBER 2014, DECEMBER 2015, NOVEMBER 2016, AND DECEMBER 2017 SURVEYS COMPLETED BY GOLDER ASSOCIATES LTD.

DRAFT

0 60 120 180 240 300

1:6,500 METRES

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-16
PREPARED	JEM
DESIGN	PLE
REVIEW	YJM
APPROVED	PLE

TITLE
PROPOSED LANDFILL PROPERTY AND EXPANDED LANDFILL FOOTPRINT

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	0	ES-2

O.Reg. 232/98 does not require a landfill gas collection and flaring system for an expanded landfill of this size. Also, considering the high water table that is almost at ground surface on and in the area of the landfill site, off-site lateral migration of landfill gas through the subsurface is not expected.

For the expansion, it is proposed that a wetland type stormwater facility will be constructed at the northeast corner area of the landfill site on the south side of Boyne Road and outlet at the same as outlet as for the existing perimeter ditch. A ditch is also proposed on the north face of the existing landfill to help capture the majority of the existing disposal area that currently drains directly to the Boyne Road roadside ditch; this north side ditch will connect to the proposed stormwater management facility. Similarly, the existing perimeter ditch is proposed to be reconfigured and extended around the perimeter of the expansion footprint.

It is also proposed as a component of the expansion design to install a culvert in the roadside ditch along the north side of Boyne Road (Volks Municipal Drain) opposite the landfill site frontage. This measure would isolate and convey surface water past the landfill site from upstream (west) to downstream (east) and prevent potential seepage of leachate-impacted groundwater into the surface water in the ditch.

The expanded landfill will continue to operate during the same hours as the existing landfill. The existing waste diversion facilities will continue to operate in the central portion of the landfill area.

The landfill will be progressively closed in phases after the final waste contours have been reached and landfill operations have proceeded into the next Phase. The final cover on the landfill will consist of 600 mm of soil and topped with 150 mm of soil capable of sustaining vegetation.

Impact Assessment of The Preferred Undertaking

Section 13.0 of the EASR presents an overview of the predicted effects of the proposed expansion on each of the components. These assessments were conducted in accordance with the requirements set out in the approved ToR (Volume 2, Appendix A) and detailed in the work plans for specific components and as described in Section 8.2 of the EASR. For some of the components, additional supporting detail to that provided in the main EASR Volume 1 is provided in Technical Appendices in Volume 2, Appendices B through H.

Atmosphere

The Atmosphere environment component is comprised of two sub-components: air quality (including dust, odour, greenhouse gas (GHG)) and noise.

Air Quality

The effects of the proposed landfill expansion on air quality were identified through comparing the existing landfill and the proposed expansion, using the following three steps:

- Calculating representative emissions rates for each of the significant sources
- Carrying out atmospheric dispersion modelling to predict off-Site concentrations of the indicator compounds
- Comparison of predicted concentrations to existing conditions and the Applicable Guidelines

The emission estimation methods followed accepted MECP practices including, where applicable, guidance in the Ontario MECP document Procedure for Preparing an Emission Summary and Dispersion Modelling Report Version 4.1 (MECP, 2018b).

In calculating these emissions, all potential sources of emission at the proposed landfill expansion were considered; however, only sources with emissions rates that are expected to be either negligible or infrequent were not considered. Emissions during existing operations and after expansion are expected to be greater than during the post-operation phase (i.e., closure) because the level of on-site activities will be greater during the operational phase; therefore, the air emissions and associated effects during the operational phase represent the greatest potential impacts.

To determine potential effects of the proposed project on air quality and odour, the predicted concentrations of indicator compounds were compared to the applicable guidelines, which are the Ontario's Ambient Air Quality Criteria (AAQC) (MECP 2020) and the Canadian Ambient Air Quality Standards (CAAQSs) (CCME 2014).

The maximum cumulative concentrations of all indicator compounds are below the relevant guidelines for all indicator compounds. As such, the predicted compound concentrations associated with the expansion are predicted to meet the relevant air quality criteria.

All predicted maximum concentrations for all compounds occurred at the closest residence west of the Boyne Road Landfill along Boyne Road, located about 0.7 km to the west.

In addition to the assessment of the effects of the proposed landfill expansion on ambient air quality and odour, consideration was given to an evaluation of compliance by determining whether an ECA for air and noise under Section 9 of the *Environmental Protection Act* (Ontario, 1990d) could be obtained based on whether the facility is in compliance for those sources regulated under *O.Reg*. 419/05. At the landfill, this would include landfill gases and materials handling emissions. All mobile equipment is exempt from compliance requirements under *O.Reg*. 419/05. The assessment indicates that the proposed landfill expansion is expected to operate in compliance with Schedule 3 of *O.Reg.* 419/05.

The potential effects of climate change on infrastructure associated with the proposed landfill expansion have been included in this report to qualitatively assess potential climate change effects. The activities associated with the landfill expansion that will produce greenhouse gases (GHGs) include the following:

- landfill gas
- on-site transportation fuel combustion emissions
- stationary combustion emissions from propane used for comfort heating in the buildings
- land clearing as part of the expansion

The GHG emission estimates, where applicable, followed quantification guidelines for both provincial and federal reporting:

- Federal reporting under Section 46 of the *Canadian Environmental Protection Act*, (CEPA), SC 1999: Greenhouse Gas Emissions Reporting Program (GHGRP).
- Provincial reporting under Ontario's Greenhouse Gas Emissions: Quantification, Reporting, and Verification Regulation, *O.Reg*. 390/18.

The results of the GHG assessment indicate that the increase in emissions from the existing landfill to the proposed expansion would have a negligible contribution of less than 0.003% to the Ontario emissions and less than 0.0006% to the Canadian emissions; therefore, the proposed landfill expansion will have a negligible effect on climate change.

Noise

The noise impact assessment for the proposed expansion describes and summarizes a noise assessment that considers the existing conditions and potential effects of the landfill expansion on the outdoor acoustic environment.

The following methodology was carried out to assess the potential impacts due to the proposed landfill expansion:

- determination of future noise levels with the Boyne Road Landfill proposed expansion
- determination of potential noise impact due to the Boyne Road Landfill proposed expansion
- assessment of noise mitigation, if required

The methodology used for the noise assessment was based on the MECP publications "Noise Guidelines for Landfill Sites" (Landfill Guidelines) (MECP 1998) and NPC-300 (MECP 2013). These guidelines outline the sound level limit criteria for evaluating landfilling operations and ancillary facilities (i.e., stationary noise sources).

The noise assessment was carried out at the representative points of reception (PORs) identified within the Site-vicinity Study Area, which included both existing PORs and vacant lot PORs. All representative PORs identified in this noise assessment are conservatively described as being located in a Class 3 area, as defined in NPC-300 as a rural area with an acoustical environment that is dominated by natural sounds.

Noise predictions of landfilling operations, ancillary equipment, and off-site haul routes were each assessed independently against the applicable guidelines. Noise levels associated with landfilling operations and ancillary equipment met the applicable sound level limits.

During the proposed landfill expansion predictable worst-case hour, the change in noise levels at PORs along the haul route compared to there being no landfill present ranges from insignificant to noticeable. General industry practice typically does not require action to be carried out unless a significant rating is predicted. Note that if the Boyne Road Landfill proposed expansion worst case hour noise levels were compared to existing worst case hour noise levels with the existing Boyne Road Landfill traffic included (more representative of current conditions), changes in noise level would be insignificant.

Geology and Hydrogeology

A series of analytical contaminant transport calculations were conducted based on a conceptual model of groundwater flow and contaminant transport at the site to calibrate to current conditions and assess expected future expanded landfill site compliance with MECP Reasonable Use Guideline B-7. Guideline B-7 establishes a quantitative benchmark for protecting off-site groundwater quality for drinking water purposes. The calculations were completed using GoldSim to simulate the passage of contaminants in the landfill leachate from the source area (i.e., the active and expanded landfill areas) through the overburden groundwater flow system to the downgradient boundary of the CAZ.

The overburden conditions in the area consist of discontinuous topsoil/peat, underlain by discontinuous silt/clay, underlain by silty sand/sandy silt glacial till. Bedrock, consisting of limestone (interbedded with shale) is present beneath a total overburden thickness ranging from 1.4 and 9.0 m. The model considered two groundwater flow directions (pathways) from the disposal area, one towards the south and one towards the north.

The model assessed the impact of groundwater contaminants chloride and boron as representative conservative indicators of leachate migration through the groundwater system.

The model indicates that chloride concentrations are simulated to be closer to the Guideline B-7 allowable concentrations than boron. The predictive results indicate that chloride concentrations are likely to meet Guideline B-7 for overburden groundwater beyond 700 m downgradient of the fill area, for both the northward and southward groundwater flow pathways) for the proposed landfill expansion. To achieve compliance in future, it will be necessary for the Township in future to obtain control over an additional 400 m of groundwater travel distance towards the south as CAZ through either property acquisition or groundwater easement below this land area. It is noted that this additional CAZ land is not needed immediately, and the timing such that the landfill site remains in compliance with the Reasonable Use Guideline will be dependent on the ongoing groundwater monitoring program results.

An evaluation of the proposed expansion in terms of Source Water Protection for existing communal water supply wells was also carried out. The proposed Boyne Road Landfill expansion is within the existing Wellhead Protection Area (WHPA)-D of the Chesterville wellfield. The proposed Boyne Road Landfill expansion is not interpreted to have an impact on the Winchester, Chesterville, or nearby residential wells due to its location within the geological setting, the local hydrogeology and its remote location from residents.

Using the source concentration output files from POLLUTE (Volume 2 Appendix D-3), the contaminating lifespan of the proposed expanded landfill (the time period which leachate from the landfill can be expected to have an adverse effect on groundwater quality) was estimated using the parameter chloride. It is estimated that the contaminating lifespan will be below the RUPO at approximately year 2070 or 22 years post closure. This is a relatively short amount of time, but not unexpected for a natural attenuation landfill with a permeable soil cover.

Surface Water

In terms of surface water, the impact assessment considers both surface water quality and surface water quantity.

There is currently no quality or quantity control system for stormwater management in place for the existing landfill except for the existing perimeter ditch that collects and conveys runoff to the Volks Municipal Drain ditch along the north side of Boyne Road. For the expansion, it is proposed that a wetland type stormwater management (SWM) facility will be constructed at the northeast corner area of the landfill site on the south side of Boyne Road and outlet at the same location as the existing perimeter ditch.

As a requirement of the MECP SWM Planning and Design Manual (MECP, 2003) the design of the SWM pond requires Enhanced Level Protection (80% total suspended solids (TSS removal)) and matching post-expansion outlet flows from the ponds to corresponding pre-expansion flows for selected storm events. Surface drainage from potentially contaminated areas, i.e., originating from active landfilling areas, will be contained locally within berms and will discharge into the waste. Surface drainage from non-contaminated areas such as road areas and areas with interim or final landfill cover will be conveyed to the SWM pond via the internal drainage ditches. As mentioned as part of the description of the preferred undertaking, leachate-impacted groundwater presently and in the future will discharge into the Volks Municipal Drain located to the north of the landfill. To mitigate this, the installation of a culvert in the drain to prevent this groundwater discharge is proposed, thereby protecting the surface water quality within the drain.

A 20% increase of design storm intensity values was applied to the 1:100 year return period design storm to “stress test” the proposed SWM system and evaluate potential climate change effects.

Because of the required quality and discharge quantity control for the expanded landfill, there is not expected to be an adverse impact on off-site surface water quantity or quality. The net result is an improvement compared to existing conditions.

Biology

The Biology environment component is comprised of two sub-components: aquatic and terrestrial.

The impact assessment considers the potential direct and indirect impacts of the proposed landfill expansion on the aquatic and terrestrial ecosystems within the Site and Site-vicinity Study Areas for the construction, operations and closure stages of the landfill expansion. Potential direct impacts to natural heritage features and functions are those that result in an immediate loss of the feature or function as a consequence of the landfill expansion. Potential indirect impacts are those whereby the landfill expansion causes impacts to an adjacent or downstream feature or function through the alteration of the site.

Aquatic Biology

Direct Impacts:

- the removal of an area of evaluated and unevaluated wetland; and relocation and / or re-grading of the existing perimeter ditch (effects on marginal and seasonal fish habitat)
- modifying Volks Municipal Drain in an approximately 588 m long pipe along the north side of Boyne Road to isolate and convey surface water past the landfill site from upstream (west) to downstream (east) will remove fish habitat

Potential residual effects of the expansion (i.e., those that cannot be fully mitigated) that could result in the death of fish or the harmful alteration, disruption, or destruction of fish habitat (HADD) will need to proceed through the Department of Fisheries and Oceans (DFO) review process, and a DFO *Fisheries Act* Authorization for the landfill expansion may be required. The DFO permit application will include a comprehensive impact assessment that will incorporate the landfill expansion detailed design.

It is considered that the resulting improvements in water quality from the SWM facility into Volks Municipal Drain, a fish bearing watercourse, will outweigh the loss of access to the seasonal, low quality habitat within the perimeter ditch.

To mitigate the effects on fish habitat by enclosing a section of Volks Municipal Drain in a culvert, it is proposed that an alternative approach consisting of a low permeability lined ditch be considered at the design stage. This approach would maintain the watercourse as an open ditch would reduce the likelihood of potentially leachate-impacted groundwater seepage entering the watercourse and also maintain fish passage and access to upstream habitats.

Once the proposed expansion is constructed, potential direct impacts related to the landfill during the Operations Stage on surface water features are expected to be limited to effects related to the use of site operations equipment, which can be avoided through the implementation of standard operational measures.

Activities during the landfill Closure Stage will include the addition of final cover soil, organic material capable of supporting vegetation growth (such as topsoil) and revegetation; as such, potential direct impacts to aquatic systems are considered minor and can be readily mitigated with standard practices.

Indirect Impacts:

Potential indirect effects on fish and fish habitat during the Construction Stage can be minimized or eliminated using appropriate mitigation measures and best practices, and development and implementation of an Erosion and Sediment Control Plan and Spill Contingency Plan.

With the addition of the SWM pond and modifications to Volks Municipal Drain and implementation of appropriate mitigation measures (i.e., erosion and sediment control, existing standard operational measures, and groundwater and surface water quality/quantity monitoring), potential indirect impacts to fish and fish habitat during the Operations Stage are considered minor.

Indirect impacts to fish habitat as a result of landfill closure are not anticipated.

Terrestrial Biology

Direct Impacts:

- The proposed expansion will result in disturbance of 9.3 ha of naturally occurring vegetation, which are: habitat for endangered or threatened species (little brown myotis); significant woodland; evaluated non-Provincially Significant Wetland (PSW) (Melvin Swamp) and unevaluated wetlands; significant wildlife habitat - species of conservation concern (wood thrush and eastern wood-pewee); and significant wildlife habitat – interior forest
- The loss of habitat for little brown myotis, which is designated endangered under the Endangered Species Act (ESA), will require an Information Gathering Form to be prepared and submitted to the MECP prior to any works being undertaken to initiate permitting under the ESA, which will include compensation and appropriate mitigations.
- It is not expected that the proposed expansion will affect the function of the woodland for provision of wildlife habitat, or have a significant impact on the remaining portions of the wetlands or their functions, or reduce the ability of wood thrush or eastern wood-pewee to continue to use the remaining forest adjacent to the proposed expansion for breeding.

The proposed expansion has the potential to cause direct mortality to wildlife during the Construction Stage. To avoid contravention of the Migratory Birds Convention Act, clearing of vegetation should take place outside of the breeding bird nesting period (April 1 – August 31) to protect birds, their nests and young. Other wildlife has the potential for direct mortality during construction, such as snakes and mammals. A Wildlife Encounter Protocol should be developed for use during construction, and all staff should be trained on the contents of the protocol.

Once the proposed expansion is constructed, direct impacts related to the Operations Stage of the landfill are expected to be limited to potential, occasional mortality of wildlife.

Activities associated with landfill closure, i.e., the addition of final cover soil, organic material capable of supporting vegetation growth (such as topsoil) and plantings of native vegetation, will result in some compensation for natural communities lost during construction and operations. No negative direct impacts are anticipated.

Indirect Impacts:

Potential indirect impacts of the construction phase include typical construction-related impacts such as:

- Accidental spills or sedimentation in adjacent vegetation communities
- Dust deposition on vegetation in adjacent vegetation communities
- Noise related impacts to wildlife in adjacent habitats
- Introduction of invasive plant species via construction equipment

These indirect impacts are not considered significant and are mitigatable with standard construction best management practices.

Potential indirect impacts during the Construction Stage are not considered significant and are mitigatable with standard construction best management practices.

During the Operations Stage of the proposed expansion, potential indirect impacts to terrestrial ecosystems are likely to be limited and can be readily mitigated.

Indirect impacts as a result of landfill closure are not anticipated.

Land Use Planning

The assessment of impacts from the proposed expansion of the Boyne Road Landfill on land use considered the relevant provincial policy, County official plan, municipal zoning by-law and provincial guidelines to discern land use composition in the existing Site Area and Site-vicinity Study Area characteristics.

The preferred expansion for the landfill site is primarily a horizontal expansion to the south of the existing landfill. The expansion will add an additional 3.8 ha to the landfill footprint, as well as 16.21 ha of Township-owned property to the east and southeast of the overall landfill property as buffer lands. These Township-owned lands are not currently zoned for landfill use and will remain zoned as Rural.

In regard to the Provincial Policy Statement (2020), The landfill expansion will help to promote an efficient land use pattern to help sustain the financial well-being of the Province and Township over the long term. In this regard, the landfill expansion is expected to increase the available capacity of the landfill to the year 2048, which will allow the Township to continue to use these lands as designated for waste to be disposed of locally.

The lands for the expansion are Class O (Organic) soils, which are not considered as being lands that would normally be considered for protection as Prime Agricultural Lands nor included within a Prime Agricultural Area for long-term protection for agriculture. The landfill expansion is to take place within the existing landfill property, avoiding the need to use additional undeveloped lands.

In terms of the County Official Plan, the denotation of the landfill site on the Official Plan Schedule is a symbol, and does not designate spatial usage; as such, an Official Plan Amendment will not be required to expand the landfill site. Also, according to the OP schedule, the existing landfill is surrounded by Agricultural and Rural land uses. Through the land use analysis, agricultural fields were identified surrounding the landfill site. It is considered that the expansion of the landfill will not have any direct negative effects on these existing land uses.

In the Zoning By-law, the current active Boyne Road Landfill site is zoned SRD; the balance of the Township-owned lands are zoned as Rural. Waste disposal sites are not a permitted use within the Rural designation; however, the area proposed for the expansion is already owned by the Township and is simply being added to the designated part of the lands as an additional buffer to accommodate the landfill expansion and will not be used for waste management services. Therefore, a re-zoning of this property is not required to accommodate the proposed landfill expansion. However, it is recommended that once the EA has been approved confirming that this additional land is to be reserved as part of the landfill site property for buffer area, the Township rezone the lands to ensure that the 500 m separation distance between SRD uses and dwelling units is correctly identified when using the land use schedule to the Zoning By-law, as this is the only tool available to the general public in regard to potential development within the 500 m restricted zone around the landfill site.

Agriculture

In the United Counties of Stormont, Dundas and Glengarry Official Plan, the majority of the Township of North Dundas is designated as Agricultural Resource Lands outside of the Urban Settlement Area. The County Official Plan defines Agricultural Resource Lands as lands predominated by prime agricultural lands and other large tracts of land characterized by viable farming activity.

In the Township of North Dundas, subject lands that are in the former Township of Winchester immediately surrounding the Boyne Road Landfill site are designated as Rural, where agricultural use is a permitted use. Lands on the perimeter of these Rural lands are designated Agricultural Zone.

The Ministry of Agriculture, Food and Rural Affairs Agricultural Maps shows the landfill site within a Muck soil area. Muck soil, as defined in the Soil Survey of Dundas County is generally not suitable for agriculture and has traditionally not be included in an Agricultural designation, as it requires a great deal of work to prepare for crops and the rate of return is low. The proposed landfill expansion is to take place within this Muck soil area.

An Agricultural Impact Assessment (AIA) is a study that evaluates the potential impacts of non-agricultural development on agricultural operations and the Agricultural System and recommends ways to avoid or, if avoidance is not possible, minimize and mitigate adverse impacts. The assessment of effects on agricultural land use, while not an AIA, provides an

AIA-based summary of the potential effects from the proposed landfill expansion, considering the requirements described in the Draft Agricultural Impact Assessment Guidance Document.

There are five active farming operations in proximity to the landfill site. The Township engages in regular discussions with the owners of these farms, and they are aware of the expansion and the expansion process.

It is expected that neighbouring agricultural operations will continue to implement normal farm practices. It is anticipated that any nuisance effects associated with the landfill expansion will be at worst occasional and of low magnitude. As identified in studies completed for the EA, elevated dust levels can pose a potential impact to nearby crops. Mitigation measures will be implemented to minimize the amount of airborne dust such as enforcing on-site speed limits and applying site fugitive dust best management practices, as necessary and appropriate (e.g., watering or applying dust suppressant to on-site road surfaces).

The expansion is not expected to cause issues with farm vehicles in the area. The volume of farm vehicles and observations during a September 2021 traffic counting period did not identify any major impacts at intersections or along the roadways due to the equipment.

No active agricultural operations will be affected with the proposed landfill expansion. Lands adjacent to the landfill site and used as agricultural fields will continue to be used for this purpose.

Cultural Heritage Resources

Archaeological Resources

A Stage 1 Archaeological Assessment was completed for the Site Study Area. The northern portion of the Site Study Area has been disturbed by the existing landfill, while the southern portion of the Site Study Area is not associated with any features indicating archaeological potential and is thus considered to have low potential for archaeological resources. As such, the Site Study Area does not meet the requirements for further archaeological assessment based on the MHSTCI Standards and Guidelines for Consultant Archaeologists (MHSTCI, 2011) and no further archaeological assessments are recommended.

Cultural Heritage Landscapes and Cultural Heritage Resources

The Counties' Official Plan identifies the study area as an active landfill site within a Rural District and across from Crown Land located on part of Lot 8, Concession 7. The Counties' Land Use Schedules B1 and B2 indicate that the Site-vicinity Study Area is surrounded by wood lots, organic soils and non-significant wetlands but no identified built heritage resources or cultural heritage landscapes. There is also no evidence that any part of the Site-vicinity Study Area is considered to be a cultural heritage landscape.

Socio-economic

The assessment of impacts on the socio-economic environment looked at both direct and indirect effects and the level of change that may result to the baseline environment.

Direct effects – These are effects to the socio-economic environment that occur as a direct result of a change to a socio-economic feature such as population change, employment effects or visual effects.

Indirect effects – these are effects to the socio-economic environment that occur indirectly as a result of landfill expansion related changes on other aspects of the environment (e.g., increased noise, dust or odour creating nuisance effects).

Local Economy

The following indicators (and criteria) were evaluated to assess effects to the local economy:

- Expected effect on local employment (Employment opportunities during landfill expansion construction and operation
- Expected effects on local businesses and commercial activity (Potential effects to local commercial businesses in the Site-area, excluding agriculture)
- Expected effects on municipal finances (Capital costs associated with construction and operation)

The proposed landfill expansion is expected to neither create nor decrease jobs in the community, the existing landfill workforce is deemed sufficient. The annual operating cost are expected to remain the same at approximately $55,000. No significant changes to local traffic around the landfill as a result of the landfill expansion are predicted. Other businesses (excluding farms) in the Site-vicinity Study Area are not anticipated to be affected negatively or positively as a result of the landfill expansion.

Revenue to the landfill is expected to remain generally the same with mild increases related to inflation and the modest population increase forecast.

Residents and Community

The following factors (and criteria) were evaluated to assess effects to residents and community:

- Displacement of residents (Proximity to nearby residences)
- Expected interference with use and enjoyment of residential properties, i.e., nuisance effects (Biophysical and social interactions with nearby residential and community receptors (i.e., noise, dust, odour, and nuisance wildlife/pests))

The physical landfill expansion does not require any displacement of residences. There are no properties with existing homes or community features within the 500 m Site-vicinity Study Area. To date, the Township has never received a complaint from neighbours about the operation of the landfill related to noise, traffic, dust, odours or visual. Current noise, dust and odour sources within the Site-vicinity Study Area will primarily be agricultural and traffic as well as potential noise, dust and odour from the existing site.

Studies of air quality and noise conclude that with the use of standard site operating practices, the expansion is not expected to result in adverse effects off-site. Similarly, the traffic study shows the anticipated increase in traffic as a result of increasing population is not forecast to cause any issues with traffic movement along the haul routes to the landfill site, or at the site entrance/exit location.

Visual

The proposed expansion that is somewhat higher than the currently approved top of waste contours is limited to the southern half of the current footprint. For the horizontal expansion area, trees and vegetation will be removed to prepare for the expansion. A row of trees and bushes along the western and southern boundaries will remain in place and grow over time to further screen the view from potential off-site receptors.

A computer-generated 3D landscape model was developed in a geographic information system (GIS) and available land cover information to account for potential vegetation screening, and 3D modelling of the proposed expansion design. The 3D model was used to conduct visibility analysis and determine potential key representative public locations for viewing the landfill site within a 1 km Site-vicinity Study Area. This model also allowed for the rendering of simulated images of the proposed expansion from key viewpoints. These simulated images were combined with field survey photographs to produce photo-composite images to portray the relative scale and extent of the proposed expansion within the existing viewing conditions and to support the assessment of potential visible effects.

A detailed assessment of potential visible impacts was completed for a total of four identified key off-site vantage points along Boyne Road and from the south. The assessment concluded that the expansion will be not visible or only be visible to a limited extent from off-site. The weak level of contrast does not change the overall rural landscape character of the area.

To further mitigate visibility and reduce contrast with the surrounding landscape, it is recommended that additional trees be planted within the tree line between the proposed expansion and the southwestern property boundaries.

Transportation

The traffic impact study evaluated the operation of the Access/Boyne Road, St. Lawrence Street/Main Street and County Road (CR) 7/Boyne Road intersections and examined the lane configuration and left turn lane warrants. The analysis was conducted for the traffic using 2021 traffic counts, and the expected 2048 traffic, which represents the end of the 25 year planning period for the landfill expansion. The time period selected for the analysis was the weekday peak a.m. and p.m. hours, which are expected to be the peak traffic periods for both the landfill facility and the background traffic.

The trip generation analysis determined that following the expansion of the Boyne Road Landfill site, the facility would generate 11 trips entering and 10 trips exiting the site during the weekday peak a.m. hour for a total of 21 vehicle trips, and 21 trips entering and 20 trips exiting during the peak p.m. hour for a total of 41 vehicle trips.

The landfill site is currently operating with one access onto Boyne Road. The access is a single lane entering and one lane exiting the site. An analysis of the expected 2048 traffic determined that there would be no roadway modifications required to the site access and Boyne Road intersection due to the expansion of the landfill facility. The traffic analysis further examined the St. Lawrence Street/Main Street intersection in the Village of Winchester, and CR 7/Boyne Road intersection located 6.6 km east of the landfill site. The expected site trips at both intersections would have a minor impact on the operation of the intersections with no modifications required.

Design and Operations

In terms of landfill expansion development, the landfill expansion involves a limited vertical expansion on the south portion of the existing landfill and a new 3.8 ha horizontal expansion footprint area. The horizontal expansion area will have a constructed base consisting of a pad of imported permeable fill. It is proposed that the expansion area would be constructed and filled in three or four phases; final cover would be placed progressively as the landfilling in a phase is completed. It is anticipated that the development would proceed from east to west, since the proposed SWM pond is located along the east side of the site and this would allow drainage from the first phase of the landfill cover into the pond. It is also noted that the expansion is located south of the existing landfill and is of similar height to the existing landfill; the combination of the existing landfill and forested areas will be quite effective at screening the view of the expansion operations from Boyne Road and other off-site vantage points.

In terms of leachate management, the proposed expansion will continue to reply on natural attenuation to control potential adverse effects on off-site groundwater quality. The results of the hydrogeological impact assessment are that the expanded landfill site requires some additional CAZ lands to the south to remain in compliance with the MECP Reasonable Use Guideline. With the addition of more CAZ lands to the south, adverse impacts to off-site groundwater quality are not expected. In addition, the development and operation of the landfill do not involve lowering of the groundwater level or taking of groundwater; as such, no effects on off-site groundwater availability are expected.

In terms of landfill gas, it is neither required by regulation nor proposed to install a landfill gas collection system at the Boyne Road Landfill site. The air quality assessment demonstrates that air emissions from the expanded landfill (air quality, odour, dust) are expected to comply with provincial requirements. Also, the estimated GHG generation from the expanded landfill is indicated to negligibly contribute to provincial GHG release. Off-site lateral migration of landfill gas through the subsurface is not expected; it. is expected to vent to atmosphere through the landfill cover soils. It is also noted that there are no existing structures within 500 m of the landfill site other than the landfill building. As such, there is no potential for off-site lateral migration of landfill gas from the existing landfill or the expansion area to cause adverse effects.

In terms of soil balance, there are no potential sources of earth borrow materials on the landfill site property for use in construction of the expansion or future site operations. The construction of the landfill expansion will require the importation of approximately 38,000 m^3 of permeable sandy soil for the landfill base; additional imported soil will be required for construction of the stormwater pond berms. As is done for the current landfill operations, daily cover for the expansion waste will consist of imported soil materials as well some alternative daily cover materials and will consist of a combination of surplus soils from construction projects within the Township as well as material from licensed pit sources; an estimated 84,000 m^3 of soils would be required.

The proposed final landfill cover is proposed to consist of a general soil final cover meeting the requirements of *O.Reg*. 232/98. Again, imported soil (suitable soils that are surplus from construction projects and/or from licensed pits) and topsoil will be required.

In terms of capital and operational costs, an estimate of possible costs for the main components of the capital costs (in 2021 dollars) was prepared, as follows:

- Clearing, excavation and fill placement to construct the expansion base pad: approximately $1,300,000 to $1,500,000.
- Construction of the SWM wetland facility and north side landfill ditching: approximately $171,500 to $365,000.
- Construction of the mitigation measure in the north side Boyne Road ditch (Volks Drain): approximately $615,000 to $950,000 for the culvert option, which is expected to be the more expensive option.

These capital costs will be phased with progressive construction and filling of the expansion. As such, the capital costs associated with the expansion can be planned within the Township's annual capital expenditures budgeting process. The operating costs are expected to be comparable to the current operating costs. These cost components are not expected to adversely impact municipal finances.

In summary, there are no significant impacts expected as related to site design and operations.

Comparison to Do-Nothing

For the Township, the Do-Nothing alternative would be to allow the Boyne Road Landfill to reach its approved capacity and not pursue any other solution for residual waste management for the Township. The predicted effects of the preferred alternative were compared to the Do-Nothing scenario for each of the environmental components, sub-components and indicators to better understand and appreciate the magnitude of any predicted effects of the proposed expansion design.

Not all effects of landfill expansion were negative, a few were positive, and some effects were similar whether considering Do-Nothing or landfill expansion. However, all negative effects are mitigatable to within regulatory limits, as landfill expansion is a well-known and well understood type of approach in terms of landfill development, operations and performance.

One of the Township's basic requirements as a municipality is to provide municipal services and infrastructure for its ratepayers including waste management. As such, the Do-Nothing Alterative would not be practical to implement. If the Township actually did nothing, individual residents would be responsible for finding their own solution to waste management such as hiring a private waste management company or disposing of waste on their own property. The comparison of the Do-Nothing alternative does not include the potential actual impacts of the Do-Nothing alternative.

Climate Change Considerations

The document entitled "Considering Climate Change in the Environmental Assessment Process" (MECP, 2019) was used as a guide for incorporating measures in the landfill expansion design that reduce both the potential impact of climate change on the landfill (i.e., climate change adaptation) and its potential impact on climate change (i.e., climate change mitigation).

Potential Impacts of Climate Change on the Landfill Expansion

It is expected that the planned 25 year operational period of the landfill expansion, i.e., through 2048, will be too short to be significantly affected by impacts from climate change. However, during the post-closure period, longer term changes in precipitation and temperature could possibly affect the vegetative cover growth on the closed landfill and/or runoff of surface water from the landfill final cover and the performance of the components that comprise the stormwater management system (SWMS). For example, an increase in precipitation and/or an increase in storm intensity or duration compared to historical design storms would increase the amount of runoff, potentially resulting in surface erosion of the vegetated landfill final cover surface and exceedance of the capacity of the SWMS.

Climate change adaptation was incorporated into the design of the landfill expansion in terms of design of the SWM pond to remove suspended solids prior to discharge, including larger storm events, and increasing the design storms for the SWM system by 20 percent above the 100 year design storm to account for and assess the impact of possible climate change effects.

Adaptation of landfill operations to climate change effects was also assessed and mitigation measures proposed, i.e., extremes of heat or cold, stronger winds as related to litter control, effects of increased precipitation casing increased leachate generation.

In summary, the potential impacts from climate change related to precipitation have been considered in terms of design of the stormwater management system for the expanded landfill. Adjustments to landfill operations can be made, as required, in future to mitigate potential effects from climate change.

Potential Impacts of the Landfill Expansion on Climate Change

The potential effects of the landfill expansion on climate change were assessed to quantify potential climate change effects. The two main ways that a landfill expansion could affect climate change are the generation of GHG that enters the atmosphere, and reduction of GHG sequestration by removal of forested areas.

A comparison of the Boyne Road Landfill site's proposed expansion GHG emissions to the provincial and Canadian totals indicates that the increase in emissions from the existing landfill to the proposed expansion would have a negligible contribution of less than 0.003% to the Ontario emissions and less than 0.0006% to the Canadian emissions; therefore, the proposed landfill expansion will have a negligible effect on climate change.

Cumulative Impact Assessment

A cumulative impact assessment of the potential effects of the proposed landfill expansion in combination with past, present and reasonably foreseeable future activities, where possible, was carried out following a framework often used in federal EA processes. The cumulative effects analysis involved a scoping phase and an analysis of effects phase. For the scoping phase, the components that had residual negative effects (after mitigation) from the proposed landfill expansion were identified. After this, other projects or activities in the area that may affect the same components were identified.

During the analysis of effects phase, the other projects or activities were evaluated to assess if their effects would overlap in timing or spatial extent with the effects of the landfill expansion, accounting for and including the proposed landfill expansion mitigation. The nature and extent of the possible cumulative effects were then identified along with any possible mitigation and/or monitoring strategies.

Of the natural, social, economic, cultural and technical components for which impact assessments associated with the proposed landfill expansion were carried out, the identified components with potential residual negative off-site effects after proposed mitigation measures are in effect were identified.

The existing zoning and land use in the vicinity of the landfill was considered in determining the other projects and activities to include in this cumulative assessment. There are no known new future planned land uses in the Site-vicinity. As such, the only expected activity in the Site-vicinity whose effects could possibly overlap with those from the landfill expansion is farming operations.

The potential overlap in effects was limited to the atmosphere component, i.e., dust, odour, air quality, noise, GHG. With the use of the proposed mitigation measures during landfill site operations, the resultant effects are expected to be within allowable limits.

Monitoring and Contingency

The proposed expansion of the Boyne Road Landfill has been designed to incorporate mitigation measures to minimize the potential for unacceptable environmental effects. Following the identification of mitigation measures, the environmental effects of the proposed expansion were evaluated. Although, efforts have been made to conservatively estimate potential impacts associated with the proposed landfill expansion, there is always some potential for variability between predicted and actual conditions. Effective monitoring and contingency measures are intended to address this potential variability and confirm the assumptions used in this assessment.

For the proposed expansion, it is proposed that the groundwater and surface water monitoring programs that are ongoing as part of the site operations continue, modified as appropriate for the expansion. It is proposed that a stormwater pond discharge monitoring program be added for the expansion

The proposed groundwater, surface water and stormwater monitoring programs are summarized in Section 16.1 of the EASR and will be finalized and confirmed during the ECA amendment application for the expansion in consultation with the MECP. The existing groundwater and surface water trigger mechanisms will also be reviewed and modified as appropriate at that time.

In the event that the ongoing groundwater or surface water monitoring programs detect unexpected problems, it may be necessary to implement contingency measures to further reduce the potential for any adverse environmental effects associated with the proposed expansion of Boyne Road Landfill. An overview of the proposed contingency measures that could be put into effect are described in Section 16.2 of the EASR.

Other Approvals

Following approval of the Boyne Road Landfill expansion EA by the Minister of the Environment, Conservation and Parks, the following other approvals will be required:

- Approval under the *Environmental Protection Ac*t (EPA) and the *Ontario Water Resources Act (*OWRA) will then be required; these approvals will take the form of amendments to the existing landfill Waste ECA, and a new OWRA ECA for the SWM works.
- Preparation and submission of a DFO Request for Review will be required to determine any additional mitigation and potential compensation in consultation with DFO.
- A permit under the ESA (*O.Reg.* 242/08) will be required, and conditions of such a permit will likely include compensation measures, in consultation with the MECP.
- An approval under the provincial Drainage Act for the alternations/improvements in the portion of the Volks Drain on the north side of Boyne Road opposite the landfill site to construct the proposed mitigation measures.

- Re-zoning of the landfill is not required to accommodate the proposed landfill expansion. However, it is recommended that once the EA has been approved confirming that the additional land to the south and east is to be reserved as part of the landfill site property for buffer area, the Township rezone the lands to ensure that the 500 m study area is correctly identified when using the land use schedule to the Zoning By-law.
- A work permit from the Conservation Authority is expected to be required to undertake the site work associated with the expansion.

Summary of Commitments

Section 18.0 of the EASR lists the 17 commitments made by the Township during the ToR process, how they have been considered in the preparation of the EASR and their current status. All of these commitments have been completed during the EA process.

Commitments made by the Township during the EA study process are also listed in Section 18.0. These commitments are relevant to one or more of the pre-construction, construction, operations and post-closure stages of the landfill expansion. The Township will report on the status of these commitments via compliance monitoring to the MECP annually until such time as all commitments are completed or addressed/superseded in EPA/ OWRA conditions of approval. Generally, these commitments relate to effects monitoring requirements, design of site components, operating procedures, mitigation measures and best management practices.

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Acronyms

Acronym	Definition
AAC	Agricultural Advisory Committee
AADT	Average Annual Daily Traffic
AAQC	Ambient Air Quality Criteria
AIA	Agriculture Impact Assessment
ANSI	Area of Natural and Scientific Interest
BMP	Best Management Practices
BOD	Biochemical Oxygen Demand
BP	Before Present
C_2H_3Cl	Vinyl Chloride
C of A	Certificate of Approval
CAAQS	Canadian Ambient Air Quality Standards
CadnaA	Computer Aided Noise Attenuation
CAZ	Contaminant Attenuation Zone
CEPA	Canadian Environmental Protection Act
CHVI	Cultural Heritage Value or Interest
CLI	Canada Land Inventory
CO	Carbon Monoxide
CO_{2e}	Carbon Dioxide Equivalents
CR&D	Construction, Renovation and Demolition Waste
CVC	Credit Valley Conservation
DFO	Department of Fisheries and Oceans
DOC	Dissolved Organic Carbon
EA	Environmental Assessment
EAA	Environmental Assessment Act (Ontario)
EASR	Environmental Assessment Study Report

Acronym	Definition
ECA	Environmental Compliance Approval
ECCC	Environment and Climate Change Canada
EFW	Energy from Waste
ELC	Ecological Land Classification
EOWHF	Eastern Ontario Waste Handling Facility
EPA	Environmental Protection Act (Ontario)
ESA	Endangered Species Act
ESC	Erosion and Sediment Control
GHG	Greenhouse Gases
GHGRP	Greenhouse Gas Emissions Reporting Program
GIS	Geographic Information System
GRT	Government Review Team
HADD	Harmful alteration, disruption or destruction
H	Horizontal
H_2S	Hydrogen Sulphide
HDF	Headwater Drainage Features
HHW	Household Hazardous Waste
HVAC	Heating, Ventilation and Air Conditioning
IC&I	Industrial, Commercial and Institutional Waste
IDF	Intensity Duration Frequency
L&Y	Leaf and Yard
LF	Landfill
LFG	Landfill Gas
LIO	Land Information Ontario
L_{LM}	Logarithmic Mean Impulse Sound Level
LOS	Level of Service

Acronym	Definition
MECP	Ministry of the Environment, Conservation and Parks (formerly MOE, MOECC)
MHSTCI	Ministry of Heritage, Sport, Tourism and Cultural Industries
MMAH	Ministry of Municipal Affairs and Housing
MNDM	Ministry of Northern Development and Mines
MNRF	Ministry of Natural Resources and Forestry
MOECC	Ministry of the Environment and Climate Change
MTCS	Ministry of Tourism Culture and Sport
MTO	Ministry of Transportation Ontario
NAPS	National Air Pollution Surveillance Network
NOC	Notice of Commencement
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
NHIC	Natural Heritage Information Centre
NHRM	Natural Heritage Reference Manual
NAAQO	National Ambient Air Quality Objective
NRVIS	Natural Resource Values Information System
O_3	Ozone
OHA	Ontario Heritage Act
OMB	Ontario Municipal Board
O. Reg.	Ontario Regulation
OP	Official Plan
OSAP	Ontario Stream Assessment Protocol
OWES	Ontario Wetland Evaluation System
OWRA	Ontario Water Resources Act
PFAS	Perfluoroalkyl and Polyfluoroalkyl Substances
PPS	Provincial Policy Statement

Acronym	Definition
$PM_{2.5}$	Particles Nominally Smaller than 2.5 µm in Diameter
PM_{10}	Particles Nominally Smaller than 10 µm in Diameter
PoE	Pathways of Effects
PORs	Points of Reception
POW	Plane of Window
PSW	Provincial Significant Wetland
PWQO	Provincial Water Quality Objectives
RPRA	Resource Productivity and Recovery Authority
RRC	Raisin River Conservation
RUG	Reasonable Use Guideline
SAR	Species at Risk
SARA	Species at Risk Act
SCS	Soils Conservation Service
SDG	United Counties of Stormont, Dundas and Glengarry
SNC	South Nation Conservation
SO_2	Sulphur Dioxide
SOCC	Species of Conservation Concern
SPM	Suspended Particulate Matter
SRD	Special Rural – Waste Disposal Zone
SSO	Source Separated Organics
SWH	Significant Wildlife Habitat
SWHECS	Significant Wildlife Habitat Ecoregion Criterion Schedules
SWHMiST	Signification Wildlife Habitat Mitigation System Tool
SWHTG	Significant Wildlife Habitat Technical Guide
SWM	Stormwater management
SWMP	Stormwater Management Pond

Acronym	Definition
SWMS	Stormwater management system
SWP	Source Water Protection
TDS	Total Dissolved Solids
ToR	Terms of Reference
ToT	Time of Travel
TRCA	Toronto and Region Conservation Authority
TSS	Total Suspended Solids
US EPA	United States Environmental Protection Agency
UTL	Upper Tolerance Limit
V	Vertical
VES	Visual Encounter Survey
VOC	Volatile Organic Compound
WHPA	Wellhead Protection Area
WEEE	Waste Electrical and Electronic Equipment
WWIS	Well Water Information System

Units of measure

Acronym	Definition of Units
dBA	decibels
cm	centimetre
ha	hectare
g	gram
hr	hour
km	kilometre
km^2	square kilometres
m	metre

Acronym	Definition of Units
masl	metres above sea level
mm	millimetre
m^3	cubic metre
L	Litre
$L_{eq,1hr}$	one hour equivalent sound level
OU	Odour Unit
s	second
scfm	standard cubic feet per minute
$\mu g/m^3$	Microgram per cubic metre
yr	year

GLOSSARY OF TERMS

Term	Definition
'Alternative Methods'	Alternative methods of carrying out the proposed undertaking are different ways of doing the same activity associated with an undertaking. Alternative methods could include consideration of one or more of the following: alternative technologies; alternative methods of applying specific technologies; alternative sites for a proposed undertaking; alternative design methods; and, alternative methods of operating any facilities associated with a proposed undertaking.
'Alternatives To'	Alternatives to the proposed undertaking are functionally different ways of approaching and dealing with a problem or opportunity.
Ambient Air	Open air not enclosed in a structure, machine, chimney or stack.
Aquifer	A layer of permeable soil, i.e., sand and/or gravel, or bedrock through which groundwater flows and can yield enough water to supply wells for use.
Berm	At a landfill site, a narrow mound or ridge comprised of soil (for example, a screening berm used to block the view of the landfill activities from off-site)

Term	Definition
Borehole	A hole drilled into the ground to obtain information on the soil, bedrock and groundwater conditions and characteristics. A borehole can be completed as a groundwater monitoring well.
Buffer Area	The part of the landfill site not used for waste disposal, usually between the perimeter of the disposal area and the landfill property boundary.
Certificate of Approval (Waste)	An approval issued by the Ministry of the Environment for the establishment and operation of a waste management site/facility. Now referred to as an Environmental Compliance Approval.
Township of North Dundas	The Township of North Dundas (the proponent); used when referencing the political or corporate administrative body.
CR&D Waste	Waste generated by the Construction, Renovation and Demolition sector of the economy.
Criteria	A description of each environmental component to be considered in the environmental assessment, consisting of the rationale for including the component and the indicator(s) to be used in the assessment.
Cumulative Effects	The net effects of the proposed undertaking combined with the predicted effects of other existing and identified certain and probable projects in the area of the proposed undertaking, where the effects would overlap.
Disposal Area	The area within the landfill property approved for the disposal of residual waste; also referred to as the waste footprint.
EA Study	The activities associated with the EA for the Township of North Dundas Waste Management Plan, as described in the approved Terms of Reference (ToR).

Term	Definition
Environment	As defined by the *Environmental Assessment Act* [1], 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	An environmental assessment, commonly known as an individual EA, is a study that is completed by the proponent to assess the potential environmental effects (positive or negative) of an individual undertaking.
Environmental Compliance Approval	An approval issued by the Ministry of Environment, Conservation and Parks for the establishment and operation of a waste management site/facility.
Environmental Components	Environmental components are different aspects of the natural, social, economic, cultural and built environments.
Greenfield Site	A parcel of land that has not been previously developed for urban use, i.e., rural or agricultural land or green space.
Groundwater	Water below the ground surface contained in the pore spaces in soil or in openings within the bedrock.
Haul Route	Public roadways used by vehicles transporting waste to a landfill site.
Hazardous Waste	Waste generated from any source that is defined as hazardous by the regulations of Ontario.
Indicators	Specific characteristics of the environmental components that can be measured, qualified, quantified or determined in some way.

Term	Definition
IC& I Waste	Waste generated by the Industrial, Commercial & Institutional sector of the economy.
Landfill	An approved site used for the long-term disposal of residual waste.
Landfill Capacity	The volume approved for disposal of residual wastes and cover materials, described in cubic metres. Also referred to as the approved airspace.
Landfill Expansion	An increase in the approved landfill capacity.
Landfill Gas	Gases generated from the anaerobic decomposition of organic waste materials; mainly consisting of methane and carbon dioxide and traces of other gases
Landfill Gas Collection System	The system used to collect the gases generated by decomposition of the waste in the landfill, typically consisting of a network of gas wells and/or horizontal piping attached to vacuum to extract the gas and convey it to a location where the gas can be combusted in a gas flare or processed for subsequent use.
Leachate	The liquid produced when water (typically rainwater or snowmelt) passes through a landfill and contains contaminants as a result of coming in contact with the waste.
Leachate Collection System	The system used to collect leachate generated by a landfill, usually consisting of a network of piping and drainage stone beneath or around the perimeter of the disposal area.
Mitigation Measures	Design features and/or operational approaches used to control the potential effects of the landfill on the environment.
Monitoring Well	An installation at a selected depth in a borehole in which the groundwater level can be measured and groundwater samples obtained for chemical analysis to determine its quality. At a landfill, this information is typically monitored at some frequency over time and is referred to as a groundwater monitoring program.
Non-hazardous Solid Waste	Waste generated from any source that is defined as non-hazardous and solid by the regulations of Ontario.
Ontario Regulation 232/98	The regulation that governs the design, operation, closure and post-closure of new or expanding waste disposal sites in the province of Ontario.

Term	Definition
Proponent	A person, corporation, government agency or other legal entity who: a) Proposes to carry out an undertaking, or b) Is the owner or person having charge, management or control of an undertaking. For this EA Study and undertaking, the proponent is the Township of North Dundas.
Reasonable Use Guideline (or Concept)	The Ministry of Environment, Conservation and Parks guideline used to determine the acceptable level of impact from landfill leachate on off-site groundwater quality, and used to assess compliance of landfill sites in terms of effects on groundwater resources.
Receptor	A specific location where the effect(s) from a waste management facility may be received. Also referred to as Points of Reception (PORs).
Residential Waste	Waste generated by residences (ranging from singe to multi-residential units).
Residual Waste	The waste material that cannot be diverted through recycling or other processes and requires disposal.
Service Area	The geographic area from which generated waste can be received at a recycling or disposal site, in accordance with the approval for the recycling or disposal site.
(the) Site	(the) Township of North Dundas.
Site Life	The period of time during which the Boyne Road Landfill can continue to accept wastes.
Stormwater Management System	An engineered system to manage/control the quantity and/or quality of stormwater runoff from the site, typically consisting of ditches and ponds that discharge to the natural environment.
Surface Water	Water on top of or flowing across the ground surface, i.e., lakes, rivers, ditches.

Term	Definition
Terms of Reference	A document prepared by the proponent and submitted to the Ministry of Environment, Conservation and Parks for approval. The Terms of Reference (ToR) document sets out the framework for the planning and decision-making process to be followed by the proponent during the preparation of an EA. In other words, it is the Township of North Dundas' (the proponent's) work plan for what is going to be studied. If approved, the EA must be prepared according to this ToR. The ToR also provides the framework for evaluating the EA.
(the) Undertaking	The activities associated with the EA for the Township of North Dundas Waste Management Plan, as described in this EASR.
Waste Generation Rate	The quantity of waste generated by an individual(s) on a daily or annual basis, typically described in tonnes (or kilograms) per person per year.

1.0 Introduction

This document is the environmental assessment study report (EA Study Report) for the environmental assessment (EA) of the Township of North Dundas Waste Management Plan (the EA Study) being undertaken by the Township of North Dundas (the Township). This is an individual EA completed under the provincial *Environmental Assessment Act* (EAA). This EA was prepared following the 2014 *Code of Practice for Preparing and Reviewing Environmental Assessments* in Ontario (MOECC, 2014). This EA has been completed and will be submitted to the Ministry of Environment, Conservation and Parks (MECP) following the approved Terms of Reference (ToR) as required by subsection 6.1(1) of the EAA, and in accordance with the requirements of subsection 6.1(2) of the EAA.

An EA is a planning study that assesses environmental effects and advantages and disadvantages of a proposed undertaking. The environment is considered in broad terms to include the natural, social, and technical aspects of the environment. The first step in the individual EA process is to develop a ToR, which provides the framework for the preparation of the EA. Two public open house meetings were hosted by the Township as part of the consultation process for the development of the ToR. A ToR was developed by the Township, submitted to the MECP on Aug 2, 2019 and approved by the MECP (Minister) on July 1, 2020. An overview of the ToR development and approval process is provided in Section 2.2 of this EA Study Report (EASR). The approved ToR is provided in Volume 2 Appendix A.

Consultation was an important component for the development of the ToR. The Township has developed a Consultation Plan as part of the ToR to be considered throughout the EA process. The key vehicles in the Consultation Plan that were used to engage the public and the other stakeholders and elicit feedback were open houses, letter/email correspondence, the Township's Environmental Assessment North Dundas Waste Management Plan website (the EA Website) and newspaper and social media advertisements.

The following sections identify the proponent and describe the site, the need for the EA Study and the purpose of the EA Study. They also provide an overview of the history of the EA Study, along with the development of the ToR, and the scope of approvals being sought. An outline of the entire EASR is provided in Section 2.4.2 of this report.

1.1 Description of the EA Study

The proposed EA Study is the EA of the Township's waste management plan for a 25-year planning period. The description and rationale have evolved during the preparation of the EA. A description of the undertaking was defined after a preferred undertaking was identified during the EA. Therefore, the final description of the proposed undertaking and the rationale for it are included in the EA once the alternatives were considered and evaluated.

1.2 Identification of Proponent

The Township is the proponent for the proposed EA Study. The Township is located in eastern Ontario about 40 kilometres (km) south of Ottawa within the United Counties of Stormont, Dundas and Glengarry as shown in Figure 1-1, and has a total area of 503 square kilometres (km^2) and a 2016 population of 11,278. The contacts for this project are as follows:

Doug Froats
Director of Waste Management
Township of North Dundas
636 St. Lawrence Street
P.O. Box 489
Winchester, ON K0C 2K0
Telephone: 613-774-2105 ext. 228
Fax : 613-774-5699
E-mail : dfroats@northdundas.com

Trish Edmond, P.Eng.
EA Project Manager
Golder Associates Ltd.
1931 Robertson Road
Ottawa, ON K2H 5B7

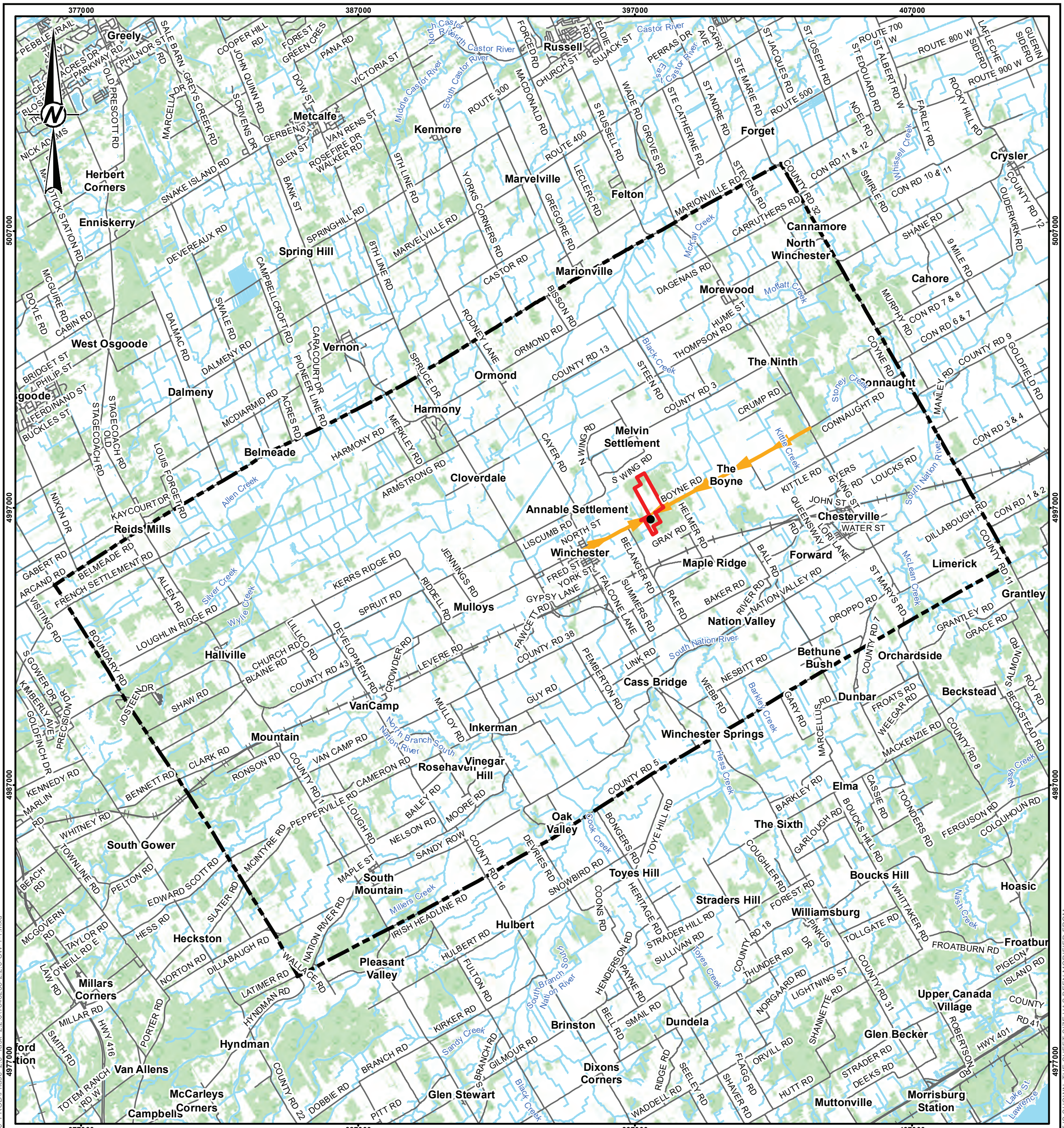
Telephone: 613-592-9600

E-mail : trish_edmond@golder.com

1.3 Current Waste Management System

1.3.1 Overview of Waste Management System

The Township, through its Waste Management department, currently provides curbside waste collection and disposal services to its ratepayers for residential and some institutional, commercial and industrial waste. It also provides waste diversion services, including recyclable materials, tire recycling, as well as the collection of household hazardous waste (HHW) and Waste Electrical and Electronic Equipment (WEEE) for export to authorized processing facilities. A pilot program for leaf and yard waste is currently providing collection services for this material to two villages in the Township, with two collection events per year. The HHW facility also serves the Township of South Dundas. The Township’s diversion rate, as reported in 2017 and 2018 to Resource Productivity and Recovery Authority, is approximately 23 percent (%) (RPRA, 2017, 2018). The waste diversion rate for the Township is expected to be similar in 2019 and 2020.



LEGEND

- DISPOSAL AREA
- HAUL ROUTES
- TOWNSHIP OF NORTH DUNDAS
- CURRENT ACTIVE BOYNE ROAD LANDFILL SITE PROPERTY

DRAFT

0 2 4 8

1:200,000 KILOMETRE

REFERENCE(S)
1. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: MTM ZONE 9 VERTICAL DATUM: CGVD28

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
STUDY LOCATION MAP

CONSULTANT

GOLDER MEMBER OF WSP

YYYY-MM-DD	2019-02-25
DESIGNED	PLE
PREPARED	JEM
REVIEWED	YJM
APPROVED	PLE

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	0	1-1

Path: N:\Active\Spatial_IM\Township of North Dundas\BoyneRoadLandfill\99_PROJ\1648253\40_PROD\Phase_2.0_Task_2.2.0\1648253-2.2.0-CW-1-1.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 25mm 0

The material recycling facility, the HHW and WEEE transfer station as well as the waste disposal facility are located at the Township's Boyne Road Landfill site. All recyclables (metal, plastic, paper, cardboard) collected within the Township are taken to the recycling transfer station at the Boyne Road Landfill site, from where they were transferred out of the Township by a recycling contractor. In 2019, the following recyclable materials were collected and diverted from landfill: approximately 127 tonnes of paper, 336 tonnes of cardboard, 32 tonnes of plastic, 10 tonnes of aluminum, and 30 tonnes of steel cans. Between January and June 2020, the following materials were collected by a recycling contractor: approximately 194 tonnes of cardboard, 48 tonnes of paper, 92 tonnes of plastic, and 17 tonnes of steel. From July through December 2020 onwards, the Township directed the following recyclable material collected at curbside to the recycling facility in Brockville: 119.57 tonnes of plastic, cans, and glass; and 264.43 tonnes of fibrous material (paper and cardboard). The tonnages reported for paper and cardboard are derived from both residential and industrial, commercial and institutional (IC&I) sources, whereas the other materials are primarily residential.

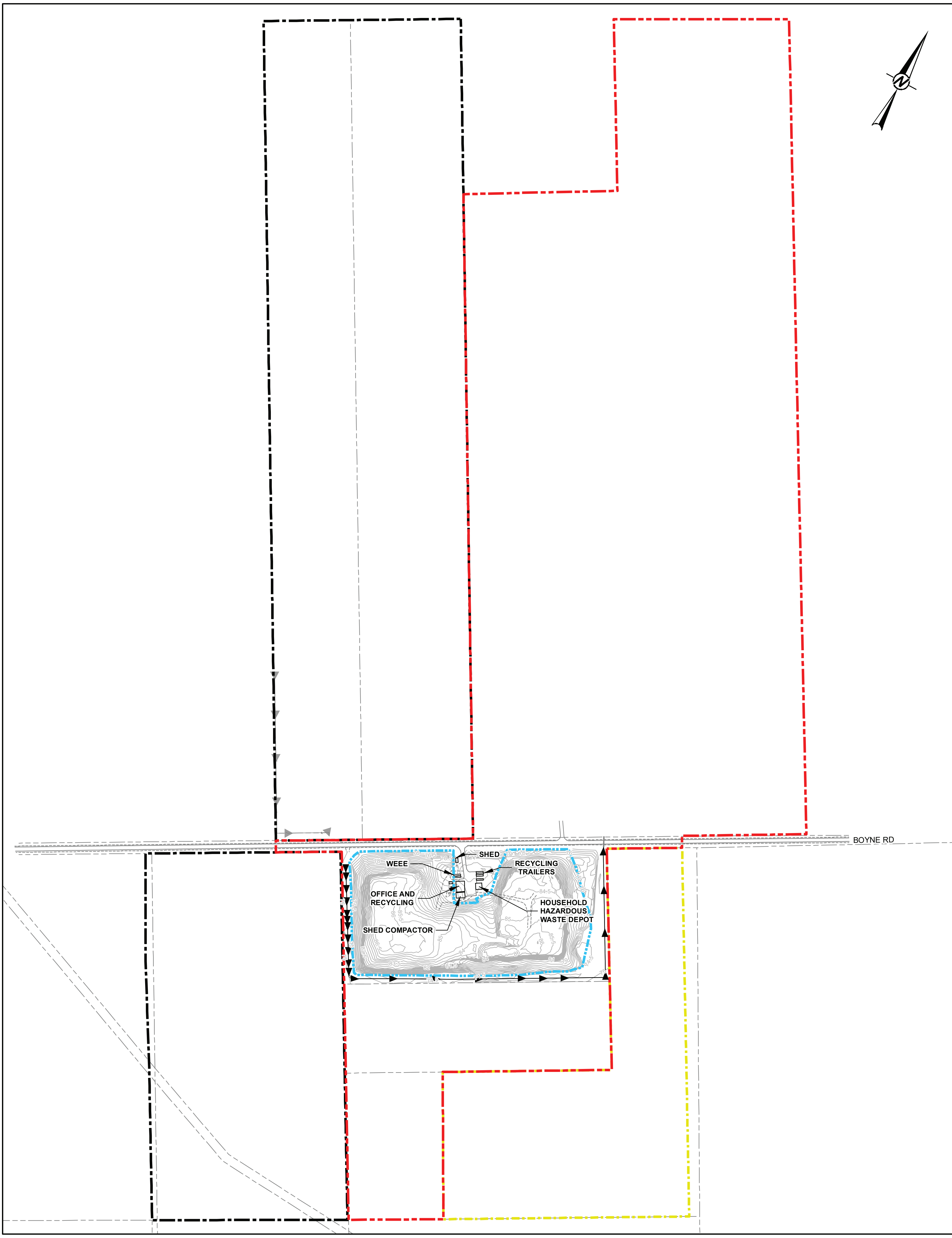
1.3.2 Residual Waste Disposal (Boyne Road Landfill Site)

The Boyne Road Landfill is located on Lot 8, Concession VI in the former Township of Winchester, along the south side of Boyne Road about 2 km east of the Village of Winchester, which is approximately mid-way between the two main population centres within the Township – the Villages of Winchester and Chesterville. The service area for the landfill is the Township of North Dundas. The current extent of the landfill site property is shown on Figure 1-2. The site has been operating as a licensed landfill for the disposal of solid, non-hazardous waste since 1965. The Boyne Road Landfill is the only operational waste disposal site in the Township and receives all the residential and some of the IC&I residual waste from the entire Township. The waste collection vehicles haul along the municipal road network directly to disposal at the landfill site; there is no transfer station facility. The Township is mainly rural with several small villages, with Winchester and Chesterville being the two largest villages. The landfill site operates under Environmental Compliance Approval (ECA) No. A482101.

The main haul routes to the Boyne Road Landfill are indicated on Figure 1-1. The main haul route is via Boyne Road, either directly out from the Village of Winchester to the west or from the Village of Chesterville to the east using County Road 7 and then westward along Boyne Road to the landfill site.

The Boyne Road Landfill currently has an approved disposal area of 8.1 hectares (ha). The land area that comprises the landfill property consists of the original disposal area and the addition of a number of parcels of adjoining land between 1992 and 2018 located around the original disposal area, corresponding to a total land area of approximately 97.13 ha. This includes a 20 metre (m) wide strip of Boyne Road across the northern edge of the landfill footprint and a 73.48 ha parcel of land located north of Boyne Road, both added to the landfill in 2018 as per Notice No. 9 of the ECA dated January 31, 2018. For purposes of this EA, which proposes to consider all reasonable waste management options including the alternative of expanding the Boyne Road Landfill, the Township acquired an additional

16.21 ha (40.05 acres) of property to the east and southeast to possibly be added to the site pending the outcome of the EA, eventually bringing the total site area to approximately 113.34 ha. In addition to the landfill property, the Township has acquired groundwater easements (referred to as Contamination Attenuation Zones (CAZs) 1 and 2 in the ECA). These parcels are shown on Figure 1-2.



LEGEND

- EXISTING LANDFILL FILL AREA
- APPROXIMATE BOUNDARY OF CONTAMINANT ATTENUATION ZONE
- TOWNSHIP OWNED PROPERTY
- APPROXIMATE LANDFILL SITE PROPERTY BOUNDARY
- APPROXIMATE LOCATION OF PERIMETER DITCH AND FLOW DIRECTION
- GROUND SURFACE CONTOURS (masl), BASED ON RESULTS OF THE SURVEYS CONDUCTED IN 2008, 2010, AND 2012 THROUGH 2020

REFERENCES

1. BASE PLAN SUPPLIED IN ELECTRONIC FORMAT BY STANTEC CONSULTING LTD.
2. 2008 AND 2010 SURVEYS COMPLETED BY STANTEC CONSULTING LTD.
3. MAY 2012, JULY 2013, NOVEMBER 2014, DECEMBER 2015, NOVEMBER 2016, AND DECEMBER 2017 SURVEYS COMPLETED BY GOLDER ASSOCIATES LTD.

DRAFT

0 60 120 180 240 300
1:6,500 METRES

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

CONSULTANT
GOLDER MEMBER OF WSP

YYYY-MM-DD	2021-05-27
PREPARED	JEM
DESIGN	PLE
REVIEW	YJM
APPROVED	PLE

TITLE
BOYNE ROAD LANDFILL SITE PLAN

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	0	**1-2**

Based on the original application for licensing of the landfill in 1971, the approved landfill site capacity was approximately 395,000 cubic metres (m^3). When it was first determined in late 2014 that the landfill site was in an overfill situation, the volume of waste in place was approximately 462,000 m^3. As of December 1, 2020, the volume of waste in place was about 560,000 m^3. Additional details regarding the current status of the landfill site to be able to continue to receive waste for disposal are provided in Section 2.1 of this EASR.

As of the end of 2020, there was approximately 48,000 m^3 of approved airspace remaining in the landfill, which is expected to allow for disposal until the end of 2023 to mid-2024.

Operation of the landfill site, including its diversion facilities, is carried out by the Township in accordance with the requirements of its ECA conditions. The existing landfill site is a natural attenuation landfill, without an engineered bottom liner and leachate collection system. Compliance of the landfill with the applicable requirements for protection of off-site groundwater quality relies on natural processes in the subsurface. An annual monitoring program, consisting of groundwater and surface water monitoring, is part of the current landfill site operations. The results of the 2020 monitoring program (Golder 2021) indicate that with respect to protection of off-site groundwater quality, the landfill is operating in compliance with the Ministry of Environment, Conservation and Parks (MECP) Reasonable Use Guideline (MOE, 1994). Surface water quality in the often-stagnant water within the drainage ditch along the north side of Boyne Road that receives surface water runoff from the landfill site is interpreted to experience discontinuous marginal impacts by landfill leachate but is generally in compliance with provincial surface water management policies. The results of the landfill monitoring programs show that the Boyne Road Landfill is performing acceptably and the impacts on the natural environment are deemed acceptable as described in the most recent ECA amendment approving continued landfilling (dated January 30, 2019).

2.0 Overview of the Environmental Assessment Process and Environmental Assessment Study Report

2.1 Rationale and Purpose of the Proposed Undertaking

As part of a 2013 application procedure intended to update a number of items related to the Boyne Road Landfill operations and amend the Boyne Road Landfill ECA, the MECP determined in late 2014 that the landfill had exceeded its originally approved capacity and was in an overfill situation. At that time, it had been estimated that the landfill had approved disposal capacity through 2022. Due to the elements governing the originally approved landfill site capacity, the Township was unexpectedly required to evaluate waste management alternatives to deal with this overfill situation at the landfill.

To continue using the landfill in the short-term, an amendment to the ECA for extension of approval for continued landfilling (emergency ECA) was received from the MECP and required the Township to evaluate long-term waste management alternatives (Golder, 2015).

Using an assumed planning period of 25 years, the previously completed study provided an evaluation of waste management options to address the overfill situation at the Boyne Road Landfill using a combination of technical, approvability and financial factors to assist the Township in identifying a preferred course of action to provide both short-term and long-term waste management services for the municipality. This previous assessment of waste management alternatives was summarized in Section 4.0 of the approved ToR (Volume 2, Appendix A).

The alternatives considered by the Township consisted of the following:

- Alternative 1 – Landfill Site Closure and Export of Waste for Disposal
- Alternative 2 – Landfill Site Expansion
- Alternative 3 – Establish New Landfill Site in the Township
- Alternative 4 – Alternative Waste Management Technologies (thermal treatment, e.g., Energy from-Waste).

Alternatives 3 and 4 were not expected to be financially viable alternatives for a small rural municipality considering the small population and relatively small volume of waste generated within the Township; as well, these alternatives would involve a lengthier and likely more contentious approvals process, and/or the need to collaborate with other municipalities. Alternatives 3 and 4 were therefore screened out early in the evaluation, and in the assessment only Alternatives 1 and 2 were considered in detail.

Alternative 1 would involve the following steps: 1) preparation of a closure plan for the landfill site; 2) application to establish a waste transfer facility at the site; 3) negotiation of a disposal contract at a privately owned landfill facility and commence hauling for disposal; and 4) completion of the landfill closure works. Post-closure monitoring and maintenance of the landfill would be ongoing. For Alternative 1, two scenarios were considered: Alternative 1a where services would be provided to export both the residential and non-residential waste that is currently disposed at the Boyne Road Landfill (estimated 8,000 tonnes/year), and Alternative 1b where service would be provided for only the residential waste component (estimated 2,900 tonnes/year). For Alternative 1b, the owners of all non-residential generated waste would have to make their own arrangements for disposal at facilities other than those provided by the Township.

Alternative 2 would involve a landfill expansion of more than 100,000 m^3 of capacity and require an individual EA according to the Waste Management Projects Regulation (Ontario Regulation 101/07) and the following steps would be followed: 1) obtain MECP approval to continue landfilling operations on the existing approved footprint at the Boyne Road Landfill site during the expansion approvals process; 2) identify the property and easements that may be required for the expansion and if possible secure options to acquire them during the ToR or EA; 3) commence EA process; 4) assuming landfill expansion was selected during the EA, after EA approval, apply for an amended ECA for expanded site operations (expected 5 to 6 year combined EA and ECA approvals process); and 5) construct initial phase and associated works for the expansion area and commence landfilling within the expansion.

For Alternative 2, preliminary studies were undertaken to assess potential impacts associated with a conceptual expanded Boyne Road Landfill layout on specific aspects of the environment: groundwater, surface water, atmospheric (air, odour, noise) and natural environment (biology). For purposes of this preliminary assessment, a conceptual design configuration of the expansion was located on the south side of the existing landfill.

To compare Alternatives 1 and 2, the following evaluation factors were considered,

- Technical feasibility
- Likelihood to obtain MECP Approval
- Opinion of Probable Costs (capital expenditures and long-term annual operating costs over 30 years)

The advantages and disadvantages of Alternatives 1 and 2 were also determined and considered. The result of the comparative evaluation was that expansion of the existing Boyne Road Landfill was identified as the preferred long-term waste management alternative. Based on the findings of this evaluation, a Council resolution was passed in November 2015 to pursue approval to expand the landfill site via an Environmental Assessment pursuant to the Ontario *Environmental Assessment Act* (EAA).

The Environmental Assessment commenced in late February 2017 and open houses on preparation of the ToR were held in March and October 2017, followed by preparation and circulation of the Draft ToR in late April 2018. At this point, the EA was for the expansion of the Boyne Road Landfill site. Based on comments received on the Draft ToR from the MECP in December 2018, it was determined that the 2015 assessment of waste management alternatives was not completed with the necessary detail to support the identified preferred 'Alternative To' – expansion of the Boyne Road Landfill – at a level of detail considered appropriate for an EA. As such, key changes were made to the Draft ToR and were presented in the Final ToR to review and re-assess the waste management alternatives that are reasonable for the Township to consider within the EA process and identify the preferred alternative. To reflect this revised approach, the title of the EA Study was changed to Environmental Assessment of the Township of North Dundas Waste Management Plan.

Starting in 2015, the Township applied annually for an extension to allow continued landfilling operations at the site. Subsequently in 2019, the MECP identified that the Township was not required to seek annual ECA extensions, but rather should apply for an administrative amendment to the landfill site ECA to request that the expiry date for continued landfilling currently provided in Condition 2.1 (a) of the ECA be removed and instead allow continued landfilling operations until reaching the final waste contours design presented in Section 7.0 and Figure 3 of the 2013 Design & Operations Plan (Golder, 2013) while the Township pursues an EA for its long-term waste management plan. The ECA amendment approval permitting this change was received from the MECP in January 2020.

An EA Study location map is provided on Figure 1-1 showing the Township of North Dundas and the location of the current active Boyne Road Landfill.

The purpose of the proposed EA Study has been reviewed since approval of the ToR and is confirmed as:

To provide environmentally safe and cost-effective long-term waste management for the Township of North Dundas for a 25 year planning period.

The purpose statement will be influenced by diversion studies proposed by the Township and made as a commitment in the ToR. It was proposed that the diversion studies be conducted during the EA, early in the process to provide input into post-diversion residual waste management requirements. Diversion is also an ‘Alternative To’ in this EA. The Waste Diversion Study is provided in Volume 3 Appendix J to the main EASR and the results are summarized in Sections 6.3.5 and 7.0 of this report. The Township has reviewed the purpose of this EA throughout the EA process. The purpose has not changed from that discussed in the approved ToR.

2.2 Approval of the Terms of Reference (ToR)

The Township prepared the ToR for the EA of the Township Waste Management Plan according to the Code of Practice *Preparing and Reviewing Terms of Reference for Environmental Assessments in Ontario* (MOECC, 2014b). The ToR was submitted to the Minister on August 2, 2019. The ToR was approved by the MECP on July 1, 2020.

The first step in the EA process is the preparation of the ToR. Once approved, the ToR becomes the framework for conducting the EA. The ToR was submitted to the MECP, government review team (GRT) members, Indigenous communities and the public for review and comments. The comments received by the MECP were considered in their review of the proposed ToR and in the decision regarding approval to carry out an individual EA under the EAA.

As noted in the approved ToR, the Township committed to preparing and submitting an EA to the MECP for review and approval in accordance with the approved ToR as required by subsection 6.1(1) of the EAA, and in accordance with the requirements of subsection 6.1(2) of the EAA.

The subsections that will be addressed by the EA are listed in Table 2-1.

2.3 Development of the EA Study Report

2.3.1 Concordance of ToR and EA Study Report Documentation

As noted previously, the ToR provides the framework for conducting and evaluating the EA. This EASR fully addresses the requirements of the ToR.

Table 2-1 documents the concordance between the legislative EA requirements under the EAA and this document. It is intended to assist readers that wish to review and evaluate the EA. The left column of the table states the requirements listed in the ToR and the right column indicates the location(s) in the EASR where the requirement is addressed.

Table 2-1: Concordance Table

Subsection of EAA (Ontario, 1990a)	EA Requirements	Section of the EASR
6.1(2*)(*a)	A description of the purpose of the undertaking.	Section 2
6.1(2)(b)(i)	A description of and statement of the rationale for the undertaking.	Section 2
6.1(2)(b)(ii)	A description of and statement of the rationale for the 'Alternative Methods' of carrying out the undertaking.	Section10
6.1(2)(b)(iii)	A description of and a statement of the rationale for the 'Alternatives To' the undertaking.	Section 6
6.1(2)**I**(i)	A description of the environment that will be affected or that might reasonably be expected to be affected, directly or indirectly.	Sections 5 and 9
6.1(2)(c)(ii)	A description of the effects that will be caused or that might reasonably be expected to be caused to the environment.	Sections 6 and 13
6.1(2)(c)(iii)	A description of the actions necessary or that may reasonably be expected to be necessary to prevent, change, mitigate or remedy the effects upon or the effects that might reasonably be expected upon the environment.	Sections 10 and 12

Subsection of EAA (Ontario, 1990a)	EA Requirements	Section of the EASR
6.1(2)(d)	An evaluation of the advantages and disadvantages to the environment of the undertaking, the ‘Alternative Methods’ of carrying out the undertaking and the ‘Alternatives To’ the undertaking.	Sections 6.4 and 11.2
6.1(2)(e)	A description of any consultation about the undertaking by the Township and the results of the consultation.	Section 4

2.3.2 Organization of the EA Study Report

This EASR is presented in four volumes. Volume 1 (this volume) describes the EA studies, consultation results, effects assessment of alternatives, and identification of the preferred alternative.

Volume 1 of the EASR contains 19 sections as follows:

- Section 1 – Provides an introduction to the EA and relevant background information
- Section 2 – Provides an overview of the EA process
- Section 3 – Presents the methodology used in the assessment
- Section 4 – Presents the consultation process and results of each event
- Section 5 – Describes the existing conditions in the Study Area for the assessment of ‘Alternatives To’, which is the Township of North Dundas
- Section 6 – Provides the description, rationale for and assessment of ‘Alternatives To’ for waste management and identifies the preferred ‘Alternative To’
- Section 7 – Provides updated residual waste disposal requirements including findings of the Waste Diversion Study Report (Volume 3 Appendix J)
- Section 8 – Provides the Study Areas and environmental component workplans related to assessment of ‘Alternative Methods’
- Section 9 – Describes the existing environmental conditions within the study areas for landfill expansion for each of the environmental components
- Section 10 – Provides a description of and rationale for the ‘Alternative Methods’ to landfill expansion

- Section 11 – Presents the potential effects of each 'Alternative Method' for landfill expansion and the comparative evaluation of alternatives, including consideration of advantages and disadvantages of each alternative, as well as the identification of the preferred 'Alternative Method'
- Section 12 – Describes the proposed undertaking
- Section 13 – Presents the prediction of effects of the proposed undertaking and assesses the need for additional mitigation measures
- Section 14 – Presents climate change considerations for the undertaking
- Section 15 – Presents a cumulative impact assessment
- Section 16 – Describes the follow-up monitoring programs to assess that the landfill is performing as expected and presents contingency measures that would be implemented should the proposed undertaking not perform as expected
- Section 17 – Describes other approvals required to implement the undertaking
- Section 18 – Summarizes the commitments made in the approved ToR and EA
- Section 19 – Provides a list of reference documents used in preparation of this EA

Note that J.L. Richards and Associates Limited and D.J. Halpenny & Associates Ltd. contributed to the component write-ups in Sections 5.6, 9.5, 9.6, 13.5 and 13.6 and in Sections 5.9, 9.9 and 13.9 of the EASR, respectively.

Volume 2 contains the approved ToR and Technical Appendices to this EA that are mostly supporting information, calculations, etc. unless otherwise noted. The following Appendices are contained in Volume 2:

- Appendix A: Approved ToR (Volume 1)
- Appendix B: Air Quality and Odour Technical Appendices
- Appendix C: Noise Technical Appendices
- Appendix D: Geology, Hydrogeology and Geotechnical Technical Appendices
- Appendix E: Surface Water Technical Appendices
- Appendix F: Biology Technical Appendices
- Appendix G: Cultural Heritage Resources Technical Appendices including the Stage 1 Archaeological Assessment in Appendix G-2
- Appendix H: Traffic Technical Appendices (completed by D.J. Halpenny & Associates Ltd.)

Volume 3 contains supporting documents to this EA. The following Appendices are contained in Volume 3:

- Appendix I: New Landfill Site Selection Assessment memo on Alternative 3 – New Landfill Site Selection Assessment, Application of Exclusionary Criteria and Mapping to Identify Potential Sites
- Appendix J: Waste Diversion Study Report

Volume 4 contains the Consultation Record for this EA.

3.0 Methodology for the Assessment

The methodology used to conduct the EA is loosely described in sections 4.2 and 5.1 of the approved ToR (see Volume 2 Appendix A) and further refined and summarized in the sections below. The methodology included characterization of the existing environment for both the assessment of ‘Alternatives To’ and ‘Alternative Methods’, consideration of ‘Alternatives To’ and then ‘Alternative Methods’ for carrying out the proposed undertaking, prediction and assessment of the likely effects of these alternatives on the natural, social, and technical aspects of the environment, and identification of a preferred alternative through a comparative evaluation of alternatives. Consultation with the public, Indigenous communities, GRT members, and other stakeholders was ongoing throughout the EA process.

The following steps were followed:

3.1 Identify Study Areas and Characterize Existing Environmental Conditions of the Waste Management Plan Study Area

Study areas and existing conditions for the ‘Alternatives To’ assessment related to the waste management plan were identified in the ToR and updated in the EASR.

3.2 Confirm ‘Alternatives To’ and Evaluation of ‘Alternatives To’

The preliminary identification of environment categories and preliminary evaluation criteria presented in the ToR were further refined into the proposed components, criteria and indicators for the evaluation of ‘Alternatives To’.

The list of ‘Alternatives To’ were identified and approved as part of the ToR. These ‘Alternatives To’ were considered and determined to still be the representative alternatives available to the Township of North Dundas for a 25-year planning period.

To provide a basis for comparative evaluation, each of the alternatives was developed at a conceptual level so that their feasibility of implementation, potential effects on the environment and relative advantages and disadvantages could be identified.

The potential effects and/or implications of each alternative was generally identified and described for each of the evaluation criteria. A qualitative assessment methodology was then used to complete a comparative assessment. The methodology consisted of assigning an overall relative ranking from most preferred to least preferred for each alternative, first for each of the criteria and then for the environmental component.

As part of the comparative assessment, the advantages and disadvantages of each ‘Alternative To’ were then described. The Do-Nothing alternative was included in this comparison.

The outcome of this ranking exercise was the identification of the preferred ‘Alternative To’ for waste management for the Township.

3.3 Update the Waste Diversion and Residual Waste Requirements

To update the residual waste management requirements, it was first necessary to complete a waste diversion study considering current policy and legislation requirements around diversion in Ontario for smaller rural populations like the Township of North Dundas. This study looked at existing diversion activities accomplished by the Township and areas for improvement, along with timing of new or improved diversion programming. After this was completed, this information was used as the basis for estimates of existing residual waste generation and projected future residual waste generation.

3.4 Characterize Study Areas and Prepare Environmental Component Work Plans and Comparative Evaluation Criteria

This step included the characterization of the proposed study areas for the evaluation of ‘Alternatives Methods’, which were different than the study areas for evaluation of ‘Alternatives To’. The environmental components were further refined as they pertain to the preferred ‘Alternative To’ and work plans with new (different) components, rationale, criteria, indicators and methods to evaluate ’Alternative Methods’, methods to complete impact assessments for the preferred ‘Alternative Method’, and data sources were developed. These were established during the EA in consultation with the MECP, conservation authorities and the Ministry of Natural Resources and Forestry (MNRF) for select work plans. All the work plans were also provided to Indigenous communities, and the public for comment.

3.5 Characterize the Existing Environmental Conditions for the Preferred ‘Alternative To’

Next, more detailed existing environmental conditions relevant to the preferred ‘Alternative To’ were described. As mentioned in Section 3.4, the environmental components for the ‘Alternative Methods’ were different than those for ‘Alternatives ’To' and hence more component descriptions were prepared related to the preferred ‘Alternative To’.

3.6 Identify and Develop ‘Alternative Methods’

In EA terminology, ‘Alternative Methods’ are the different ways that the preferred ‘Alternative To’ can be implemented. The MECP Code of Practice (MOECC, 2014) states that a reasonable range of alternative methods should be considered that address the need and are within the proponent’s ability to implement. The alternative methods should be determined by the significance of potential environmental effects of the preferred ‘Alternative To’ and the circumstances specific to the preferred ‘Alternative To’, such as the proponent’s situation, timing and financing.

The individual ‘Alternative Methods’ were identified and developed during this step.

3.7 Comparison and Evaluation of 'Alternative Methods' and Identification of Preferred Alternative

The EA Study team qualitatively and/or quantitatively (as appropriate for the environmental component) predicted the effects for each 'Alternative Method' on the environment. The assessment was done for each component based on the conceptual designs for each alternative, including design-based mitigation and the existing environmental conditions.

If needed, if the assessment indicated that any additional mitigation measures were required to achieve site compliance with provincial standards, they were developed, and the assessment repeated to incorporate these measures.

In this step, each 'Alternative Method' was examined to determine if it would ultimately be approvable under the any applicable regulations or Acts. This screening step is included to eliminate any alternative that would not likely be approvable. If needed, any alternative found to not be approvable due to unacceptable net effects (i.e., no further refinement of mitigation is possible) or technical reasons, then the alternative was eliminated from further consideration. At this point, the EA Study team also considered additional 'Alternatives Methods for' the EA Study that may have been identified by the public or other parties during the EA process, if available.

As part of this comparison assessment, the advantages and disadvantages of each 'Alternative Method' were described.

The outcome of this ranking exercise was the identification of the preferred 'Alternative Method'. The preferred alternative became the preferred undertaking for the EA Study.

3.8 Describe the Preferred 'Alternative Method'

The outcome of this step was the description of the preferred 'Alternative Method' in enough detail that net effects and any additional mitigation measures could be identified by the environmental component study teams.

3.9 Refine the Mitigation Measures and Determine the Net Effects of the Preferred Alternative

The prediction of potential future environmental effects associated with the preferred 'Alternative Method' (assuming that conceptual design mitigation measures are in place) was carried out. Assessment of potential effects was done using appropriate objectives, standards, policies, and regulations. The remaining effects or net effects, if any, were documented and any need for refinement of mitigation measures recorded.

Also, a qualitative comparison was made between the predicted effects of the preferred alternative and the Do-Nothing alternative considering the indicators for the environmental components.

3.10 Consideration of Climate Change

The 2017 Guide- Consideration of Climate Change in EA in Ontario (MOECC, 2017) describes two basic aspects to be considered: 1) Undertaking Effects on Climate Change (for example greenhouse gases), and 2) Climate Change Effects on the undertaking (for example stormwater management or other infrastructure requirements). For this EA, climate change has been assessed with these considerations in mind.

3.11 Cumulative Impact Assessment

The net effects of the proposed undertaking, as determined by the analysis completed was qualitatively combined with the predicted effects of other existing and identified certain and probable projects in the area, where the effects would overlap in time or space. The evaluation considered potential effects on the various components to determine if there are any unacceptable predicted cumulative impacts, as measured against applicable regulatory standards and considered the effects of climate change.

3.12 Develop Monitoring and Contingency Plans

Appropriate monitoring programs and contingency plans for those environmental components where they are necessary were developed. These programs and plans were developed at a level of detail appropriate for an EA and will be finalized during other future approvals, as necessary.

3.13 Other Approvals

Any other anticipated approvals, whether through municipal, provincial or federal requirements, were determined and discussed in this step.

3.14 Commitments

Commitments from both the ToR and the preparation of this EA were developed and documented.

3.15 Preparation of EA Study Report

A Draft EASR was prepared, consisting of the main EASR, technical supporting documents as appropriate, and a Consultation Record. The components of the EASR are described in Section 2.3.2. The EASR contains an Executive Summary, a list of references consulted, and appropriate maps illustrating various aspects of the overall undertaking and aspects of the technical component studies.

4.0 Consultation Methods and Activities

The consultation program for the EA was carried out in accordance with the approved ToR. The results of the program and supporting documents, including copies of notices, presentation materials, comments, and correspondence are contained in the Consultation Record, which is Volume 4 of this EASR. The following sections provide a summary of the consultation program including the consultation program objectives, the individuals/groups involved, the methods of consultation, and a brief summary of the results of the consultation activities.

4.1 Overview

The Consultation Record is part of the requirements of the EA and was prepared following the 2014 *Code of Practice for Consultation in Ontario's Environmental Assessment Process* (MECP, 2014a). The results of the consultation program are summarized in this section of this EASR.

Prior to commencing the ToR development process, the Township of North Dundas developed a Consultation Plan to support the development of the approved Amended ToR as well as support the EA process. This plan was updated prior to and during the EA, renamed the Consultation Plan and a copy of the current Consultation Plan is provided in Volume 4 Appendix A.

During the preparation of the EA, the Township developed a list of potentially interested persons, which included identified members of the public, government agencies (known as the government review team (GRT)), and Indigenous communities. As the EA development process progressed, the Township updated the consultation list to reflect additional parties interested in the proposed undertaking. This same consultation list was then used to communicate with stakeholders throughout EA activities, unless otherwise noted in the sections below.

4.2 Consultation Objectives

Engagement of and consultation with the public and other stakeholders is a key component of the EA process. It enables stakeholders to participate in the planning process and enhance the quality of the project. The key vehicles of the consultation process used to engage the public and the other stakeholders and elicit feedback were the in-person and virtual open house, distribution of technical bulletins, letter/email correspondence, newspaper advertisements, and the Township of North Dundas's Environmental Assessments website.

As stated in the approved ToR, the objectives of the Consultation Plan for the EA process were to:

- Engage stakeholders from the beginning of the process through the use of a variety of consultation events and activities including technical bulletins, open houses, letters/emails, and the undertaking website.
- Ensure that there are adequate opportunities for stakeholders to learn about the EA Study and to provide input, feedback and comments concerning the undertaking and EA process, and that these comments are considered by the EA Study team.
- Engage local elected officials to ensure that they are provided with regular and timely information concerning the EA process.
- Engage stakeholders as early as possible in the development of the ToR and the EA and to facilitate their involvement in the process in ways that meet their needs.
- Ensure the engagement process is open, transparent and inclusive.
- Document all issues and concerns identified by the public, Indigenous communities, agencies and other stakeholders and to demonstrate how these concerns and issues have been incorporated into the EASR.
- Fulfill the EA process public consultation requirements.

Details of the engagement related to the development of this EASR is documented within the Volume 4 Consultation Record. The following sections summarize the primary engagement activities that have occurred throughout the development of this EA.

4.2.1 Key Decision-Making Milestones

To meet the objectives of consultation, Open Houses with the public and other stakeholders and technical bulletins were scheduled during the following key decision-making milestones in the EA process. In situations where Open Houses were proposed in the approved ToR but could not be held due to public safety associated with the COVID-19 pandemic, technical bulletins were distributed in their place. The main milestones are:

1) Results of the Waste Diversion Study through distribution of Technical Bulletin #1.
2) Identification of the preferred ‘Alternatives To’ was to be via Open House but instead was through distribution of Technical Bulletin #2.
3) Identification of the preferred ‘Alternative Method’ through distribution of Technical Bulletin #3.
4) Reviewing the draft EA including results of the impact assessment through in-person and virtual Open House #3.

The frequency and timing of consultation allowed for public and other stakeholders with an interest in the waste management plan the opportunity to contribute to decision making and to influence decision before moving forward to the next step in the planning process.

4.2.2 Issues Resolution Strategy

Throughout the EA process, the Township solicited feedback and information from the local community, government agencies, Indigenous communities, and other interested persons about the proposed waste management plan. Issues identified were reviewed by the Township and a reasonable effort was made to respond to concerns raised throughout the planning process. The Township has attempted to resolve all issues or disputes to reach a resolution that is amenable, recognizing that interests of multiple stakeholders and/or regulations may sometimes dictate a resolution that may not be desirable to all parties. There were no issues where mutually agreeable resolution was not achieved and the matter had to be referred to the MECP for guidance.

4.3 EA Consultation Methods

Various consultation events and activities were used during the EA process to achieve the objectives noted above as part of the Consultation Plan. The consultation events were designed to optimize engagement of the potentially interested persons in the process of the EA studies. The consultation activities carried out during the EA consisted of:

- Letter and email correspondence distributed to the public, interested stakeholders, GRT, and Indigenous communities
- Notices published in local newspapers
- Notices published on the EA website (https://www.northdundas.com/municipal-services/environmental-assessments)
- Three technical bulletins summarizing key results
- An In-person and Virtual Open House for the local community
- Meetings and telephone calls between the Township, the EA consultants, and the MECP
- Informal meetings, telephone calls and discussions with neighbours to the existing Boyne Road Landfill on an as needed basis throughout the EA
- A meeting with the Huron-Wendat Nation
- The Draft EASR was made available for the GRT, Indigenous communities and public for comment for a four week review period prior to finalization and submission to the MECP.

The results of the consultation activities are recorded in the EASR, specifically in Volume 4 Consultation Record. A summary of each consultation event was prepared documenting comments and issues that were raised. If no comments or issues were raised, then this was documented as well.

4.4 Undertaking Contact List

The Township has maintained a contact list of persons and organizations who might have an interest in being involved in the process. Anyone on the contact list was notified of all community engagement events (Open Houses and Technical Bulletins) as well as provided with general updates of the EA process on a regular basis through e-mail. The undertaking contact list is comprised of the following groups:

- GRT members
- Indigenous communities
- Property Owners and Tenants located within a 1 kilometre (km) radius of the Boyne Road Landfill
- Persons or organizations who requested to be added to the contact list

GRT and Indigenous communities are summarized below, and the full list is provided in Volume 4 Appendix B and Appendix C for GRT and Indigenous communities, respectively. In total there were 35 property owners or tenants within 1 km and other persons or organizations who requested to be added to the contact list. For privacy reasons, their names and contact information is not publicized in Volume 4.

4.4.1 Agencies

The following federal and provincial government departments, health units, municipal offices, and school boards, were kept informed throughout the progress of the EA.

Federal Agencies

- Environment and Climate Change Canada

Provincial Government

- Ministry of Agriculture, Food and Rural Affairs
- Ministry of the Solicitor General
- Ministry of Energy, Northern Development and Mines
- Ministry of Municipal Affairs and Housing
- Ministry of Natural Resources and Forestry
- Ministry of the Environment, Conservation and Parks
- Ministry of Heritage, Sport, Tourism and Culture Industries

Other

- Catholic District School Board of Eastern Ontario
- Conseil des écoles catholiques du Centre-Est
- Conseil des écoles publiques de l’Est de l’Ontario
- Upper Canada District School Board
- Eastern Ontario Health Unit
- Winchester Fire Department

- Ottawa International Airport
- Rideau Valley Air Park
- South Nation Conservation
- Raisin River Conservation
- Counties of Stormont, Dundas and Glengarry
- Township of North Dundas

4.4.2 Indigenous Communities

It is recognized that Indigenous communities have specific interests and rights regarding consultation on projects that might potentially affect them. The consultation with Indigenous communities provided insight into the potential effects on Indigenous communities, including the potential effects on use of lands for traditional purposes. It is also recognized that Indigenous communities may have specific and differing needs regarding how they would like to be consulted. To address these interests, the Township continued to inform Indigenous communities about the proposed undertaking and invite their participation during the EA process.

As documented in the approved Amended ToR, a list of three potentially affected Indigenous communities was developed in consultation with the MECP and Northern Affairs Canada. Throughout the EA process, the Township provided notification and offered to consult with each of the following Indigenous communities.

- Algonquins of Ontario
- Mohawks of Akwesasne
- Huron-Wendat Nation

4.5 Schedule of Events

The principal consultation events that took place during the development of the EA included:

- Notice of Commencement (NOC) of the EA – September 10, 2020
- Technical Bulletin #1 (Diversion Study Results) – January 13, 2021
- Technical Bulletin #2 (‘Alternatives To’ Assessment) – March 3, 2021
- Select agency Review of Draft EA Work Plans – June 2021
- Technical Bulletin #3 (‘Alternative Methods’ Assessment) – November 22, 2021
- Review of preliminary draft EASR by the MECP
- Public and Indigenous Community Review of Draft EA Work Plans – February 2022
- Open House #3 (held in-person and virtually) – April 7, 2022
- Submission of the draft EASR – May 2022 (expected)
- Submission of the final EASR – August 2022 (expected)
- Social Media and EA Study Website Postings (throughout the process)

These consultation events are further described in the following sections. All referenced materials, including copies of all comments received, and the subsequent responses are available in Volume–4 - the Consultation Record of this EASR.

4.6 Summary of Consultation Events

The following is a summary of the principal consultation events that occurred during the EA phase. Note that the Appendices referred to in this Section 4.6 refer to Volume 4 – the Consultation Record of this EASR.

4.6.1 Notice of Commencement of the EA

The Township initiated the EA process by publishing the NOC of the EA on September 10, 2020 (Volume 4 Appendix D1) as required by the EAA.

The NOC provided information about the approval of the Amended ToR, a brief overview of the proposed undertaking, information about the project location, information about the EA process, contact information for the Township and EA Study team, as well as information about how to obtain further information and participate in the process.

The NOC of the EA was posted on the Township's website and is provided at: https://www.northdundas.com/municipal-services/environmental-assessments (Volume 4 Appendix D1). The NOC of the EA was also published in the Chesterville Record and in the Nation Valley News on September 10, 2020 (Volume 4 Appendix D2). Note that the Winchester Press, where the material from the ToR had previously been advertised, closed in January 2020.

The NOC of the EA, accompanied by a letter from the Township, was also emailed or mailed to the GRT, Indigenous communities, neighbours within 1 km of the Boyne Road Landfill, and interested persons and organizations who asked to be on the EA Study contact list. Examples of this correspondence are provided in Volume 4 Appendix D2 for all stakeholders, with the exception of Indigenous communities that are discussed in Section 4.7 and examples provided in Volume 4 Appendix C2. Responses from members of the GRT are available in Volume 4 Appendix D3. There were no responses from the public. Consultation with and responses from Indigenous communities are available in Volume 4 Appendix C2 (see Section 4.7 for additional details).

4.6.2 Technical Bulletin #1 – Diversion Study Results

The Township distributed the Technical Bulletin #1 accompanied by a tailored feedback form on January 13, 2021 (Volume 4 Appendix E1).

Technical Bulletin #1 presented a general overview on the EA process and Waste Diversion Study (Volume 3 Appendix J), including the purpose of the Waste Diversion Study, the current status of diversion practices in the Township, the diversion options considered, and the evaluation criteria for the diversion options. The technical bulletin also invited public participation by completing the feedback form or by providing comments. Contact information for the EA Study team was provided in the technical bulletin so feedback and comments could also be submitted by phone, mail, or email.

Technical Bulletin #1 and its associated feedback form was posted on the Township's website and can be found at: https://www.northdundas.com/municipal-services/environmental-assessments . An advertisement to promote the technical bulletin and solicit public input was published in the Nation Valley News on January 13, 2021 (Volume 4 Appendix E-2). The advertisement again included contact information for the EA Study team so feedback and comments could also be submitted by phone, mail, or email. Technical Bulletin #1 was also advertised by the Township's social media platforms on Facebook and Twitter (Volume 4 Appendix E2).

Technical Bulletin #1, accompanied by a letter from the Township, was also emailed or mailed to the GRT, Indigenous communities, neighbours within 1 km and interested persons and organizations who asked to be on the EA Study contract list. Examples of this correspondence are provided in Volume 4 Appendix E-2. Comments received from members of the GRT are provided in Volume 4 Appendix E3, . These comments are further discussed Section 4.8.1. There were no responses from the public. Consultation with and responses from Indigenous communities are available in Volume 4 Appendix C3 (see Section 4.7 for additional details).

4.6.3 Technical Bulletin #2 – 'Alternatives To' Assessment

The Township distributed the Technical Bulletin #2 accompanied by a tailored feedback form on March 3, 2021 (Volume 4 Appendix F1).

Technical Bulletin #2 presented a general overview of the EA process, the criteria and methodology used to identify the preferred 'Alternative To', the environmental components and criteria used to assess 'Alternatives To', the preliminary results of the 'Alternatives To' assessment and proposed next steps. The technical bulletin also invited public participation by completing the feedback form or by providing comments. Contact information for the EA Study team was provided in the technical bulletin so feedback and comments could also be submitted by phone, mail, or email.

Technical Bulletin #2 and its associated feedback form was posted on the Township's website and can be found at: https://www.northdundas.com/municipal-services/environmental-assessments. An advertisement to promote the technical bulletin and solicit public input was published in the Nation Valley News on March 2, 2021, with identical advertisements concurrently published in the Chesterville Record and the North Dundas Times (Volume 4 Appendix F2). The advertisement again included contact information for the EA Study team so feedback and comments could also be submitted by phone, mail, or email. Technical Bulletin #2 was also advertised by the Township's social media platforms on Facebook and Twitter.

Technical Bulletin #2, accompanied by a letter from the Township, was also emailed or mailed to the GRT, Indigenous communities, neighbours within 1 km and interested persons and organizations who asked to be on the EA Study contract list. Examples of this correspondence are provided in Volume 4 Appendix F2. Comments received from members of the GRT or public are provided in Volume 4, Appendices F3 and F4, respectively. These comments are further discussed in Section 4.8.2. Consultation with and responses from Indigenous communities are available in Volume 4 Appendix C4 (see Section 4.7 for additional details).

4.6.4 Work Plans

As required in the approved ToR detailed technical work plans for each of the environmental components related to criteria, indicators, how 'Alternative Methods' would be compared, how the impact assessment would be completed and data sources were developed and are provided in Section 8 of this EASR.

The EA Study team first prepared a detailed work plan for the required biology environmental component in October 2019 and shared it with MNRF and MECP (Volume 4 Appendix G1). Comments on this work plan were received from MECP on December 16, 2020, and are provided in Volume 4 Appendix G2. Follow up emails were sent to MNRF on multiple occasions, but no comments on the work plan were received from MNRF.

The Township then provided draft detailed work plans for groundwater, surface water, and atmosphere (air and noise quality) to MECP technical reviewers and the local conservation authority for review and comment. These draft detailed work plans shared with MECP and conservation authority reviewers are provided in Volume 4 Appendix G1.

A teleconference meeting was held on June 10, 2021, to discuss the proposed draft atmosphere environmental component work plan. The meeting was hosted by members of the EA Study team and attended by relevant technical reviewers from the MECP. During the meeting, the MECP technical reviewers provided feedback and comments on the proposed work plan. A draft meeting summary was prepared by the EA Study team and submitted to the MECP technical reviewers for their confirmation and comments. The finalized meeting summary is provided in Volume 4 Appendix G2.

A teleconference meeting was held on June 23, 2021, to discuss the proposed draft groundwater and surface water environmental component work plans. The meeting was hosted by members of the EA Study team and attended by relevant technical reviewers from the MECP, a representative from the Raisin River Conservation (RRC), and representatives from the South Nation Conservation (SNC). During the meeting, the MECP technical reviewers and RRC and SNC representatives provided feedback and comments on the two proposed work plans. A draft meeting summary was prepared by the EA Study team along with updated draft work plans and submitted to the meeting attendees for confirmation and comments. The finalized meeting summary is provided in Volume 4 Appendix G2.

Additionally, a copy of all environmental component work plans was posted on the EA Study website on February 3, 2022 and e-mails sent to Indigenous communities and individuals who signed up to receive notices regarding the EA directly for their review and comment. This step was meant to be completed in advance of distribution and circulation of Technical Bulletin #3; however, this was inadvertently missed. To provide opportunity to provide feedback, the work plans were circulated as soon as the error was identified and were also highlighted for consideration during review of the draft EASR. These consultation efforts with the public, along with the detailed work plans, are provided in Volume 4 Appendix G3. Consultation with Indigenous communities is available in Volume 4 Appendix C6.

Comments received on the work plans are discussed in Section 4.8.3.

4.6.5 Technical Bulletin #3 – 'Alternative Method' Assessment

The Township distributed the Technical Bulletin #3 accompanied by a tailored feedback form on November 22, 2021 (Volume 4 Appendix H1).

Technical Bulletin #3 presented a general overview on the EA process, the finalized preferred 'Alternative To', the 'Alternative Methods' to be considered, the environmental components and criteria for the comparative evaluation of those 'Alternative Methods', the preliminary results of the 'Alternative Methods' comparison and proposed next steps. The technical bulletin also invited public participation by completing the feedback form or by providing comments. Contact information for the EA Study team was provided in the technical bulletin so feedback and comments could also be submitted by phone, mail, or email.

Technical Bulletin #3 and its associated feedback form was posted on the Township's website and can be found at: https://www.northdundas.com/municipal-services/environmental-assessments (Volume 4 Appendix H2). An advertisement to promote the technical bulletin and solicit public input was published in the Nation Valley News on November 22, 2021 (Volume 4 Appendix H2). The advertisement again included contact information for the EA Study team so feedback and comments could also be submitted by phone, mail, or email.

Technical Bulletin #3, accompanied by a letter from the Township, was also emailed or mailed to the GRT, Indigenous communities, neighbours within 1 km, and interested persons and organizations who asked to be on the EA Study contact list. Examples of this correspondence are provided in Volume 4 Appendix H2. Comments received from members of the GRT are provided in Volume 4, Appendix H3. These comments are further discussed in Section 4.8.4. There were no comments from the public. Consultation with Indigenous communities is available in Volume 4 Appendix C5 (see Section 4.7 for additional details).

4.6.6 In-person and Virtual Open House #3

Open House #3 was held in-person and virtually before the distribution of the draft EASR to the stakeholders and Indigenous communities. This open house presented the proposed EA and informed the public about the confirmed identification of the preferred 'Alternative Method', as well as the results of the existing conditions studies and the predicted effects on the environment, and the commitments the Township is making to mitigate any adverse effects.

This event was designed with a formal presentation to those in person and broadcast virtually, followed by opportunities for attendees and those on-line to speak directly with the Township and the EA consulting team. Attendees were asked to sign in and were encouraged to fill out a comment sheet to provide feedback and recommendations. Contact information for the EA Study team was provided in the feedback form so feedback and comments could also be submitted by phone, mail, or email. Copies of the information available at the open house and the feedback sheets are provided in Volume 4 Appendix I2.

Open House #3 and its associated feedback form was posted on the Township's website and can be found at: https://www.northdundas.com/municipal-services/environmental-assessments (Volume 4 Appendix I2). An advertisement to promote the open house and solicit public input was published in the Chesterville Record on March 24 and 31, 2022 (Volume 4 Appendix I1). The advertisement again included contact information for the EA Study team so feedback and comments could also be submitted by phone, mail, or email. Notice of the Open House was also emailed or mailed more than a week in advance of the presentation to the GRT, Indigenous communities, neighbours within 1 km, and interested persons and organizations who asked to be on the EA Study contact list. Examples of this correspondence are provided in Volume 4 Appendix I1. The Open House was also advertised on the Township's social media platform via Facebook.

A total of 5 members of the public attended Open House #3 in person and one Township Councilor and the Mayor were also present for part of the presentation. One newspaper, one school board, the local district MECP and the SNC attended Open House #3 on-line. The overall atmosphere of the open house was professional, courteous and respectful.

No feedback forms were received during or after the Open House #3.

Only one comment was received from the GRT following Open House #3. The comment complimented the overview provided on the project and asked about a copy of the presentation. This correspondence is documented in Volume 4 Appendix I3. There were no written comments received from the public. Consultation with Indigenous communities is available in Volume 4 Appendix C8 (see Section 4.7 for additional details).

4.6.7 Preliminary Draft

A preliminary draft of Volume I EASR was shared with the MECP Environmental Assessment Services in February 2022 in advance of the draft of the full EA circulation, to get their initial thoughts on the studies completed and the EASR preparation. These comments are shared in Section 4.8.6.

4.6.8 On-going Activities

The Township continues to provide information updates regarding on-going project activities and the status of the EA process on the Township's project website, and in-person to residents visiting the Boyne Road Landfill.

Regular in-person updates have been provided by the landfill operators and staff to the neighbouring residents and neighbouring farms throughout the EA process.

The website has been periodically updated throughout the EA process with relevant updates, the updated environmental component work plans, technical bulletins, feedback forms, and requests to provide comments and documents for review. Indigenous Community Involvement

As noted in Section 4.4.2, it is recognized that Indigenous communities have specific interests and rights regarding consultation on projects that might potentially affect them. Considerable efforts were made during the commencement and throughout the EA process to make and remain in contact with consultation representatives and key figures from the identified Indigenous communities. The identified Indigenous communities are:

- Algonquins of Ontario
- Mohawks of Akwesasne
- Huron-Wendat Nation

During distribution of the Notice of Commencement (NOC), Technical Bulletin #1, Technical Bulletin #2, Technical Bulletin #3, Work Plans and In-person and Virtual Open House #3, the EA Study team reached out by email and/or phone to the points of contact established for each Indigenous community. The NOC and technical bulletins, along with associated feedback forms, were shared electronically via email to each Indigenous community. Starting with the second consultation event, Technical Bulletin #1, follow up emails or calls were conducted with Indigenous community contacts if no confirmation, feedback form, or response was received After minimal contact was confirmed from the Algonquins of Ontario for Technical Bulletin #1 and Technical Bulletin #2, additional efforts were made to re-establish contact for Technical Bulletin #3. Contact was established and receipt of all material was confirmed. These consultation efforts are recorded in Volume 4 Appendix C5.

When requested by an Indigenous community, physical and/or electronic copies of notices, technical bulletins, feedback forms, and reports were provided by mail. All three Technical Bulletins and the Stage 1 Archaeology Assessment were provided to the Mohawks of Akwesasne by mail by either hardcopy or electronically on a USB. A record of these consultation efforts is provided in Volume 4 Appendix C.

As part of this EASR, a Stage 1 Archaeology Assessment was completed, and a Stage 1 Archaeology Assessment Report was prepared. As established in the ToR for this project, the Huron-Wendat Nation identified an interest in the archaeological studies at the Boyne Road Landfill site. The results of the studies along with the Stage 1 Archaeology Assessment Report were shared with the Huron-Wendat Nation, as well as the Algonquins of Ontario and the Mohawks of Akwesasne, in December 2021 for review and comments. A record of this consultation and the responses received are provided in the consultation record, in Volume 4 Appendix C6.

Following distribution of the notice for In-person and Virtual Open House #3 the Huron-Wendat Nation indicated they would like to have further discussion about this EA. A brief call was held on April 5, 2022 where some high level details were reviewed and a more in depth teleconference was coordinated for April 21, 2022. The summary of phone conversation and teleconference minutes are provided in Volume 4 Appendix C8. Some of the issues discussed and their resolution are summarized in Section 4.8.6.

4.7 Summary of Concerns Raised During Consultation

Comments and questions were welcomed by the Township from participants or through the distribution of feedback forms for each of the consultation events described in Section 4.6 and 4.7. Notice of Commencement and Technical Bulletin #1

Only one comment, from an Indigenous community representative, was received by email on September 11, 2020, following the distribution of the Notice of Commencement. The same comment was received by email from the same Indigenous community representative on January 13, 2021, following the distribution of the first technical bulletin. The EA Team responded to this comment on February 9, 2021. This comment is summarized in Table 4-1. This correspondence in full is also provided in Volume 4 Appendix C2 and Appendix C3.

Table 4-1: Summary of Comments Received on Technical Bulletin #1

Commenter	Summary of Comment Received	EA Team Response
Huron-Wendat Nation	Can you please clarify if any archaeological studies are anticipated as part of the EA process?	No archaeological study has yet to be completed at this time. The project will include a desktop archaeological study, which will determine if any intrusive archaeological assessment needs to be completed.

Other responses received on the NOC and Technical Bulletin #1 from members of the GRT were not related to the content of the technical bulletin or the EASR, but requested that future emails be redirected to an alternate contact. These correspondences have been provided in Volume 4 Appendices D3 and E3.

4.7.1 Technical Bulletin #2

For the second technical bulletin, comments were received from members of the GRT, as well as members of the public. These comments are included in full in Volume 4 Appendix F3. Comments received from the GRT were received by email and are summarized in Table 4-2, along with the GRT member who provided the comment. Comments from the public were provided by email and social media. One respondent from the public also completed a feedback form. The comments from the public are included in full in Volume 4 Appendix F4. The comments received from the public are summarized in Table 4-3, and the comments received in the feedback form for Technical Bulletin #2 are summarized in Table 4-4.

Table 4-2: Summary of GRT Comments Received on Technical Bulletin #2

Commenter	Summary of Comments Received	EA Team Response
Laura Hatcher (MHSTCI)	• We recommend that 'Cultural Heritage' is changed to say 'Built Heritage Resources and Cultural Heritage Landscapes'. • "Approximate degree of potential" is unclear and may be more appropriate to say "presence of known or potential". • In addition to identifying the potential for archaeological resources, built heritage resources and cultural heritage landscapes, it is suggested the criteria also speak to the potential impact to these resources. • Please advise whether screening or technical studies for cultural heritage resources have been undertaken.	The EA Team provided a full letter response to MHSTCI to address the comments received, which is provided in Volume 4, Appendix F3.
James Holland (SNC)	• We have no comments at this time.	N/A
Joffre Côté (MNRF)	• We have no comments on Technical Bulletin #2.	N/A

Table 4-3: Summary of Public Comments Received on Technical Bulletin #2

Summary of Comments Received	EA Team Response
• We have noticed that the edges of the landfill have been built up recently. Will that provide enough space until an extension or expansion can be done? • I would like to be added to the distribution list for updates on the Environmental Assessment. • Also, since the pandemic makes it difficult to hold another open house on the EA, have you considered have a video (zoom) type of meeting, to help share the progress on the EA to residents, and what decisions are made? I think that this would help inform people in a more direct way.	• The landfill has enough space to continue operations for a short while until the EASR can be provided to the MECP for review to hopefully allow expansion of the landfill. • The submitter was added to the EA contact list. Technical Bulletin #2 was originally supposed to be an in-person Open House but was shifted to a technical bulletin in light of COVID-19 requirements and very limited public participation at past Open Houses during the ToR. This decision was made in consultation with the MECP. Future planned consultation will take under advisement the request for virtual or in-person Open House.

Summary of Comments Received	EA Team Response
• The referenced feedback form on Technical Bulletin #2 is dated February 19, 2021. Since it is now 3 months later, has anything changed in Technical Bulletin #2? • What is the deadline date to provide comments on Technical Bulletin #2?	• It was confirmed to the commenter that Technical Bulletin #2 has not changed since it was published on the project website in February, nor had its corresponding feedback form. • Although there was no formal deadline to provide comments on this bulletin, feedback was encouraged to be provided by June 25, 2021.
• I was wondering if there have been any further updates on the Boyne Road landfill environmental assessment, in the past month. Has a third newsletter been published, or is it still planned to be published?	• It was noted that the EA Team was working on the studies required and the individual is on the contact list for future updates.
• Would you be able to provide me with more information on this initiative? I would like to know what the implications are (where the landfill will be expanded to), where the project is in terms of implementation (are we in an assessment phase or is the plan going into action ASAP) and what the impacts are going to be for residents. • I'd be more than happy to set up a phone call with either of you if you could spare a few minutes of your time.	• The EA Team had a call with the respondent to explain: • The Environmental Assessment process and the anticipated timing of the changes. • What progress has been made in the project to date and what the current next steps are. • The impacts anticipated for residents who live in proximity to the landfill. • The general estimated limits for landfill expansion alternative methods. • The respondent was satisfied with the call and had no further questions.
• We would like to be added to the project mailing lists for the environmental assessment of North Dundas' waste management plan, please.	• Respondent was added to the mailing list and provided an electronic copy of Technical Bulletin #2.

Table 4-4: Summary of Comments Received on Feedback Form for Technical Bulletin #2

Feedback Request	Comment Received	EA Team Response
Please provide any general comments regarding this Environmental Assessment Process.	• Due to the ongoing COVID-19 pandemic, some of the open houses were replaced with technical bulletins, with the opportunity for interested parties to send in any comments or questions that they may have. Are there any plans in the future for zoom type presentations, such as is often done for township meetings? • Will this EA or the eventual decision on the future of North Dundas Township's landfill consider activities taking place outside of the scope of ND? • Does this EA consider the projected population growth in North Dundas Township? With recent increases seen in the demand for water and sewer services beyond the normal projected growth, is it anticipated that the amount of waste destined to the landfill will also increase by the same amount?	• Technical Bulletin #2 was originally supposed to be an in-person Open House but was shifted to a technical bulletin in light of COVID-19 requirements and very limited public participation at past Open Houses during the ToR. This decision was made in consultation with the MECP. There is a planned Open House at conclusion of the EA. • Within the EASR we have documented our activities to pursue collaboration related to continued use of the Boyne Road Landfill. The Township remains open to collaboration for waste management services in SDG. • Yes, the EA considered the projected population growth in the Township.

Feedback Request	Comment Received	EA Team Response
The purpose of this EA is to provide environmentally safe and cost-effective long-term waste management for the Township of North Dundas for a 25 year planning period. Do you agree with or have any comments on this purpose statement?	• Why is the planning period limited to 25 years? While 25 years is a good length of time, what will happen after 25years? Will the expected lifetime of the "new" landfill be made clear in the resulting recommendations?	• A 25 year planning period for waste management is typical, as waste diversion and management options can develop, which would result in changes to a plan of longer duration.
Various components of the environment have been used to assess potential effects of the 'Alternatives To' considered for the waste management plan. Similar components are also being considered to assess and compare the 'Alternative Methods' to implement the preferred long term approach to waste management. The following table lists proposed natural, social, economic /financial and technical components of the environment being considered for this EA. Please tell us how these rank in importance to you. Is there any aspect we may have missed?	• [All components listed as 'Very Important'] • Please add "on going costs" to the Socio-Economic component	• Acknowledged. • Ongoing costs are included in the Design and Operation environmental component.

Feedback Request	Comment Received	EA Team Response
Do you agree with the identification of the preferred 'Alternative To' for this waste management plan –expansion of the Boyne Road Landfill site? If not, why not?	• In the comparison of the various six alternatives, it is not clear as to why the expansion of the Boyne Road Landfill site has been selected. Was a scoring mechanism used for each component and sub component, for each of the alternatives? How do the scores compare between each of the alternatives? • With regard to the alternative to "Establish New Landfill Site in the Township", why would the land on the north side of Boyne Road, near the existing site not be considered? How is that land used currently?	• See Section 6.4 of this report for the complete comparison of 'Alternatives To'. • Section 10.1 of the EASR provides the rationale of why the north side of Boyne Road is not a suitable location for expansion.

4.7.2 Work Plans

As discussed in Section 4.6.4, detailed work plans for select environmental components (atmosphere, biology, groundwater, and surface water) were provided to the MECP, MNRF and conservation authorities for review and commentary. The work plans for atmosphere, groundwater and surface water were primarily discussed over teleconference meetings, for which meetings summaries are available in Volume 4 Appendix G2. Outside of, or in lieu of the teleconference meetings, additional formal comments were received on the detailed work plans by some of the recipients. These additional comments are summarized in Table 4-5 and are available in full in Volume 4 Appendix G2. Workplans for all environmental components were emailed or mailed to Indigenous communities, neighbours within 1 km of the Boyne Road Landfill, and interested persons and organizations who asked to be on the EA Study contact list on February 3, 2022. Additionally, the Work Plans for all environmental components were posted on the project website for feedback and comments from the public in February 2022; no comments from these groups on the work plans were received.

Table 4-5: Summary of Comments Received on Work Plans and Meeting Summaries

Commenter	Summary of Comment Received	EA Team Response
Atmosphere Work Plan		
Ross Kircher (MECP)	• I have no comments or revisions.	N/A
Header Merza (MECP)	• It is suggested that existing traffic (with landfill) should be compared to 'no landfill' conditions • Remove the following text: "*Quantitative noise assessment requirement for public owned land can be ignored if owner of public lands provides confirmation in writing that no noise sensitive building will be built on this land.*"	The EA Team acknowledged the comments and revised the work plans and meeting summaries accordingly. As suggest during the teleconference meeting, the Township provided a letter to the MECP to confirm the Township will not permit a noise sensitive land use within 500 m of the landfill or within the existing or any future CAZ.
Surface Water Work Plan		
Beth Gilbert (MECP)	• The proposed preliminary areas to be studied appear reasonable. This includes the snow dump facility to the north of the landfill and the watercourse to the southwest of the potential expansion area. • The workplan intends to provide an impact assessment from the snow dump facility including evaluation of surface water flow in and around the snow dump. This is reasonable. The aim should include identifying any drainage pathways from the snow storage facility in relation to the landfill surface water monitoring stations at a time of year when snowmelt runoff is anticipated. Another consideration	Acknowledged.

Commenter	Summary of Comment Received	EA Team Response
	would be any potential ground-surface water interaction contributions from the snow dump to the drainage ditch along the north side of Boyne Road. • The workplan intends to obtain a sample for analysis if enough surface water is available for sampling in the watercourse (Quart Municipal Drain) located to the south west of the existing footprint. This is reasonable. In the long-term, it would be beneficial for a baseline dataset to be developed prior to waste being deposited. • Additional leachate indicators should be explored. Per- and poly-fluoroalkyl substances (PFAS) are a group of parameters that are associated with landfill leachate and should be considered in surface water to identify the extent of leachate impact in surface water and distinguish it from other sources. • The workplan intends to update the trigger mechanism and surface water monitoring program, if required. Any changes to the trigger mechanism or surface water monitoring program would require consultation and concurrence with a Regional Surface Water Specialist. • With regard to the Evaluation of 'Alternative Methods' for the surface water quantity component, the workplan would benefit from evaluating the potential change in erosion and sedimentation effects on the perimeter drainage ditch which may result from the changes in surface water quantity conveyed/generated under the different 'alternative method' scenarios.	

Commenter	Summary of Comment Received	EA Team Response
Biology Work Plan		
Shamus Snell (MECP)	• As part of this review the SARB examined the proposed and completed studies to check if they were sufficient to detect all potential occurrences of SAR on or adjacent to the site. It is noted that observations of Bobolink (Dolichonyx oryzivorus) and Eastern Meadowlark (Sturnella magna) occur but no species specific surveys have been conducted or are proposed. It is recommended that species specific surveys be conducted for Bobolink and Eastern Meadowlark. • Numinous observations Barn Swallow (Hirundo rustica) have been detected overlapping the site. If the there are any structures or buildings onsite which have the potential to be impacted by the proposed landfill expansion they should be surveyed for the presence of Barn Swallow nests. • If SAR bats are detected during the acoustic surveys, stem surveys should be performed to help determine the amount of potential nursery habitat on site. • It is recommended that any observations of SAR which are encountered during surveys be reported Natural Heritage Information Center so that they can import it into the provincial database. The link and instructions on how to do this can be found here www.ontario.ca/page/report-rare-species-animals-and-plants, or an email with the observation details (i.e. date, time, location) can be sent directly to NHICrequests@ontario.ca.	The EA Team responded with the following: • There is no suitable habitat for BOBO or EAME on the expansion site itself, as the open fields were row crops. We do not anticipate any impacts to habitats for these species on adjacent lands resulting from the proposed expansion, and the crops in the area were again row crops. This is why we did not perform targeted surveys for these species. Please confirm that you agree with this approach. • As it relates to the SAR bats, please elaborate on what the MECP will be looking for with respect to the stem surveys mentioned in your email. We assume these surveys should be performed in winter when the trees and limbs are more visible. • Further confirmation on the above points was obtained from Shamus Snell over email, as provided in Volume 4 Appendix G2.

4.7.3 Technical Bulletin #3

For the third technical bulletin, comments were only received from the MHSTCI. These comments are included in full in Volume 4 Appendix H3. The comments received from the MHSTCI were provided by letter dated December 3, 2021 and are summarized in Table 4-6, along with the other groups who acknowledged receipt of the technical bulletin.

Table 4-6: Summary of Comments Received on Technical Bulletin #3

Commenter	Summary of Comments Received	EA Team Response
Jack Mallon (MHSTCI)	• MHSTCI recommends that the Environmental Component "Cultural Heritage" is changed to "Cultural Heritage Resources," and that the Evaluation Criterion/Criteria be subdivided into "Archaeological Resources," "Built Heritage Resources" and "Cultural Heritage Landscapes" for consistency with terminology used in provincial legislation and policy. • This Bulletin does not identify what evaluation methods were used to determine the alternative method's impact on cultural heritage resources. • The Terms of Reference (ToR) for this EA committed to undertaking a Stage 1 Archaeological Assessment and completing MHSTCI's checklist Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes. • Additionally, the ToR committed to communicating the planned schedule, studies and results of the Stage 1 Archaeological Assessment with the Huron-Wendat Nation. Please advise what technical studies have been undertaken to determine the potential impact on cultural heritage resources, and whether the schedule, studies, and results have been shared with the Huron-Wendat Nation.	The EA Team provided a full letter response to MHSTCI to address the comments received, which is provided in Volume 4, Appendix H3.

4.7.4 Open House #3

No feedback forms or follow-up questions were received following the presentation of Open House #3. Only one comment was received from the MECP Senior Environmental Officer from the Cornwall Area Office requesting a copy of the presentation material. A record of this correspondence is provided in Volume 4 Appendix I3.

4.7.5 Preliminary Draft

A preliminary draft of Volume I EASR was shared with the MECP Environmental Assessment Services in February 2022 in advance of the draft of the full EA circulation to get their initial thoughts on the studies completed and the EASR preparation. Comments received (Volume 4 Appendix J1) were predominantly procedural about EAs and requirements of the Code of Practice (MECP, 2014a), about appropriately clear and concise documentation, and an emphasis on including the Do Nothing scenario when discussing and comparing 'Alternative Methods'. A completed disposition table of the comments received, and the responses is provided in Volume 4 Appendix J1.Indigenous Community Involvement

As discussed in Section 4.7, efforts were made throughout the EA process to keep the identified Indigenous communities informed of the progress of the EA study and provide opportunities for Indigenous community participation. All EA study material was communicated to Indigenous communities by email. For all consultation events following the Notice of Commencement, follow up attempts were made by both phone or email. Table 4-7 below summarizes the communications received from Indigenous communities. Full records of consultation with Indigenous communities are provided in Volume 4 Appendix C.

Table 4-7: Summary of Consultation with Indigenous Communities

Commenter	Summary of Comments Received	EA Team Response
Notice of Commencement		
Huron-Wendat Nation	• Can you please let us know if any archaeological assessment is planned under the EA process?	It was communicated that no archaeological assessment had been completed yet. The project will include a desktop archaeological study, which will determine if any intrusive archaeological assessment needs to be completed.
Technical Bulletin #1		
Huron-Wendat Nation	• We acknowledge receipt of this email. • Can you please clarify if any archaeological studies are anticipated as part of the EA process?	It was communicated that no archaeological assessment had been completed yet. The project will include a desktop archaeological study, which will determine if any intrusive archaeological assessment needs to be completed.
Technical Bulletin #2		
Mohawks of Akwesasne	[Comments made over a follow up phone call on February 17, 1] • Please send me the files on a USB.	The EA Team provided the files on a USB as requested.
Technical Bulletin #3		
Mohawks of Akwesasne	• Thank you for the follow phone call. • At this time, I have no comment but would like to review the hard copy.	The EA Team provided a hard copy of Technical Bulletin #3 by mail on December 17, 2021.
Algonquins of Ontario	• Thank you for the follow-up with the Algonquins of Ontario. • We have received your correspondence.	Acknowledged.

Commenter	Summary of Comments Received	EA Team Response
Stage 1 Archaeological Assessment		
Huron-Wendat Nation	• We would like to receive the Archaeological Assessment for review and comment, is there funding available to help review it all? • Please contact us if archaeological fieldwork is required in the future for this project.	The EA Team provided the Huron-Wendat Nation with an electronic copy of the Stage 1 Archaeological Assessment and provided these comments: • The study area identified in the archaeological assessment was determined to have low potential for archaeological resources and no further archaeological assessments will be required for this study area. • It was communicated that there was no budget for review, but comments would be welcome. • It was communicated that no future archaeological field work will occur for this project, nor will a Stage 2 Archaeology Assessment be prepared.
Mohawks of Akwesasne	• At this time, I have no comment but would like to review the hard copy. • After reviewing the Stage 1 Archaeological Assessment, our office concurs with the recommendation that no further archaeological work is needed. • We have no further comment on this project.	The EA Team provided a hard copy of the Stage 1 Archaeological Assessment by mail on December 17, 2021.

Commenter	Summary of Comments Received	EA Team Response
In-person and Virtual Open House #3		
Huron-Wendat Nation	• Requested a call to discuss the EA the summary of which is provided in Volume 4 Appendix C8 • Key points discussed included: • No further comment on Stage 1 Archaeology Assessment. • Can landfilled waste be documented to record the location and type of waste landfilled to facilitate material recovery if deemed necessary or valuable in the future.	Acknowledged. Although waste diversion was historically not part of a municipality's waste management system, it has been part of the Township's waste management system for many years; it is proposed to further enhance the diversion program during the operating period of the landfill expansion. The Township's focus is on pro-active waste diversion, with the objective of having to dispose of less waste material that has value in the landfill. In this regard, the Township diverts electronic waste, tires, metal, refrigerants, and household hazardous waste (as well as typical household recyclables such as paper, glass, metal and plastics) from landfill. The Township also directs C&D wastes generated in the Township to locations other than the Boyne Road landfill for recycling or disposal and accepts only a limited amount of commercial or industrial waste materials at the landfill. Also, the municipality has an electronic Recycle Coach, to provide residents and businesses with information so they can divert as much as possible from landfill. Lastly, as part of landfill site operations, incoming loads are checked by the site attendant to direct materials to the

Commenter	Summary of Comments Received	EA Team Response
		appropriate locations, again with the objective of increased diversion. It is acknowledged that, in future, specific materials that are not currently thought to have value could be identified as having a beneficial re-use. However, considering that the landfilling will mostly be the residual from a diverted residential waste stream because of the Townships' proactive diversion approach, it is anticipated there would be little material disposed that would be of benefit in the future, and that would warrant the significant effort to locate, excavate and separate it from other wastes for re-use (let alone the regulatory approvals required to do so and the disturbance to the landfill to create such excavations). Furthermore, this a small municipality and the potential quantity of any such material would be small. Although recording the disposal position within the landfill is done for a limited number of specific types of wastes, it is not done for disposed waste in general. For all of these reasons, the Township does not propose to segregate and record the position of the post-diversion waste placed in the landfill.
	• Will the perimeter ditches and the proposed stormwater pond be vegetated and, if so, would native species be used.	The perimeter ditches will be vegetated, but it is typical to vegetate them similar to the final cover that will be like a typical seed mix. The stormwater pond will also be vegetated and it is common to use a typical seed mix. Above the wetted surface native species will be considered. A commitment has been added in Section 18.0.
	• During below ground surface construction activities can there be more than just the equipment	Presently there is a commitment in Section 18 of the EA that says:

Commenter	Summary of Comments Received	EA Team Response
	operating keeping an eye out for archaeological resources.	"Should archaeological resources be unexpectedly encountered during the landfill expansion, a licensed archaeologist will be contacted to assess the need for additional archaeological assessment." When excavation work associated with the proposed expansion is required, the Landfill Site Manager or their designate will periodically observe the excavation area to specifically look for the presence of archaeological resources.

5.0 Waste Management Plan Study Area and Existing Conditions

5.1 Study Area

The environment is defined as those components of the natural, social, economic, cultural and built environment that may be affected by the undertaking. This section presents an overview of existing environmental conditions within the overall waste management plan Study Area, which is the Township of North Dundas as shown on Figure 1-1.

The Township was formed in 1998 by the amalgamation of the former Townships of Winchester and Mountain, as well as the Villages of Winchester and Chesterville. The Township is located south of the City of Ottawa, within the Counties of Stormont, Dundas and Glengarry. The total land area comprising the Township is 503.2 km^2. Based on the Canadian census, the 2016 population was 11,278, only slightly larger than the 2011 population of 11,225. Approximately one-third of the population is within Winchester and Chesterville, with the remainder located in several smaller communities and spread across this largely rural municipality.

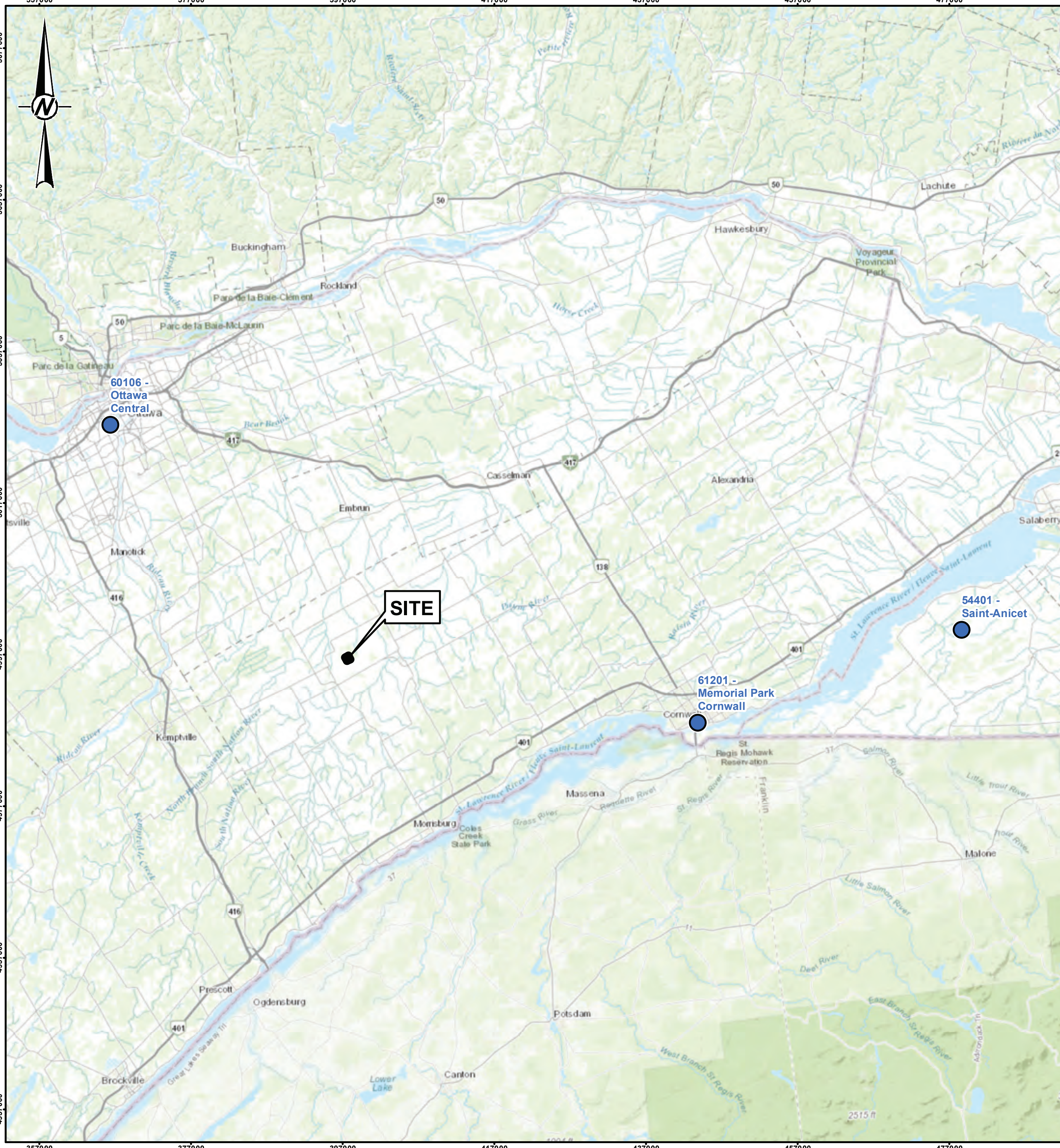
5.2 Atmosphere

5.2.1 Air Quality

Within the Township, air quality is expected to be typical of rural eastern Ontario with transportation and agricultural activities contributing to baseline air quality/odour levels. The closest air quality monitoring stations to the Township are located in Ottawa and Cornwall, Ontario; however, these are located in urban environments, which typically experience different emission sources and air quality than that of rural environments as they are impacted by different types of emission sources (e.g., residential and commercial sources, in addition to local traffic). For this reason, the Saint-Anicet, Quebec monitoring station has also been considered to represent the background air quality due to being located in an area with similar rural surrounding land use setting as the Township of North Dundas. The locations of these monitoring stations are presented on Figure 5-1 .

Within the Township, two of the main potential sources of odour include agricultural activities and the landfill. In terms of odour emissions, those from agricultural activities are often related to handling and storage of animal manures and their re-use as fertilizer. Landfills can emit two types of odours: refuse odour and landfill gas odour; refuse odour is generated by recently disposed waste, and landfill gas odour is generated during the anaerobic decomposition of organic material within the waste.

With regards to greenhouse gases, it is most appropriate to consider greenhouse gas emissions on a national or provincial scale. The primary sources of greenhouse gas emissions in Canada and Ontario are from anthropogenic sources that include the transportation sector (e.g., vehicles on 400 series highways in Ontario) and large industrial activities (e.g., manufacturing facilities) (ECCC, 2020a).



LEGEND

AIR MONITORING STATION

DRAFT

0 7,000 14,000 28,000
1:750,000 METRES

REFERENCE(S)
1. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: MTM ZONE 9 VERTICAL DATUM: CGVD28

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
AIR MONITORING STATIONS

CONSULTANT
GOLDER MEMBER OF WSP

YYYY-MM-DD	2021-05-27
DESIGNED	----
PREPARED	JEM
REVIEWED	----
APPROVED	----

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	A	5-1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 25mm

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5.2.2 Noise

Within the Township, existing noise levels are expected to be typical of rural eastern Ontario with transportation, agricultural and sounds of nature contributing to baseline noise levels.

5.3 Geology and Hydrogeology

The uppermost bedrock unit underlying the majority of the Township is limestone of the Gull River Formation, which is indicated to be overlain by Rockcliffe Formation shale in the south-central part of the Township.

The topography of the Township is generally flat to undulating and ground surface elevations range between 70 to 80 metres above sea level (masl) for the majority of the Township, with select pockets across the Township at higher elevations between 80 and 90 masl and the western-most portion of the Township features much higher ground surface elevations of approximately 100 to 120 masl near Mountain and Hallville. The majority of the Township is located in the physiographic region of the Winchester Clay Plain, with portions of the Township at the western, northwestern, and southeastern limits located within the Edwardsburg Sand Plain, the North Gower Drumlin Field, and the Glengarry Till Plain, respectively (Chapman and Putnam, 1984). Overburden soils generally consist of a mixture of marine silty clay and glacial till plain, with some specific areas underlain by organic soils. In the eastern part of the Township, there are two occurrences of glacial-fluvial deposits, an elongated northeast to south west trending ridge locally known as the Morewood Esker (and more regionally as the Vars-Winchester esker), and an east-west oriented terminal moraine known as the Maple Ridge Esker. There is also a northeast-southwest trending area of granular soils in the western part of the Township (Hallville area) known as Hyndmans Ridge. There are several licensed aggregate operations that extract sand and gravel from these ridge features.

The thickness of overburden soil overlying the bedrock is shown to generally range from about 5 to 10 metres (m), with some areas of both thicker and thinner soil cover. It is known from previous subsurface studies within the Township for specific purposes, i.e., water supply studies, Boyne Road Landfill site, wastewater lagoons, that the thickness of overburden can be quite variable over relatively short horizontal distances and that there can be significant departures from the general drift thickness shown on published mapping.

The Township relies on groundwater from drilled wells for potable water supply. The Villages of Winchester and Chesterville each have communal water supplies from high capacity drilled overburden wells located within portions of the Morewood Esker. The remainder of the Township relies on individual wells that generally obtain their water from zones within the bedrock.

5.4 Surface Water

In regard to surface water, the Township is located within the South Nation River watershed and overlaps the Upper South Nation, Middle South Nation, and Castor River subwatersheds (SNC, 2018), all within the regulatory jurisdiction of SNC. The overall regional drainage is towards the northeast, with the majority of the Township surface water runoff towards branches of the South Nation River and the northern portion towards the South and East

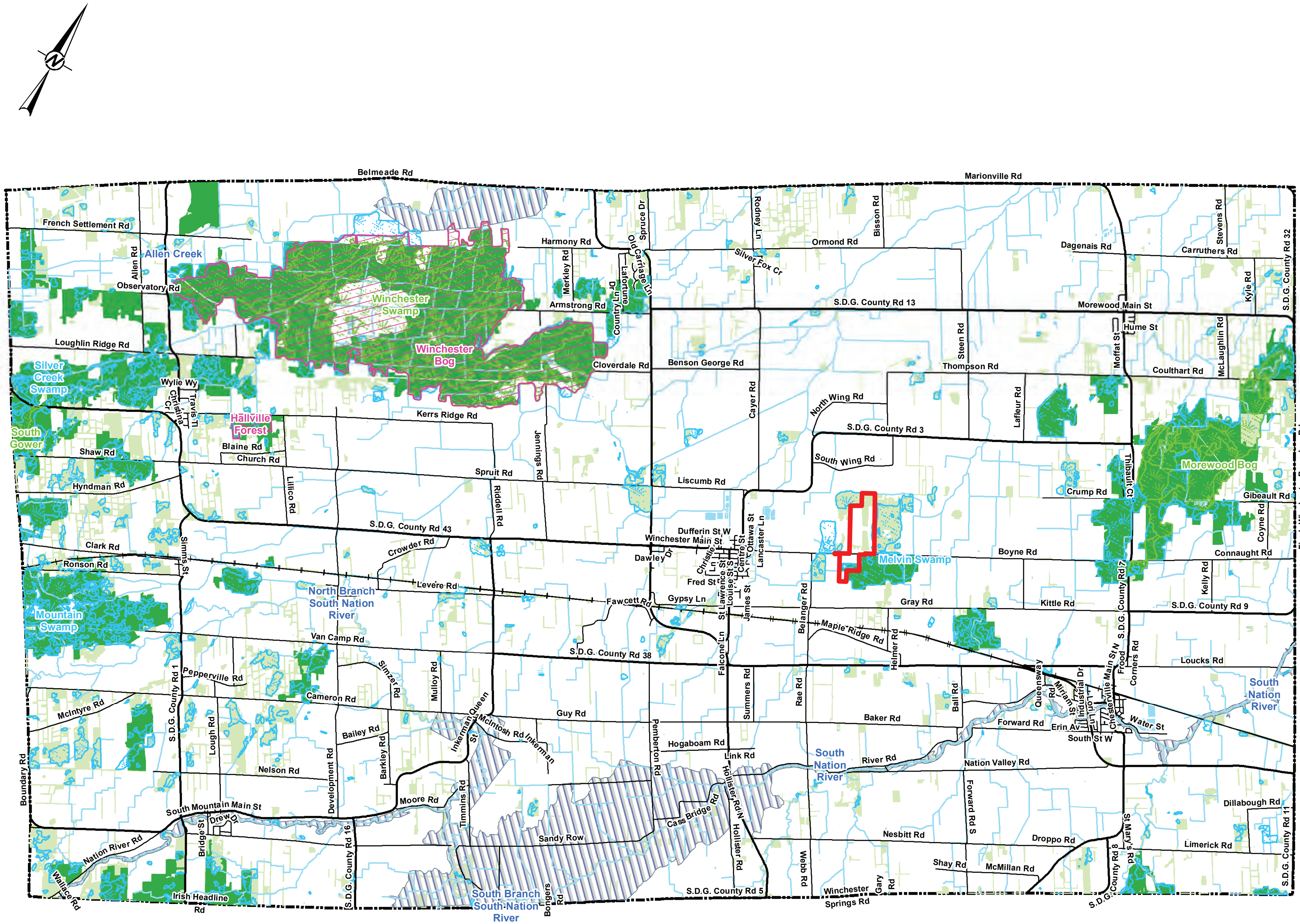
Castor Rivers, which in turn discharge to the South Nation River further to the northeast. Drainage of this largely rural agricultural area is via a network of constructed municipal drains, which have a low Department of Fisheries and Oceans (DFO) drain classification as related to aquatic habitat.

5.5 Biology

The Township is located in Ecoregion 6E (Lake Simcoe - Rideau), which covers approximately 6.4% of Ontario, extending from Lake Huron east to the Rideau River (Crins et al., 2009). The majority of this ecoregion exists as cropland (44.4%) and pasture or abandoned fields (12.8%), while water covers 4% of the ecoregion (Crins et al., 2009). Forest cover within the Township of North Dundas is 13.3% (SNC, 2016).

The Township is located in the Upper St. Lawrence section of the Great Lakes – St. Lawrence Forest Region, which contains a wide variety of both coniferous and deciduous species (Rowe, 1972). The region is dominated by sugar maple (Acer saccharum) and American beech (Fagus grandifolia) forests, with associates of red maple (Acer rubrum), yellow birch (Betula alleghaniensis), white ash (Fraxinus americana), basswood (Tilia americana), largetooth aspen (Populus grandidentata), red oak (Quercus rubra) and bur oak (Quercus macrocarpa). Hemlock (Tsuga canadensis), white pine (Pinus strobus), white spruce (Picea glauca) and balsam fir (Abies balsamea) occur on acidic soils, while white cedar (Thuja occidentalis), silver maple (Acer saccharinum), green ash (Fraxinus pennsylvanica) and black ash (Fraxinus nigra), and elms (Ulmus spp) occur in poorly drained areas (Rowe, 1972).

The Township includes the Winchester Swamp Provincially Significant Wetland (PSW) and candidate regionally significant Area of Natural and Scientific Interest (ANSI) to the northwest, the Morewood Bog PSW to the northeast, and a small portion of the South Gower PSW at the western edge of the Township. There are three wetlands in the Township that have been evaluated, but found to be non-provincially significant, namely Melvin Swamp in the area of the existing Boyne Road Landfill site; and Silver Creek Swamp and Mountain Swamp in the west. The Hallville Forest, located in the northwest portion of the Township, is considered a regionally significant ANSI. The Township contains one county forest, namely the Alvin Runnalls Forest, located within the Morewood Bog PSW. The Township is located wholly within the South Nation Watershed, and the South Nation River is the major watercourse in the Township. These natural features are illustrated on Figure 5-2. SNC also operates several small conservation areas in the Township, including Cass Bridge and Oak Valley Pioneer Park that also functions as a nut tree research site.



LEGEND

- WATERCOURSE
- ROAD
- COUNTY ROAD
- RAILWAY
- WETLAND
- PROVINCIALLY SIGNIFICANT WETLAND (PSW)
- WATERBODY
- AREA OF NATURAL AND SCIENTIFIC INTEREST (ANSI)
- REGULATORY FLOODLINE
- WOODLAND
- SIGNIFICANT WOODLAND
- TOWNSHIP BOUNDARY
- APPROXIMATE PROPERTY BOUNDARY OF THE EXISTING BOYNE ROAD LANDFILL SITE

REFERENCE(S)

1. DATA OBTAINED ON ARCGIS ONLINE THROUGH UNITED COUNTIES OF SDG, SOUTH NATION CONSERVATION AUTHORITY AND ONTARIO MINISTRY OF NATURAL RESOURCES AND FORESTRY.
2. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: MTM ZONE 9, VERTICAL DATUM: CGVD28

DRAFT

0 1,000 2,000 4,000

1:100,000 METRES

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
TOWNSHIP OF NORTH DUNDAS SIGNIFICANT NATURAL FEATURES

CONSULTANT

GOLDER MEMBER OF WSP

YYYY-MM-DD	2022-01-31
DESIGNED	----
PREPARED	JEM
REVIEWED	----
APPROVED	----

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	A	5-2

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5.6 Land Use Planning and Agricultural

The Township of North Dundas is located within the United Counties of Stormont, Dundas, and Glengarry (SDG). The Counties lie south of Ottawa, west of Montreal, east of Kingston, and north of New York State.

5.6.1 Population Projections

The United Counties of Stormont, Dundas and Glengarry released growth projections from 2006-2031 in 2013 (Hemson Consulting, 2013). These growth projections, including population and households, are shown in Table 5-1. Overall, the County is expected to grow over this period in both population and households. The number of households is expected to disproportionately increase compared to the population, with a projected growth rate that is 10% greater than the population growth over this period. It can be expected that based on growth trends, most growth will occur in the urban centers of the Townships.

Table 5-1: Growth Projections for the United Counties of Stormont, Dundas and Glengarry including Cornwall, 2006-2031

Year	Population	Households
2006	115,300	44,300
2011	116,600	46,000
2016	117,100	47,400
2021	118,400	48,700
2031	121,600	50,900
% change 2006-2031	5.5	15

The Township of North Dundas is similarly poised to see population growth. This growth projection, based on projections completed as part of the Township's Planning, is shown in Table 5-2.

Table 5-2: Population Growth Projections for the Township of North Dundas

Year	Total Population
1996	11,064
2001	11,014
2006	11,095
2011	11,225
2016	11,715
Projections	
2021	12,107
2026	12,640
2031	13,099
2036	13,236

In 2016, the population of Winchester was 2,394, which represents 2% of the population of the Counties and 20% of the Township of North Dundas.

5.6.2 Labour Force Characteristics and Activities

Employment and participation rates in Winchester are shown in Table 5-3. Currently, the employment rate was slightly higher in Winchester than in the Counties overall. Individual median income and household median income were also higher in Winchester than the Counties overall. These trends are reflective of the stable and successful nature of the local economy.

Table 5-3: Employment and Participation Rates

	Winchester	SDG
Total Population 15 years and over[1]	1,915	93,070
Labour Force	1,125	55,175
Employment Rate (%)	56.7	54.7
Unemployment Rate (%)	4.4	7.8
Participation Rate (%)	59.1	59.3
Individual Median Income ($)	36,389	30,935
Median Income – All Private Households ($)	66,880	59,526

Note: [1] Source: Statistics Canada. (2017).

A large portion of the land area within the Township of North Dundas is used for agricultural purposes. The main industry of employment in Winchester, according to Statistics Canada, is concentrated in health care and social assistance, followed by public administration and retail trade, respectively. These industry trends are similar to those of the Counties, where these three industries are among the highest in employment statistics. There is also a large employer involved in the dairy industry in the Village of Winchester.

5.6.3 Agriculture

Much of the land area within the Township has been cleared for farming purposes. Most of the Township is classified as being underlain by Class 1 to 3 farmland, indicating its high potential for agricultural uses. Areas of Class 4 farmland are present in the western portion of the Township, and an area of Class 5 in the far east central portion. Within the Township there are a range of active farm activities, mainly various types of crops and raising of animals.

5.7 Cultural Heritage Resources

5.7.1 Archaeology

5.7.1.1 Regional Indigenous History

Eastern Ontario was covered by the Laurentide ice sheet until approximately 11,000 years before present (BP). Following the period of deglaciation, Eastern Ontario was inundated by the Champlain Sea which is interpreted to have extended from the Rideau Lakes in the south, along the Ottawa Valley and St. Lawrence areas and terminating in the vicinity of Petawawa in the west.

During much of the Paleo Period (11,000. to 10,000 BP) Eastern Ontario would have remained inundated by the Champlain Sea, although as the Champlain Sea receded towards the end of this period it is possible that people migrated along the changing waterfront landscape eventually moving into the Ottawa Valley (Watson, 1999a).

The ridges and old shorelines of the Champlain Sea and early Ottawa River channels generally represent areas most likely to contain evidence of Paleo occupation in this region; however, identifying the location and dates of these ancient shorelines has proved challenging. As a consequence, only the margins of the Champlain Sea at its maximum extent, a time when the Ottawa region would have been fully submerged, have been reliably mapped due to the rapid inundation creating pronounced shoreline features (Loring, 1980).

The earliest possible settlement in the Ottawa Valley and its tributaries including the South Nation River would have occurred during the recession of the Champlain Sea when the vegetation and wildlife began to develop within the area, which enabled the sustainability of humans (Watson, 1999a). The ridges and old shorelines of the Champlain Sea and early Ottawa River channels reflect areas most likely to contain evidence of Paleo Period occupation in the region.

Evidence of human occupation during this period has been documented by a variety of archaeological discoveries including fluted points (laurel leaf shaped points with a channel flake scar extending from the base of the point) recorded in the Rideau Lakes area (Watson 1982; 1999b).

During the succeeding Archaic Period (ca. 10,000 to 2,800 BP), the environment of Eastern Ontario approached modern conditions (Ellis et al., 1990). Occupation within the Ottawa Valley developed as the environment became habitable, with an Early Archaic Dovetail projectile point recovered in Ottawa South sometime around 1918-1920 (Pilon and Fox, 2015), potentially representing the earliest diagnostic evidence of humans in the area.

The Ottawa River and its tributaries were important routes for the movement of natural copper, either through direct trade between individual groups, or through trips to Lake Superior to exploit the surface deposits located there. This commodity, as well as other tradable goods, was presumably transported by canoes and other vessels along the navigable waterways including the Ottawa River.

The earliest evidence of human burials within the Ottawa Valley are interpreted to date to the Archaic Period (Pilon and Young, 2009). Archaic sites have been documented within the vicinity of the Rideau River (Golder, 2017), and evidence from archaeological investigations around Honey Gables, Albion Road and Rideau Road may contain Early Archaic Period material (Swayze, 2004). Evidence of Archaic Period occupation has also been recovered from isolated find spots within the City of Ottawa (Jamieson, 1989), although the context of many of these have been poorly documented.

The Woodland Period (ca. 2,800 to 450 BP) is primarily distinguished from the Archaic Period by the introduction of ceramics (Wright, 1972). Early Woodland Period inhabitants continued to live as hunters, gatherers and fishers in much the same way as earlier populations had done. They also shared an elaborate burial ceremonialism influenced by the inclusion of exotic artifacts within grave deposits (Spence et al., 1990, p. 129).

By the Middle Woodland Period (2,400 to 1,150 BP) regional cultural expressions or traditions have been distinguished by archaeologists. These traditions have been identified based on patterns of ceramic decorations, use of lithic materials, and are the primary basis to differentiate the Middle Woodland Period from the Early Woodland Period. A greater number of known sites from this period have been investigated allowing archaeologists to develop a better picture of the seasonal round followed in order to exploit a variety of resources within a home territory. Through the late fall and winter, small groups would occupy an inland “family” hunting area. In the spring, these dispersed families would congregate at specific lakeshore sites to fish, hunt in the surrounding forest, and socialize. This gathering would last through to the late summer when large quantities of food would be stored for the approaching winter.

Another significant development of the Woodland Period was the introduction of agriculture and appearance of domesticated plants ca. 1,450 BP. Initially, only a minor addition to the diet, the cultivation of corn, beans, squash, sunflowers and tobacco gained economic importance during the Late Woodland Period. Unlike in Southern Ontario, where the shift in subsistence resulted in the development of semi-permanent and permanent villages, evidence suggests that the Ottawa Valley remained primarily occupied by mobile hunter-gatherers. In part, this was because the terrain was less than suitable for early agriculture. It was also a reflection of the increased pressure on hunting territories and conflict over trade routes at the end of the Woodland Period.

By the end of the Late Woodland Period, distinct regional populations occupied specific areas of Southern Ontario separated by vast stretches of largely unoccupied land, including the Huron along the north shore of Lake Ontario, and the St. Lawrence Iroquois along the St. Lawrence River. Facing persistent hostilities with Iroquoian populations based in what is now New York State, the Huron moved from the north shore of Lake Ontario to the Lake Simcoe and Georgian Bay region. The St. Lawrence Iroquois relocated sometime in the late 16th century with refugees possibly dispersing among the Algonquin populations in the Ottawa Valley region (Pendergast, 1999).

The Algonquins, who occupied the lands north of the Huron, had historical hunting territories in the Ottawa Valley that may have extended as far east as the St. Maurice River in Quebec. They also claimed the lowlands south of the St. Lawrence River after the disappearance of the St. Lawrence Iroquois in the late 16th century (Trigger and Day, 1994). At the time of initial contact, the French documented several Algonquin groups residing in the vicinity of the existing Boyne Road Landfill (Heidenreich and Wright, 1987).

Late Woodland Period sites have been recorded throughout the Ottawa Valley.

The Algonquins' location along the same river networks used for transportation by early French traders positioned them to monopolize the early fur trade with the two communities becoming close allies following Champlain's expedition in 1603. Competition for furs increased existing tensions between the Algonquin communities and their neighbours including the Haudenosaunee Nations, such as the Mohawk, residing to the south in what is now Ontario and New York State. The 17th century saw a long period of conflict known as the Beaver Wars between the Algonquin and the Haudenosaunee that resulted in the significant disruption of life. Mohawk raids against Algonquin villages in the Upper Ottawa and St. Lawrence Valleys resulted in the abandonment or destruction of many Algonquin settlements in these areas (Trigger and Day, 1994). Some Algonquins found refuge in French settlements such as Trois-Riviéres, Quebec City, Sillery, and Montreal while others may have retreated to interior locations along the Ottawa River's tributaries (Holmes, 1993). At the end of the 17th century, the Haudenosaunee were driven out of much of Southern Ontario by the Mississaugas, though they continued to occupy parts of Eastern Ontario on a seasonal basis.

The French brokered a peace treaty in 1701 at Montreal where the Algonquin, the French, and the Haudenosaunee agreed to peacefully share the lands around the Great Lakes (INAC, 2011). In exchange for peace, the Algonquin gave the Haudenosaunee secure access to furs, which the Haudenosaunee used to secure their alliance with the British.

Following the Seven Years' War in the mid-18th century, the defeat of the French, Algonquin, and their allies by the British and the Haudenosaunee resulted in the further loss of Algonquin hunting territories in southern Quebec and eastern Ontario as the British seized France's colonies. The extension of Quebec's boundaries in 1774 through the Quebec Act and the use of the Ottawa River as the boundary of Upper and Lower Canada following the 1791 Constitution Act separated the Algonquins between two government administrations (AOP n.d.).

Britain's colonial policy differed from the French in that the Crown was much more interested in securing land surrenders from the Indigenous populations for settlement by Europeans. The Royal Proclamation of 1763 issued by King George III enabled the Crown to monopolize the purchase of Indigenous lands west of Quebec. Although the proclamation recognized Indigenous rights to their land and hunting grounds, it also provided a way through which these rights could be taken away (Surtees, 1994). Land cession agreements between Indigenous groups and the Crown increased following the War of 1812 as a new wave of settlers arrived in Upper Canada primarily from Britain. The Crown implemented annuity systems in the purchase of lands from Indigenous peoples where the interest payments of settlers on the land would cover the cost of the annuity rather than pay a one-time lump sum. By the 1850s, Indigenous groups had become cautious of these agreements and began to demand the retention of reserved land and preservation of hunting and fishing rights (Surtees, 1994).

In 1839, the Crown denied the Algonquins and Nipissings the right to lease portions of their land, including islands in the Ottawa River, to settlers with whom they had previously been collecting rent payments (Holmes, 1993). Furthermore, the Crown did little to prevent further additional encroachments by settlers on Indigenous lands.

A reserve was purchased for use by the Algonquins in Golden Lake in 1873 (Holmes, 1993). The Golden Lake reserve, now known as the Algonquins of Pikwakanagan First Nation, has a registered population of around 2,000 people with over 400 living on the reserve (INAC, 2013). Additional reserves and settlements for the Algonquins were established in Quebec during the mid-20th century.

The Indian Act of 1876 framed the relationship between the Canadian government and Canada's Indigenous peoples as a paternalistic one where the government served as their guardian until their cultures were able to integrate into Canadian society (INAC, 2011).

The Algonquins of Ontario today consist of ten communities: Antoine, Algonquins of Pikwakanagan First Nation, Bonnechere, Greater Golden Lake, Kijicho Manito Madaouskarini, Mattawa/North Bay, Ottawa, Shabot Obaadjiwan, Snimikobi, and Whitney and Area (AOO n.d.).

The Ottawa Valley is unceded Algonquin land and land claim negotiations with Canada and Ontario are in progress. The Algonquin and the Government of Canada signed an agreement in principle to transfer 117,500 acres of Crown lands in Eastern Ontario to the Algonquin (INAC, 2016; Tasker, 2016). While this represents an important step in the negotiations, the talks are ongoing.

5.7.1.2 Post-Contact Regional History

Samuel de Champlain was the first European to document his explorations of the Ottawa Valley, initially in 1613 and again in 1615. He was preceded by two of his emissaries, Étienne Brûlé around 1610 and Nicholas de Vigneau in 1611. It is likely that all three travelled at least the lower reaches of the Rideau River. In the wake of Champlain's voyages, the Ottawa River became the principal route for explorers, missionaries and fur traders travelling from the St. Lawrence River to the interior, and throughout the 17th and 18th centuries this route remained an important link in the French fur trade.

At the time of initial contact, the French documented three Algonquin groups residing in the vicinity of the Boyne Road Landfill (Heidenreich and Wright, 1987). These included the Matouweskarini along the Madawaska River to the west, the Onontchataronon in the Gananoque River basin to the southwest, and the Weskarini, the largest of the three, situated in the Petite Nation River basin northeast of the existing Boyne Road Landfill. While prolonged occupation of the region may have been avoided as a result of hostilities with Iroquoian speaking populations to the south, at least the northern reaches of the South Nation River basin were undoubtedly used as hunting territories by the Algonquin at this time. The recovery of European trade goods (e.g., iron axes, copper kettle pieces and glass beads) from Indigenous sites throughout the Ottawa River drainage basin has provided evidence of the extent of contact between the Indigenous peoples and the fur traders during this period. The English, upon assuming possession of New France, continued to use the Ottawa River as an important transportation corridor.

Significant European settlement of the region did not occur until United Empire Loyalists and other immigrants began to move to lands along the Ottawa River and its tributaries in the late 18th and early 19th centuries. Commonly acknowledged as the first permanent European resident in the area that would become Hull, Philemon Wright settled in Hull Township with five families and 33 men in 1800 (Bond, 1984). The community along the north shore of the Ottawa River grew over the next few years and by 1805 Wright had begun significant lumbering activity in the region. It would take several more years for permanent settlement to spread to the south side of the Ottawa River.

The scarcity of roads and poor state of transportation beyond the Ottawa River shoreline slowed settlement in many parts of the Ottawa Valley (Belden, 1879); although with the construction of the Rideau Canal (18–7 - 1832) the new settlement of Bytown experienced its first major growth in population. This resulted in the development of two areas: Lower Bytown east of the Canal, primarily populated by French Canadian and Irish labourers and merchants, and Upper Bytown to the west of the Canal with a predominantly white Anglo-Saxon Protestant population. Bytown was incorporated as the City of Ottawa on January 1, 1855, with a population of 10,000. The selection of Ottawa as the capital of Canada in 1857 was the major catalyst in the subsequent development of the city.

The Township is situated within the South Nation River drainage basin, which is known to have been occupied by Indigenous populations since at least the Woodland Period (950 before common era – 1550 common era). A number of archaeological sites have been registered within the Township, providing evidence of previous historic land use and occupation.

5.7.2 Built Heritage Resources and Cultural Heritage Landscapes

The Euro-Canadian cultural heritage of the Township of North Dundas began around 1800. Settlers cleared land in the area for farming and the Township has remained primarily an agricultural area for the last two centuries. Villages including Chesterville, Winchester, and Winchester Springs developed and over time small family farms were combined into large, specialized farms as agricultural practices changed.

The first European immigrants to Winchester Township settled along the Nation River in 1819 (Mika and Mika, 1983, p. 657). Many of the lots in the Township were awarded to the children of United Empire Loyalists, but most chose to sell their lands, which were eventually settled by other immigrants. Early settlement and development were made difficult by the lack of roads. In the 1830s, the villages of Winchester and Chesterville developed following the construction of flour and sawmills (Mika and Mika, 1983, p. 657). The construction of the Canadian Pacific Railway Line in 1887 led to increased prosperity, particularly in Chesterville that saw its population grow from around 500 in 1884 to over 750 in 1890 (Harkness, 1946).

During the 20th century, agriculture retains a significant role. The establishment of Highway 31 in 1927 (Bevers n.d.) provided a convenient route to Ottawa and many of its present residents commute to the city.

5.8 Socio-economic

5.8.1 Population and Labour

The Township of North Dundas is part of the SDG. The Township's population in 2016 was 11,715 according to the Township's Municipal Department. The two main areas of population within the Township are Winchester and Chesterville. The Village of Winchester has a population of just over 2,394 people (Statistics Canada, 2016). Winchester has a number of commercial, institutional and recreational facilities for its residents including shops, churches, a community centre, public school and a large hospital. The community has a fire station, paramedic outpost and an OPP detachment. The hospital (Winchester District Memorial Hospital) is one of the largest employers in the area along with the Lactalis Canada dairy products facility located in the centre of Winchester The Village of Chesterville is located in the southeast part of the Township and has a population of 1,677 (Statistics Canada, 2016). Chesterville is similar to Winchester in that it has shops, churches, a community centre, a fire station and a public school. The remainder of the Township is rural with several small hamlets.

The existing Boyne Road Landfill site is located approximately 2 km east of the Village of Winchester in a largely agricultural setting, there are no residences or businesses within 500 m of the existing landfill and the closest businesses are agricultural operations or suppliers. The landfill is the only waste management facility in the municipality and accepts household, some business waste and light construction waste; it is also the location of recycling facilities.

5.8.2 Municipal Finances

Consolidated Financial Statements from the Township of North Dundas report total revenues of $13.7 million in 2020 (Ministry of Municipal Affairs and Housing, 2021). Almost half of the revenue was derived from taxes, predominantly property taxes. The remaining revenue was from government transfers, conditional grants, and user fees and service charges. Total municipal expenses were $12.5 million in 2020.

5.8.3 Economic Development Trends and Plans

In 2016, the Township of North Dundas identified goals for sustainable economic development to address challenges associated with the local economy including: low population growth, a steady out-migration of youth, and the provincial economy changing from agriculture and manufacturing to a service-based one. The plan identified sectors of critical focus for North Dundas, including promoting agri-food manufacturing, creative professions, retail and commercial services and tourism.

5.9 Transportation

County Road (formerly Highway) 31 provides a main north-south link through the central part of the Township, connecting the City of Ottawa to the north with Highway 401 to the south. County Road (formerly Highway) 43 provides a main east-west link through the central part of the Township, connecting with Highway 416 further to the west. The Township is serviced by a network of County and Township roads. The Canadian Pacific Railway main line passes through the Township.

The nearest airport to the Township is the Ottawa International Airport. The Rideau Valley Air Park, an aerodrome, is located outside the northwest corner of the Township adjacent to the north side of the Rideau River just east of Highway 416.

6.0 Assessment of 'Alternatives To' the Undertaking

6.1 Description of and Rationale for 'Alternatives To'

As part of the environmental assessment process as set out in the approved ToR, the Township is required to develop a reasonable range of 'Alternatives To' the undertaking. For the Township, the 'Alternatives To' are fundamentally different approaches for long term waste management in the Township. Previously, four waste management alternatives were proposed for the Township in the 2015 Waste Management Alternatives Evaluation (Golder, 2015). Two additional alternatives have been added in this Environmental Assessment compared to the preliminary 2015 Waste Management Alternatives Evaluation. The comparative assessment of these 'Alternatives To' will identify the preferred waste management alternative for the undertaking.

6.2 Environmental Components, Criteria and Indicators for 'Alternatives To'

To remain consistent with the evaluation process throughout this EA, the environmental categories (as proposed in the ToR) have been reorganized into their equivalent environmental components. A broad set of criteria were developed for comparative evaluation of the 'Alternatives To' in the ToR and are summarized in Table 3-1 of the ToR. These evaluation criteria cover the components that comprise the natural, social, economic, cultural and built environment.

The proposed preliminary evaluation criteria presented in the ToR were finalized during the EA and included changes such as:

- Addition of the criteria of potential effects of noise to the atmosphere environmental component.
- The criterion for potential impacts on existing land use was expanded to also include impacts on agricultural land given the importance of the agriculture industry in the Township of North Dundas.
- The criterion that was for potential effects to the cultural environment was split into two criteria: one for archaeology and one for built heritage resources and cultural heritage landscapes.

The environmental components, evaluation criteria and indicators were outlined in Technical Bulletin #2 and shared with the MECP, Indigenous communities and the public. There was one comment from the public received indicating that all the environmental components are very important. There was also a request to add on-going costs, but this is already in the socio-economic component.

The final environmental components are as shown in Table 6-1 below with the relevant evaluation criteria, rationale, indicators and data sources used for the comparative assessment.

Table 6-1: Environmental Components, Criteria and Indicators for 'Alternatives To' Assessment

Environmental Component	Evaluation Criteria/Criterion	Rationale	Indicators	Data Sources
Atmosphere	• Potential effects on air quality (including dust, odour, Greenhouse Gas (GHG)) • Potential effects on noise	• Waste management operations can produce gases containing contaminants that degrade air quality. Associated construction activities can also produce dust and GHG. • Waste management operations and associated construction activities can produce noise that could impact the environment.	• Qualitative amount and/or type of emissions generated/offset due to alternative. • Qualitative amount of non-renewable resources conserved. • Qualitative relative expected amount of noise from alternative.	• Boyne Road Landfill studies/reports • Applicable provincial regulations, standards and guidelines • Aerial mapping
Geology and Hydrogeology	• Potential effects on groundwater resources	• Contaminants from waste management site operations could enter the groundwater and impact off-site groundwater.	• Qualitative expected effect on groundwater quality at the property boundary.	• Boyne Road Landfill studies/reports • Aerial mapping • Borehole logs • Published geology and hydrogeology maps and reports

Environmental Component	Evaluation Criteria/Criterion	Rationale	Indicators	Data Sources
Surface Water	• Potential effects on surface water resources	• Contaminants from waste management site operations could enter the groundwater or runoff directly and impact off-site surface water.	• Qualitative expected effect on surface water quality within the area. • Qualitative expected change in peak flows (within the on-site stormwater management system (SWMS) and at the property boundary). • Qualitative expected degree of off-site effects on surface water quantity within the area.	• Boyne Road Landfill studies/reports • Aerial mapping • Topographic Maps • Published hydrology maps and reports
Biology	• Potential effects on natural environment features (aquatic and terrestrial ecosystems)	• Contaminants from waste management site operations could adversely affect aquatic or terrestrial life (including rare or endangered species).	• Qualitative amount of disturbance of terrestrial and aquatic environment.	• United Counties of Stormont, Dundas, and Glengarry Official Plan • South Nation Conservation reports, mapping, data • Boyne Road Landfill studies/reports • Published natural environment reports for the area

Environmental Component	Evaluation Criteria/Criterion	Rationale	Indicators	Data Sources
Agriculture and Land Use	• Potential effects on existing land use and agriculture	• The agricultural land base or agricultural operations may be impacted by the waste management site operations. • Other land uses, such as residential, could be impacted by the waste management site operations.	• Approximate number or types of land use conflicts.	• United Counties of Stormont, Dundas, and Glengarry Official Plan • Aerial and topographic mapping
Cultural Heritage Resources	• Potential effects on archaeology • Potential effects on cultural environment including cultural heritage landscapes and built heritage resources	• Identified archaeology resources could be altered or effected by waste management site operations. • Identified heritage landscapes and built heritage resources could be altered or impacted by waste management site operations.	• Approximate degree of archaeological potential. • Approximate degree of potential for built heritage resources and landscapes disruption.	• United Counties of Stormont, Dundas and Glengarry Official Plan • Archaeological Screening where available • Published archaeology reports for the Township

Environmental Component	Evaluation Criteria/Criterion	Rationale	Indicators	Data Sources
Socio-economic	• Potential site operational effects on sensitive off-site receptors (i.e., noise, litter, air quality) • Relative costs and timing of approvals • Relative cost of implementation (capital and operational costs)	• Waste management facilities could potentially affect the use and enjoyment of sensitive uses in the vicinity of the site. • Waste management site operations can influence employment and business in the wider regional area. • Different methods of waste disposal can have different costs based on the type and amount of engineering required.	• General attitude of public toward alternative. • Approximate proximity of alternative to potential sensitive receptors. • Approximate cost per tonne. • Approximate type or amount of potential revenue offsets. • Approximate types of approvals required for alternative and level of effort to attain the approval.	• United Counties of Stormont, Dundas, and Glengarry Official Plan • 2015 Waste Management Alternatives Evaluation • Updated costing from relevant sources • Aerial mapping • Applicable provincial regulations, standards and guidelines
Transportation	• Potential effect on road network	• Waste management operations can affect the traffic in the surrounding area through changes in truck traffic to/from disposal facilities, including potential increases in traffic associated with providing waste management services.	• Qualitative assessment of additional tonnage and resulting number of trucks to site due to selected alternative.	• United Counties of Stormont, Dundas, and Glengarry Official Plan • Approximate amount of waste to manage, distance to handling location and type of trucks available

Environmental Component	Evaluation Criteria/Criterion	Rationale	Indicators	Data Sources
Technical Considerations	• Relative ability of the Township to operate • Relative technical risks associated with the operation of the alternative	• Different methods of waste management can have different risks or effects based on the development of the technology, relative maintenance or expertise required to operate.	• Availability of examples where technology used with similar tonnage. • Types of barriers to implementation.	• Boyne Road Landfill studies/reports • Applicable provincial regulations, standards, and guidelines • Practitioner expertise

6.3 Identification and Feasibility of 'Alternatives To'

In terms of 'Alternatives To', the Township has considered the range of alternatives that are reasonably available to it as a small rural municipality and has determined that the four alternatives considered in the previously completed preliminary study represent the range of the 'Alternatives To' that will be considered in the EA, along with the Do-Nothing alternative and a waste diversion alternative.

The 'Alternatives To' available to the Township consist of the following:

- Existing Landfill Site Closure and Export Waste for Disposal
- Landfill Site Expansion
- Existing Landfill Site Closure and Establish New Landfill Site in the Township
- Existing Landfill Site Closure and Alternative Waste Management Technologies
- Enhanced Waste Diversion
- Do-Nothing

This section describes each of the 'Alternatives To' and screens their feasibility for the Township to undertake as their approach to long term waste management. The 'Alternatives To' remaining after this screening have been carried forward for comparative evaluation in Section 6.4.

6.3.1 Alternative 1 – Existing Landfill Site Closure and Export of Waste for Disposal

This alternative was previously assessed in detail as part of the 2015 Waste Management Alternatives Evaluation (Golder, 2015). For the present evaluation process, the concept as described in the preliminary assessment has been updated, including soliciting an updated tipping fee cost from the Moose Creek Landfill (previously referred to as the Lafleche site).

Under Alternative 1, the Boyne Road Landfill would be closed. The Township would likely continue to operate waste diversion activities at the landfill site or elsewhere, and the remaining waste would be exported to an appropriately licensed landfill for disposal. The Township presently accepts residential and non-residential waste, with some waste self-hauled to the existing landfill. Under Alternative 1, it was assumed that the Township will operate a waste transfer station to continue providing the current level of service with the acceptance of both residential and non-residential waste. At the present time there are two landfill sites in eastern Ontario licensed to receive solid non-hazardous waste from the Township of North Dundas for disposal, both of which are owned and operated by the private sector. The two sites are Green for Life's (GFL's) Moose Creek Landfill in North Stormont near Moose Creek and Waste Management's Ottawa (Carp Road) Landfill in the western portion of Ottawa.

The Carp Road site is currently inactive and has not proceeded to construct the additional disposal capacity for which it has received provincial EA and ECA approvals. Those approvals are for an estimated 10 years of operating landfill capacity.

Within the preliminary evaluation, this alternative was considered to be technically feasible. It is noted that the estimated expenditures and annual operating costs as presented in the 2015 preliminary evaluation have increased since the initial estimate, with projected tipping fees increasing from $56/tonne in 2015 to an approximate range of $68/tonne to $78/tonne (depending on the details of contract negotiated). The only uncertainty noted for the Township under Alternative 1 would be the Conditions imposed by the MECP for approval of the landfill site closure and the establishment of a waste transfer station at the landfill site, but these requirements are common to many landfill sites and the Conditions are not expected to be onerous. The preliminary assessment also noted that the Township may face uncertainty related to the remaining capacity at the selected private waste disposal facility (the Moose Creek Landfill); however, it is noted that in 2020 GFL commenced an EA for a large expansion of the Moose Creek Landfill site. It is considered reasonable to expect that there will be disposal capacity available in future at some licensed facility to accept the Township's waste.

6.3.2 Alternative 2 – Landfill Site Expansion

Under Alternative 2, the process to obtain approval for an increase in the disposal capacity of the Boyne Road Landfill would be undertaken so that waste disposal would continue at this location under the ownership of the Township. An envelope that could be used to accommodate the estimated 400,000 m^3 of additional landfill airspace will be developed and considered.

This alternative was previously assessed in detail as part of the 2015 Waste Management Alternatives Evaluation (Golder, 2015); additional information on this 2015 evaluation is provided in Section 2.1. Although previously assessed, this alternative is being considered in this EASR without prejudice of the results of the 2015 assessment. To determine the technical and economic feasibility of this alternative, an initial technical evaluation of the expected design and operational requirements to successfully obtain approval of an expansion under the EAA as well as Ontario Regulation (*O.Reg)*. 232/98 Landfill Standards was undertaken and reported in the 2015 preliminary assessment. Based on the results of the initial technical evaluation and this update, this alternative is still considered to have a reasonable likelihood of obtaining EA approval as a natural attenuation landfill. It was concluded in the 2015 preliminary assessment and as updated herein that the technical feasibility of Alternative 2 is favourable.

6.3.3 Alternative 3 – Existing Landfill Closure and Establish New Landfill Site in the Township

Under Alternative 3, the Township evaluated the potential to establish a disposal site at a new location within the municipality. However, considering the long time period typically required to undertake waste management planning studies to obtain approval for the establishment of new waste disposal site, it is expected that a short term alternative would have to be selected from either obtaining approval to continue landfilling at the Boyne Road Landfill in the interim period or export waste to an appropriately licensed landfill for disposal (likely the Moose Creek Landfill as per Alternative 1).

Because this alternative involves a search for and identification of a new site for a new landfill, of the available alternatives it is anticipated that this one is likely to be the most controversial (followed by Alternative 4, see below) with the public and raise the greatest concerns. Based on previous discussions between representatives of the Township and neighbouring municipalities about their need for long-term waste management options, neighbouring municipalities did not express interest in partnering with the Township for the establishment of a new regional landfill site, mostly due to their relatively close proximity to the existing privately-owned Moose Creek Landfill.

As noted in the ToR, a set of general exclusionary criteria that are typically used for landfill siting have been determined for the purpose of screening out areas of the Township that are not suitable and cannot be considered for a new landfill site. Published mapping sources and information from the Township's Official Plan provided the information used in this screening exercise. Areas surviving this screening represent potential locations for siting a new landfill. A preliminary total land area required for development of a landfill having a new airspace of approximately 400,000 m^3 and following the requirements of *O.Reg*. 232/98 was determined to be approximately 80 ha; the size of the potential locations was then assessed to determine whether they are large enough.

The screening exercise as described above was carried out and is described in the technical memorandum dated June 2020 (See Volume 3 Appendix I). The application of the exclusionary criteria considered atmosphere, transportation, biology, geology and hydrogeology, surface water, socio-economic and land use. It also considered constraints imposed by the Official Plan (only land within the Rural District can be considered for a new landfill site), as well as separation buffer distances set out in the Official Plan and from natural environment features. Six main sectors within the Township were identified as potentially eligible area for siting a new landfill. Three of the six were found to be problematic for various reasons and the remaining three were qualitatively compared and their advantages and disadvantages determined.

In conclusion, the results of the screening exercise revealed few potential areas large enough or in accordance with the land use policies set by the Township for use as a new waste management facility site. Of the screened potential areas, the most preferred area was the parcel of land containing the existing active Boyne Road Landfill site. However, constructing a second neighbouring landfill within this candidate area could cause potential environmental, social and economic impacts to other areas nearby to the existing landfill. The potential extent of landfill-related impacts may be further reduced by considering expansion of the existing landfill rather than trying to establish a new landfill disposal area within the same rural district. As such, although an area is suitable for new landfill development within the Township, this is not an alternative that the Township should reasonably pursue. In accordance with this rationale, Alternative 3 is eliminated from the comparative evaluation.

6.3.4 Alternative 4 – Existing Landfill Closure and Alternative Waste Management Technologies

Under Alternative 4, the Township evaluated the potential to use an alternative waste management technology such as an energy from waste facility (EFW, where waste is combusted at extremely high temperature, resulting in heat that can be used in a steam powered generator for example) at a new location within the municipality. The Boyne Road Landfill would therefore be closed. However, considering the length of time required to select a technology provider, obtain approval and build such a facility, it is expected that a short term alternative would have to be selected from either obtaining approval to continue landfilling at the Boyne Road Landfill in the interim period or export waste to an appropriately licensed landfill for disposal (likely the Moose Creek Landfill as per Alternative 1).

There are various EFW processes on the market, commonly separated into two categories: conventional combustion (i.e., mass burn incineration) and advanced combustion (e.g., gasification, plasma arc gasification, and pyrolysis), with mass burn incineration being the most well established and commercially proven worldwide. EFW facilities are not uncommon in Canada but are much more prevalent in the waste management practices in the United States and Europe. Most EFW processes have not been demonstrated successful at a commercial scale operation in Ontario. It is noted that the two approved EFW in Ontario (Algonquin Power EFW Facility in Brampton and Durham-York Energy Centre in Clarington) have a processing capacity of 140,000 to 182,500 tonnes of waste per year, more than 10 times the current waste disposal needs of the Township. As such, and in view of thermal facilities currently licensed and operating in Ontario (albeit for private entities or a municipality far larger than North Dundas), the only thermal treatment technology that will be considered in this assessment is mass burn incineration (i.e., incineration).

In general, EFW facilities are designed to combust waste continuously and operate at a steady state processing rate for their lifetime, which is preferred for minimizing pollutants, maximizing energy recovery and reducing fuel consumption for startup procedures. Although the incineration process is highly scalable, it is more adapted for a large base load processing need. Smaller facilities can be designed for batch consumption and will only operate when sufficient volumes of waste have been accumulated, but this is more typical for remote locations or locations where there is limited access to landfill disposal.

The use of this technology would require the service to be provided by a private sector operator of this type of facility, since it is beyond the capability of the Township both financially and operationally. It is expected that a new site within the Township would have to be established for this process. The screening exercise performed for Alternative 3 indicates few possible locations for an incineration site within the Township (even acknowledging that the required site area would be much smaller than for a new landfill) and would require an amendment to the official land-use schedule if pursued. The incineration process can reduce the volume of waste required for disposal significantly; however, it is noted that with this technology there remains a need for a landfill for the disposal of remaining ash. Disposal options for the reduced volume of waste generated from the incineration process could be a limited expansion of the Boyne Road Landfill site, a new small landfill at the same site of the incinerator or export of the ash outside the Township for disposal at a licensed landfill.

The Township could consider establishing a new regional EFW facility with neighbouring municipalities to share the capital expenditures and financial liability with and to improve the facility's steady state processing rate. However, as noted with Alternative 3, previous discussions with neighbouring municipalities revealed no interest in partnering with the Township for the establishment of a new regional waste management facility.

6.3.5 Alternative 5 – Enhanced Waste Diversion

This alternative would require the Township to consider and look for opportunities to increase diversion from disposal by considering public feedback, evaluating current legislation and funding mechanisms and assessing diversion opportunities in alignment with the small, rural nature of the Township. To fulfill this alternative, a Waste Diversion Study Report (see Volume 3 Appendix J) was completed and circulated for comment in Technical Bulletin #1 of this EA. Technical Bulletin #1 was shared with the public, Indigenous communities and GRT stakeholders and no comments changing the findings of the Waste Diversion Study Report were received. The Waste Diversion Study carefully considered the current provincial direction as related to diversion. In 2017, the Strategy for a Waste-Free Ontario: Building the Circular Economy (MECP, 2020a) was released, which provided a road map for resource recovery and waste reduction. In November of 2018, the MECP released its Environment Plan (MECP, 2018a) and a subsequent discussion paper (Reducing Litter and Waste in our Communities) was released in March 2019 (MECP, 2019a) that proposes steps to implement the Environment Plan. Lastly, the Food and Organic Waste Policy Statement (MECP, 2018) supports the province's goals to move towards zero waste and zero greenhouse gas emissions from the waste sector.

Based on the careful consideration of provincial policy and the results of the Waste Diversion Study Report the following recommendations for the Township to enhance its current waste diversion program were identified:

- Develop and implement a backyard composting program for source separated organics.
- Optimize the current blue box recycling program with a dual-stream recycling program with the purchase of new split collection vehicles.
- Develop an on-site leaf and yard waste composting program at the Boyne Road Landfill site and expand the collection program for leaf and yard waste.
- Develop new and reinforce existing waste management policies.

The implementation of these waste diversion program enhancement is reasonably estimated to increase the Township's residential solid waste diversion rate from the current 23% to 33%, noting that the current diversion rate is likely higher but cannot be quantified with the available information.

With the exception of a zero-waste solution, this alternative does not have the ability to fully address the stated problem being assessed but can reduce the amount of post-diversion waste requiring management. A zero-waste solution is not presently considered possible or available to the Township given its small size and tax base to pay for this system and no control over IC&I waste generators (which are provincially legislated).

This waste diversion alternative can be used to estimate the amount of residual waste requiring management over the 25 year planning period; however, it is not in itself a means of managing residual waste and cannot be compared as a standalone alternative. For this reason, Alternative 5 will not be included in the comparative evaluation of waste management 'Alternatives To'.

6.3.6 Alternative 6 – Do-Nothing

In EAs, the Do-Nothing alternative is considered in the evaluation of 'Alternatives To' as a benchmark against which the potential environmental impacts and the advantages and disadvantages of the alternatives being considered can be measured and compared. For the Township of North Dundas, the Do-Nothing alternative would be to close the Boyne Road Landfill when it reaches its approved capacity and not pursue any other solution for waste management for the Township. It is noted that one of the Township's basic requirements as a municipality is to provide municipal services and infrastructure for its ratepayers. As such, the Do-Nothing alternative is not an 'Alternative To' that could be considered to resolve the long-term waste management problem; rather, as stated above, it provides a basis of comparison as part of the EA process.

6.4 Comparative Evaluation of 'Alternatives To'

The potential effects and/or implications of each of the remaining Alternatives 1, 2 and 4 has been generally identified and described for each of the evaluation criteria. A qualitative assessment methodology was applied to complete a comparative assessment of remaining Alternatives 1, 2, and 4. Information on Alternative 6 is also provided as a basis of comparison. The methodology consists of assigning an overall relative rating from most preferred to least preferred for each alternative, first for each of the criteria and then for the environmental component. Qualitative comparative rating of potential impact uses the descriptors most preferred, less preferred, least preferred and equally preferred. Based on the description of potential impact for each criterion, the assignment of the qualitative descriptors should be readily apparent and understandable.

6.4.1 Summary of Comparative Evaluation of 'Alternatives To'

The comparative assessment of each criteria is presented in Table 6-2 to Table 6-10.

The outcome of this comparative evaluation is the identification of the preferred 'Alternative To' for long term waste management for the Township of North Dundas.

Table 6-2: Summary of Evaluation of Alternatives – Atmosphere

Consideration	Alternative 1: Existing Landfill Site Closure and Export of Waste for Disposal	Alternative 2: Landfill Site Expansion	Alternative 4: Existing Landfill Site Closure and Alternative Waste Management Technologies	Alternative 6: Do-Nothing
Criteria	***Potential effects on air quality (including dust, odour, GHG)***			
Comments	Closure of the existing landfill will eliminate any off-site dust and odour impacts associated with landfill site operations. Reduced methane emissions from landfill locally over time and potentially overall if landfill gas is more efficiently managed at an external site. Landfill gas generated in greater volume at the larger site to which waste is exported. Exporting waste will eliminate odour generated from active landfilling on a local level. Increased emissions of GHG from hauling efforts.	Landfill expansion will continue to produce methane, and odour at levels comparable to the current waste management practices (noting that off-site odours are not presently a problem).	Reduced methane emissions compared to landfilling, but generation of other atmospheric emissions with often less control and/or reliability (especially depending on efficiency of steady state incinerator operations).	Landfill would be capped and closed; methane generation and release to atmosphere would be ongoing as described for Alternative 1. If the Township does not pursue another waste management alternative, this would lead to an increase in uncontrolled emissions from waste to air.
Qualitative Rating	Less preferred	Most preferred	Least preferred	–
Criteria	***Potential effects on noise***			
Comments	Closure of the existing landfill will eliminate noise impacts associated with landfill site operations at neighbouring off-site receptors. Potential for different location of haul route introduces noise impacts at receptors along the potential haul route. These would result in an increase in noise levels associated with the receiving landfill and possibly more noise at sensitive receptors along the haul route.	Landfill expansion will continue to produce noise at levels comparable to the current waste management practices (noting that off-site noise complaints are not presently a problem).	Assuming that the bulk of the thermal treatment occurs indoors, then noise associated with this option is predominantly along the haul route only.	Landfill would be capped and closed; noise would be limited to post-closure landscaping maintenance activities.
Qualitative Rating	Least preferred	Less preferred	Most preferred	–

Table 6-3: Summary of Evaluation of Alternatives – Geology and Hydrogeology

Consideration	**Alternative 1: Existing Landfill Site Closure and Export of Waste for Disposal**	**Alternative 2: Landfill Site Expansion**	**Alternative 4: Existing Landfill Site Closure and Alternative Waste Management Technologies**	**Alternative 6: Do-Nothing**
Criteria	***Potential effects on groundwater resources***			
Comments	Groundwater quality at current landfill site should gradually improve following site closure. The site to which waste is exported will need to adhere to relevant environmental standards and guidelines, and potential impact to groundwater at that site should be similar to that expected without inclusion of waste from North Dundas.	Leachate can affect groundwater in the vicinity of the waste site. The expanded landfill capacity will be developed to comply with provincial standards and guidelines to protect off-site groundwater quality.	Landfilling of ash by-product from thermal treatment can affect local groundwater if not properly managed but will likely pose less serious impact than non-thermally treated waste.	Landfill would be capped and closed; leachate generation and migration in groundwater would be ongoing as described for Alternative 1. If the Township does not pursue another waste management alternative, risk of leachate generation and groundwater impacts from unregulated waste management practices.
Qualitative Rating	Less preferred	Less preferred	Most preferred	–

Table 6-4: Summary of Evaluation of Alternatives – Surface Water

Consideration	**Alternative 1: Existing Landfill Site Closure and Export of Waste for Disposal**	**Alternative 2: Landfill Site Expansion**	**Alternative 4: Existing Landfill Site Closure and Alternative Waste Management Technologies**	**Alternative 6: Do-Nothing**
Criteria	***Potential effects on surface water resources***			
Comments	Effects on surface water quality in area of current landfill site should gradually improve following site closure. The site to which waste is exported will need to adhere to relevant environmental standards and guidelines and potential impact to surface water at that site should be similar to that expected without inclusion of waste from North Dundas.	Impacted groundwater can affect surface water in the vicinity of the waste site. The expanded landfill capacity will be developed to comply with provincial standards to protect surface water quality.	Landfilling of ash by-product from thermal treatment can affect local surface water if not properly managed but will likely pose less serious impact than non-thermally treated waste.	Landfill would be capped and closed; effects on surface water would be as described for Alternative 1. If the Township does not pursue another waste management alternative, risk of leachate generation and surface water impacts from unregulated waste management practices.
Qualitative Rating	Less preferred	Less preferred	Most preferred	–

Table 6-5: Summary of Evaluation of Alternatives – Biology

Consideration	Alternative 1: Existing Landfill Site Closure and Export of Waste for Disposal	Alternative 2: Landfill Site Expansion	Alternative 4: Existing Landfill Site Closure and Alternative Waste Management Technologies	Alternative 6: Do-Nothing
Criteria	***Potential effects on natural environment features (aquatic and terrestrial ecosystems)***			
Comments	Existing landfill and landfill to which waste is exported could potentially impact aquatic resources if leachate enters the environment.	Expansion of landfill site could require some brush/tree clearing on landfill property that could disrupt the terrestrial environment. Any clearing would be carried out in accordance with provincial and local requirements. Expanded landfill could potentially impact aquatic resources if leachate impacts surface water at sufficiently high concentrations.	Footprint of new thermal treatment facility and landfill may damage or disrupt natural environment. Potential impact on aquatic resources from leachate associated with landfilling of ash.	Landfill would be capped and closed; effects on surface water would be as described for Alternative 1. If the Township does not pursue another waste management alternative, increased risk of waste/leachate effects on natural environment from unorganized waste management practices can be expected.
Qualitative Rating	Most preferred	Less preferred	Least preferred	–

Table 6-6: Summary of Evaluation of Alternatives –Land Use Planning and Agriculture

Consideration	Alternative 1: Existing Landfill Site Closure and Export of Waste for Disposal	Alternative 2: Landfill Site Expansion	Alternative 4: Existing Landfill Site Closure and Alternative Waste Management Technologies	Alternative 6: Do-Nothing
Criteria	***Potential effects on existing land use and agriculture***			
Comments	The closed landfill site would not be suitable for agricultural or other land uses and would likely remain as its current land use designation. The landfill site to which waste is exported is also unlikely to be suited for agriculture or other uses post-closure. Official planning assesses and designates surrounding land uses to be compatible with both waste disposal sites.	Current landfill site property is designated in an area for rural land use and is suitable for landfilling. There is sufficient area on the landfill property to accommodate landfill expansion although additional contaminant attenuation zone may need to be added from the surrounding land designated as agricultural land use.	Establishing a new thermal treatment facility will need to be located on a parcel in an area designated rural. Thermal treatment operations may have an impact on surrounding agricultural operations. Depending on the footprint of the facility and the establishment of a landfill for the ash by-product, it is possible there would be a need to convert nearby agricultural land to establish an appropriate buffer for surrounding land use.	Landfill would be capped and closed; effects on land uses in vicinity of the existing landfill site would be as described for Alternative 1. If the Township does not pursue another waste management alternative, unorganized waste management practices can impact quality of agricultural lands or be incompatible with other land uses.
Qualitative Rating	Most preferred	Less preferred	Least preferred	–

Table 6-7: Summary of Evaluation of Alternatives – Cultural Heritage Resources

Consideration	Alternative 1: Existing Landfill Site Closure and Export of Waste for Disposal	Alternative 2: Landfill Site Expansion	Alternative 4: Existing Landfill Site Closure and Alternative Waste Management Technologies	Alternative 6: Do-Nothing
Criteria	***Potential effects on archaeology***			
Comments	Minimal, if any, site alteration needed to close the landfill site. Approval of the site to which waste would be exported would have received the required provincial approvals regarding archaeology.	Minimal site alteration expected. Some additional land acquisition or groundwater easement may be needed for the contaminant attenuation zone. Approval of the site expansion requires provincial approvals regarding archaeology.	New thermal treatment facility location (and ash by-product landfill) may have impact on existing archaeology. Approval of the new site would require provincial approvals regarding archaeology.	Landfill would be capped and closed; effects on archaeology would be as described for Alternative 1.
Qualitative Rating	Most preferred	Less preferred	Least preferred	–
Criteria	***Potential effects on cultural environment (cultural heritage landscapes, built heritage resources)***			
Comments	Minimal, if any, site alteration expected to close landfill site. Landscape is estimated to be of no significant value and remote nature of landfill will have minimal to no impact on built heritage resources and cultural heritage landscapes. Approval of the site to which waste would be exported would have received the required provincial approvals regarding cultural heritage.	Minimal site alteration expected. Some additional land acquisition or groundwater easement may be needed for the contaminant attenuation zone. Landscape is estimated to be of no significant value and remote nature of landfill will have minimal to no impact on built heritage resources. Approval of the site expansion requires provincial approvals regarding cultural heritage.	New thermal treatment facility location (and ash by-product landfill) may have impact on existing cultural heritage landscapes and/or built heritage resources. Approval of the new site would require provincial approvals regarding cultural heritage.	Landfill would be capped and closed; effects on cultural heritage would be as described for Alternative 1.
Qualitative Rating	Most preferred	Most preferred	Least preferred	–

Table 6-8: Summary of Evaluation of Alternatives – Socio-Economic

Consideration	Alternative 1: Existing Landfill Site Closure and Export of Waste for Disposal	Alternative 2: Landfill Site Expansion	Alternative 4: Existing Landfill Site Closure and Alternative Waste Management Technologies	Alternative 6: Do-Nothing
Criteria	***Potential site operational effects on sensitive receptors (i.e. noise, air quality)***			
Comments	Closure of landfill site will eliminate odour, litter, dust or noise effects off-site associated with current landfill site operations. Few to no existing sensitive receptors in proximity of current landfill due to lack of neighbours on adjacent properties. Additional hauling distances for exporting waste could lead to additional odour/noise/litter along haul routes.	Landfill expansion expected to have similar minimal effects on sensitive existing off-site receptors as current landfill site. Few to no existing sensitive receptors in proximity of current landfill due to lack of neighbours on adjacent properties. No complaints for odour, dust, litter or noise have been received at the Boyne Road Landfill site in recent years. Expansion will maintain short haul distance from largest serviced population centres.	Atmosphere discharges from thermal processing facilities and additional airborne discharges from landfilling ash by-product from thermal treatment process are expected to have more potential to create nuisance issues.	Landfill would be capped and closed; effects in vicinity of the landfill site would be as described for Alternative 1. If the Township does not pursue another waste management alternative, unorganized waste management practices could lead to broader odour issues across the Township if waste is not disposed of properly.
Qualitative Rating	Less preferred	Most preferred	Least preferred	–
Criteria	***Relative Cost and timing of approvals***			
Comments	Closure plan for existing landfill will need to be submitted before approved capacity is reached. Approval of closure plan is expected to take 3 to 6 months. Establishing a waste transfer station in the Township will require additional ECA approvals (1 to 1.5 years). Approximate total approvals cost is estimated to be $30,000 - $40,000.	Expansion of the current landfill site will require completion and approval of an EA (4 to 5 years total, likely in 2022) followed by an amendment to the site's existing ECA (1 year). Approximate total cost is estimated to be $750,000 to $800,000.	Establishing a new thermal treatment facility will require completion and approval of an EA (4 to 5 years) followed by an application for a new ECA for the new thermal treatment facility (2 years) and associated ash waste disposal. Approximate total cost is estimated to be $1,000,000 to $2,000,000.	Landfill would be capped and closed; costs associated with approvals for closure would be as described for Alternative 1.
Qualitative Rating	Most preferred	Less preferred	Least preferred	–

Consideration	Alternative 1: Existing Landfill Site Closure and Export of Waste for Disposal	Alternative 2: Landfill Site Expansion	Alternative 4: Existing Landfill Site Closure and Alternative Waste Management Technologies	Alternative 6: Do-Nothing
Criteria	***Relative Cost of Implementation (capital and operational costs)***			
Comments	Capital closure expenditures and waste contract negotiation estimated at approximately $900,000. Annual operating costs and fees at the new landfill estimated at approximately $200,000/year based on current tipping fees. Uncertainty in future annual operating costs in view of increase tipping and hauling costs. 25-year costs estimated at approximately $5.9 million.	Initial capital costs for a natural attenuation landfill (including land acquisition, construction, and closure costs) estimated at approximately $4,550,000. It is noted that some of these capital costs, associated with additional construction and progressive closure will occur throughout the 25-year planning period. Annual operating costs will be comparable to current operating costs, approximately $55,000/year. 25-year costs estimated at approximately $5.9 million.	Capital costs will include the commissioning and setup of a new incineration facility and closure expenditures for the existing landfill (as described for Alternative 1). Operating costs will cover ongoing operation and maintenance costs as well as additional operational expenditures for the export and disposal of ash by-product waste Capital costs are estimated to be $9 million with annual operating costs of approximately $1.5 million. 25-year costs estimated at approximately $37.5 million.	Landfill would be capped and closed; capital costs associated with closure would be as described for Alternative 1.
Qualitative Rating	Less preferred	Most preferred	Least preferred	–

Table 6-9: Summary of Evaluation of Alternatives – Transportation

Consideration	Alternative 1: Landfill Site Closure and Export of Waste for Disposal	Alternative 2: Landfill Site Expansion	Alternative 4: Alternative Waste Management Technologies	Alternative 6: Do-Nothing
Criteria	***Potential effect on road network***			
Comments	Changing from hauling waste to a local landfill site to an alternate site outside the Township will result in increased traffic impacts along the selected haul routes. Traffic impacts are expected to increase over time as the future tonnage of waste increases.	Expansion of current landfill site would have continued traffic to site at current levels, with traffic expected to increase over time as the future tonnage of waste increases.	Increased traffic impacts are expected for the construction and delivery of material for the new thermal processing facility. Depending on the siting of the new facility, traffic impacts are anticipated to be similar to the current landfill site and will increase over time as the future tonnage of waste increases.	Closure of landfill would result in the end of waste hauling vehicle traffic.
Qualitative Rating	Less preferred	Most preferred	Less preferred	–

Table 6-10: Summary of Evaluation of Alternatives – Technical

Consideration	Alternative 1: Existing Landfill Site Closure and Export of Waste for Disposal	Alternative 2: Landfill Site Expansion	Alternative 4: Existing Landfill Site Closure and Alternative Waste Management Technologies	Alternative 6: Do-Nothing
Criteria	***Ability of the Township to operate***			
Comments	Main operational responsibilities will be handled through the private sector with little technical effort on the part of the Township; however, there is less control over long-term waste management planning for the Township.	Operational requirements are well understood, and ongoing operational tasks are expected to be similar to current landfilling operations at existing site. Additional surface water control and site construction will be necessary for continued expansion efforts over 25-year planning period.	Operation and maintenance of thermal processing facility is too complex for Township to operate independently and will require design-build-operate service or contracted third party support.	N/A
Qualitative Rating	Most preferred	Most preferred	Least preferred	–
Criteria	***Technical risks associated with the operation of the alternative***			
Comments	No technical risks.	Common risks and responsibilities associated with landfilling are expected (such as landfill gas generation, leachate management, nuisances such as blown litter, odour/noise).	Thermal processing (specifically incineration) is a well understood and proven technology for waste management. The technology is scalable, but the Township may have difficulty to maintain steady-state operations based on the limited waste generation by the Township. Incorrect or inefficient operation could lead to additional pollution generated.	Unorganized waste management in the Township would lead to increased future difficulty in managing environmental impacts from waste.
Qualitative Rating	Most preferred	Less preferred	Least preferred	–

6.4.2 Advantages and Disadvantages of 'Alternatives to'

As part of the comparative assessment, the advantages and disadvantages of each 'Alternative To' are described. The Do-Nothing alternative is included in this comparison. This advantage-disadvantage assessment is presented in Table 6-11.

Table 6-11: Advantages and Disadvantages of 'Alternatives to'

Alternative	Advantages	Disadvantages
Alternative 1: Existing Landfill Site Closure and Export of Waste for Disposal	• None or minimal disruption of local habitat • Minimal operational efforts required for Township • Relatively fast transition (including approvals) from current waste management service • High level of certainty of obtaining approvals • Lower capital expenditures	• Additional greenhouse gas emissions from destination landfill and from hauling vehicles • Consumption of fossil fuels from hauling efforts • Higher operating costs than current practices • Less control over long-term waste management planning for Township
Alternative 2: Landfill Site Expansion	• Land use already designated for waste disposal • No increase in operational or financial effort • Socially accepted by community. No changes to residential experience • The Township has sufficient land to support a successful expansion • Lower operating costs • Waste management operations remain under Township control	• Greenhouse gas emissions from landfill • Facility will require longer ongoing environmental monitoring • Longer approvals process, with some uncertainty of outcome • Lateral landfill expansion can possibly affect the natural environment and archaeology resources
Alternative 4: Existing Landfill Site Closure and Alternative Waste Management Technologies	• Potential for energy recovery from technology • Less greenhouse gas emissions compared to conventional landfilling if operated efficiently	• Complex technology will require design-build-operate approach • Significant environmental approval effort will be required, and approval process will be lengthy • Technology not proven effective at the Township's low waste generation volume • Can produce negative air emissions (heavy metals, dioxins)

Alternative	Advantages	Disadvantages
		• Very high capital and operating costs • Site development can affect the natural environment, agriculture, and archaeology resources
Alternative 6: Do-Nothing		• Would lead to potentially significant environmental impacts • Effects of environmental impacts would take increased effort and time to mitigate than adopting one of the other alternatives • Township would not fulfill its mandate as a municipality to manage the waste of its ratepayers

6.5 Identification of the Preferred ‘Alternative To’

From the six proposed ‘Alternatives To’ for managing the Township’s long term waste disposal needs, Alternative 3 (Existing Landfill Site Closure and Establish a New Landfill Site) was deemed unreasonable to pursue in view of the preferred landfill site characteristics, land use requirements, and land available within the Township, as determined through a new landfill site screening assessment (Volume 3 Appendix I) and summarized in Section 6.3.3. Alternative 5 (Enhanced Waste Diversion) is described in the Waste Diversion Study (Volume 3 Appendix J) and summarized in Section 6.3.5; this alternative should be implemented as part of the selected ‘Alternative To’ but (with the exception of a zero waste solution, which was not deemed feasible) is not a standalone solution for the management of the Township’s waste management needs.

Alternative 6 (Do-Nothing) offers no advantages compared to the other three ‘Alternatives To’, and the major disadvantage that the Township would not fulfill its mandate to manage the waste generated by its ratepayers.

Compared to Alternatives 1 and 2 that both involve landfilling, Alternative 4 (Adopt Alternative Waste Management Technologies) would involve much more complex technology that are not proven effective at the Township’s low waste generation volumes, would require a long term design-build-operate contract with a private sector provider since an alternative technology is beyond the Township’s capability, and it would involve much higher capital and operational costs.

From the remaining three proposed 'Alternatives To', Table 6-12 below provides a summary of the comparative assessment from Section 6.4.1 of this report. For any alternative, potential effects on groundwater, surface water and the natural environment, as well as preservation of any archaeological resources, would have to be mitigated in accordance with provincial requirements to obtain the required approvals and to be able to continue operations.

Table 6-12: Summary of Comparative Analysis of 'Alternatives To'

Alternative	Comparison Summary	Overall Qualitative Rating
Alternative 1: Existing Landfill Site Closure and Export of Waste for Disposal	Most preferred for biology, agriculture/land use, archaeology, built heritage resources and cultural heritage landscapes, relative cost of approvals, ability of the Township to operate and technical risk. Least preferred for noise criteria.	Less Preferred
Alternative 2: Landfill Site Expansion	Most preferred for air quality, transportation, built heritage resources and cultural heritage landscapes, nuisance, ability of the Township to operate and cost of implementation. Not least preferred for any criterion.	Most Preferred
Alternative 4: Existing Landfill Site Closure and Alternative Waste Management Technologies	Most preferred for noise, groundwater and surface water criteria. Least preferred for air quality, biology, agriculture/land use, archaeology, built heritage resources and cultural heritage landscapes, all socio-economic and all technical criteria.	Least Preferred

Alternative 1 (Export Waste for Disposal) and Alternative 2 (Expand the Existing Landfill) both involve landfilling. As summarized in Table 6-12, in terms of the environmental components considered in the comparison, Alternative 2 was preferred compared to Alternative 1. Alternative 4 was least preferred.

Alternatives 1 and 2 each have advantages and disadvantages. Alternative 1 has lower capital costs but much higher annual operating costs compared to Alternative 2; the operational costs for Alternative 2 are similar to current costs and the capital costs can be spread out over much of the 25 year operating life of the expansion. With Alternative 2, the Township retains full control over waste management in the municipality, while with Alternative 1 the Township has much less control and are dependent on a private sector waste disposal site owner. From a greenhouse gas generation perspective, there will be additional gas generated by vehicles associated with the longer waste haul distance while for Alternative 2 there will be gas generated from the expanded landfill.

In determining the overall preferred ‘Alternative To’, key factors for the Township were maintaining control over waste management and associated costs, having the ability to operate and being able to spread the capital costs out over time and minimizing annual operating costs. As described above, Alternative 2 satisfies these key factors much better than Alternative 1.

This assessment is relatively close; however, based on the results presented in Table 6-12, and also with consideration of the advantages and disadvantages presented in Table 6-11 and the key factors that are most important to the Township, the preferred ‘Alternative To’ from the assessment is Alternative 2 – Landfill Site Expansion.

7.0 Updated Diversion and Residual Waste Disposal Requirements

As an Ontario municipality responsible for providing waste services for its ratepayers, the Township's objective in undertaking the EA is to obtain approval for a long-term solution for waste disposal while concurrently evaluating diversion opportunities to reduce the amount of waste generated for disposal over the planning period.

The Township proposes a 25-year planning period, i.e., 2023 through 2048, for the following reasons:

- As it relates to building strong and healthy communities, the Provincial Policy Statement (2020) states under policies in section 1.1.1 that "…necessary infrastructure and public service facilities are or will be available to meet current and projected needs. Section 1.1.2 states that "Nothing in policy 1.1.2 limits the planning for infrastructure, public service facilities and employment areas beyond a 25-year time horizon." The provision of waste management and waste disposal services is a major component of municipal infrastructure; as such, a waste management planning period of 25 years is consistent with the Provincial Policy Statement.
- A planning period of 25 years is the same as has been approved in many waste management EAs in Ontario in recent years, for both public and private sector proponents.
- It is expected that the initiatives made by the province towards achieving zero-waste are likely to take time regarding planning and policy development followed by implementation. The Township needs to have secure waste management available during this time period. It is expected that some waste policy will be first implemented in urban centres, and therefore will only come later to rural municipalities like North Dundas. This is supported by comments regarding food and organic waste being applicable to larger cities found in "A-Made-in Ontario Environment Plan", November 2018 (MECP, 2018a). The plan also says that the MECP recognizes while we work to reduce the amount of waste we produce, it is also recognized that there will be a need for landfills in the future. It is acknowledged that Section 6.8 of the "Policy Statement on Ontario's Food and Organic Waste", April 2018 states that proponents of new or expanded waste management systems for disposal should consider resource recovery opportunities for food and organic waste (MECP, 2018). The Policy goes on to note that for municipalities the size of the Township, the appropriate mechanism for organic waste management would be through home composting, community composting and local event days; the Township currently encourages home composting. The Township has considered waste diversion initiatives in alignment with Provincial policies and has studied diversion opportunities as a commitment of this EA (refer to Volume 3 Appendix J). The Township welcomes further information, requirements, regulation, and funding on how this will work across the province. Based on the Waste Diversion Study and Provincial policy, the Township of North Dundas is likely to be reliant on having secure post-diversion waste management available for an extended period, which is reasonably proposed by the Township as a 25-year planning period.

The currently approved geometry provides sufficient capacity to continue landfilling operations until end of 2023 or mid-2024 and the Township can continue serving its ratepayers during this time when required approvals for landfill expansion can be obtained.

Residual solid waste is the waste remaining for disposal (by means of several possible alternatives) after diversion/recycling activities. For purposes of estimating the residual waste management requirements for the 25-year planning period, projections were based on the latest population growth statistics available for the Township as shown in Table.

Table 7-1: Historical Total Population

Year	Total Population
1996	11,064
2001	11,014
2006	11,095
2011	11,225
2016	11,715
Projections	
2021	12,107
2026	12,640
2031	13,099
2036	13,236

Notes:
[1] From Township's Municipal Department, based on population projections completed as part of the Township's Official Plan

The United Counties of Stormont, Dundas and Glengarry Official Plan consolidated in 2018 suggests that the population compounded annual growth rate between 2016 and 2036 is expected to be approximately 0.6%.

The results of previous surveys of the active portion of the landfill completed since 2008 indicate that the annual fill rate ranges from approximately 10,400 to 18,900 m^3 per year (with one higher fill rate in 2017). A survey of the full landfill footprint was completed in both December 2015 and December 2020; a comparison of the full landfill surface between 2015 and 2020 indicates an average annual fill rate of approximately 16,200 m^3 per year. Prior to 2008 these parameters were estimated based on car counts, which were later found to be inaccurate. It is also noted that there is not a weigh scale at the current landfill by which to determine tonnage received, diverted and disposed. The landfill does not differentiate between municipal and IC&I waste and hence detailed information on the volume of waste from each of these sectors is not available. In the Waste Diversion Study (Volume 3 Appendix J), it was estimated that 80% of waste received at the Boyne Road Landfill was residential, while 20% was IC&I. The projections presented herein are based on this estimate.

Based on the range indicated above, the annual landfill airspace consumed varies considerably from year to year, depending on specific events that occur within the Township, i.e., construction and demolition projects, structure fires, etc., and the corresponding need for disposal capacity. For purposes of estimating the post-diversion waste management requirements for the 2023-2048 (25 year) planning period to be provided, the current residential waste diversion rate of 23% and an allowance for post-diversion waste occupying 16,200 cubic metres (m^3) per year starting in 2021 have been assumed.

The Waste Diversion Study (Volume 3 Appendix J) identified a combination of waste diversion options for the preferred waste diversion system. The preferred combined waste diversion system includes:

- backyard composting for source separated organics (SSO)
- dual Stream Recycling program
- curbside collection and chipping or composting of leaf and yard (L&Y) waste at the Boyne Road Landfill site
- existing and new waste management policies

The preferred combined waste diversion system consists of curbside collection of waste and dual-stream recyclables by municipal staff using new 60/40 split collection vehicles. Collection will occur weekly, with recyclables collection alternating each week between fibres and containers. Waste material will be brought to the Boyne Road Landfill, whereas recyclable material will be transferred at the Boyne Road Landfill and then hauled to a private material recycling facility outside of the Township. According to the existing and new waste management policy options, curbside collection will only collect 2 bags of waste from residents and 4 bags of waste from farms. No waste will be collected from businesses or multi-residential buildings (following a phase out program) and receipt of concrete from IC&I sources will be limited at the landfill. L&Y waste will also be collected from specific areas of the Township at the curbside four times throughout the year: once in the spring, twice in the fall, and once in early January for collection of Christmas trees. The collection of L&Y waste will be done using the existing collection vehicles from the old waste diversion program until they have exhausted their useful lifespan; after which additional collection routes will be scheduled for L&Y waste using the new collection vehicles. Collected L&Y waste will be sent to the Boyne Road Landfill, where it will be chipped and used as daily cover for landfilling operations or be placed at a new composting pad for outdoor windrow composting. The Township will also promote residents to divert SSO material and excess L&Y waste from landfill using the backyard composting program introduced for SSO.

The preferred combined waste diversion system is estimated to have an increased diversion potential between 10 to 35 percentage points, corresponding to an increased residential diversion rate of 33 to 58%. The current residential diversion rate (23%, RPRA, 2018) may actually be higher, due to the voluntary backyard composting efforts by residents that already exist but are not quantifiable within the Township. It is expected that the new waste diversion programs will require a ramp up period before meeting their diversion potential.

Per the Waste Diversion Study, it is reasonably estimated that the Township can obtain a residential diversion rate of 28% and 33% by 2025 and 2030, respectively, and maintain this rate going forward. The effect of the residential waste diversion gradual increase has been applied only to the residential component of the waste stream, which has been assumed to be approximately 80% of the total waste received for landfilling as per information provided by the Township. The projected future post-diversion waste management requirements are provided in Table 7-2 below.

Table 7-2: Projected Post-Diversion Waste Management, Township of North Dundas

Year	Assumed Residential Waste Diversion Rate (%)	Estimated Annual Waste Disposal (m^3)
2021	23.0%	16,200
2022	24.3%	16,100
2023	25.6%	16,000
2024	26.9%	15,800
2025	28.0%	15,700
2026	29.0%	15,700
2027	30.0%	15,600
2028	31.0%	15,500
2029	32.0%	15,400
2030	33.0%	15,300
2031	33.0%	15,400
2032	33.0%	15,500
2033	33.0%	15,600
2034	33.0%	15,700
2035	33.0%	15,800
2036	33.0%	15,900
2037	33.0%	16,000
2038	33.0%	16,100
2039	33.0%	16,200
2040	33.0%	16,300
2041	33.0%	16,400
2042	33.0%	16,500
2043	33.0%	16,600
2044	33.0%	16,700
2045	33.0%	16,800
2046	33.0%	16,900
2047	33.0%	17,000
2048	33.0%	17,100
TOTAL CAPACITY NEEDED FOR 2021 TO 2048		**~450,000 m^3**
TOTAL CAPACITY FOR THE PLANNING PERIOD (2023-2048)		**417,700 m^3**

Based on the above assumptions and projection, the expansion of the Boyne Road Landfill will have to accommodate waste corresponding to the consumption of approximately 450,000 m^3 of landfill airspace (excluding final cover) from existing ground conditions at the landfill at the end of 2020 or 417,700 m^3 for the 25 year planning period starting in 2023.

It is noted that this updated airspace requirement is slightly higher than the previous estimate made at the time of preparation of the ToR and used in the evaluation of 'Alternatives To' in Section 6.0. This updated airspace does not affect that evaluation or its conclusion that expansion of the Boyne Road Landfill is the Township's preferred waste management alternative.

8.0 Study Areas and Environmental Component Work Plans for Landfill Expansion

The EAA defines the environment in a broad, general sense. The natural components include: atmosphere (air quality, noise), geology and hydrogeology, surface water (quantity and quality) and biology (aquatic and terrestrial ecology). The social and -economic component includes: socio-economic (local economy, residents and community and visual), land use and agriculture. The cultural components include cultural heritage resources (archaeology, built heritage resources and cultural heritage landscapes). The technical component includes: design and operation financial and transportation (traffic) aspects of the environment.

8.1 Study Areas

Data for the assessment of the 'Alternative Methods' was collected and analyzed for generic study areas that were confirmed and refined during the EA. Preliminary study areas considered for the work plan and existing conditions stage of the EA consisted of:

- **Site Study Area** – The existing Boyne Road Landfill site, located at 12620 Boyne Road, Lot 8, Concession VI. The extent of the Site Study Area includes the lands owned by the Township of North Dundas that consist of the existing Boyne Road Landfill waste footprint and an area 300 m to the south of the existing waste footprint.
- **Site-vicinity Study Area** – The lands in the area immediately adjacent to the Site Study Area that have the potential to be directly affected by the landfill expansion and activities with the Site Study Area. The extent of the Site-vicinity Study Area will be determined for each of the environmental components. For most environmental components, a Site-vicinity Study Area of 500 metres from the Site Study Area is appropriate.
- **Wider Study Area** – An area that takes on the broader community generally beyond the immediate site vicinity and for specific environmental components may include the entirety of the Township of North Dundas, as appropriate.

The rationale for the definition of these preliminary study areas is as follows:

- **Site Study Area** – The area of land within which 'Alternative Methods' of landfill expansion may occur has been defined and will be limited to a portion of the existing Boyne Road Landfill property, with the property as defined in the Boyne Road Landfill's ECA, which includes adjacent buffer zones and contaminant attenuation zones.
- **Site-vicinity Study Area** –The MECP Guideline D-4 Land Use on or Near Dumps (MOE, 1995a) describes that the most significant potential impacts typically occur within 500 m of the perimeter of the waste disposal area on a landfill site. For this reason, this Guideline distance is often used by Ontario municipalities in their Official Plans to establish a holding zone around landfills; development within these zones requires proponents to demonstrate that their proposed development will not be adversely affected by the landfill site and its operations. For most environmental components, a Site-vicinity Study Area of 500 m from the Site Study Area limits is appropriate. For specific

environmental components, the appropriate Site-vicinity Study Area is greater than 500 m from the existing or potential expanded disposal area. It should also be recognized that the Boyne Road Landfill has been in operation for over 50 years, and monitoring and operational data demonstrates compliance with the requirements of its ECA and the limited extent for potential adverse environmental impacts to occur off-site.

- **Wider Study Area** – An area that takes in the broader community generally beyond the immediate site-vicinity and for specific environmental components may include the entire Township of North Dundas.

The extent of the study area proposed for each of the environmental components to be studied during the EA, together with a rationale, is provided in Table 8-1 below.

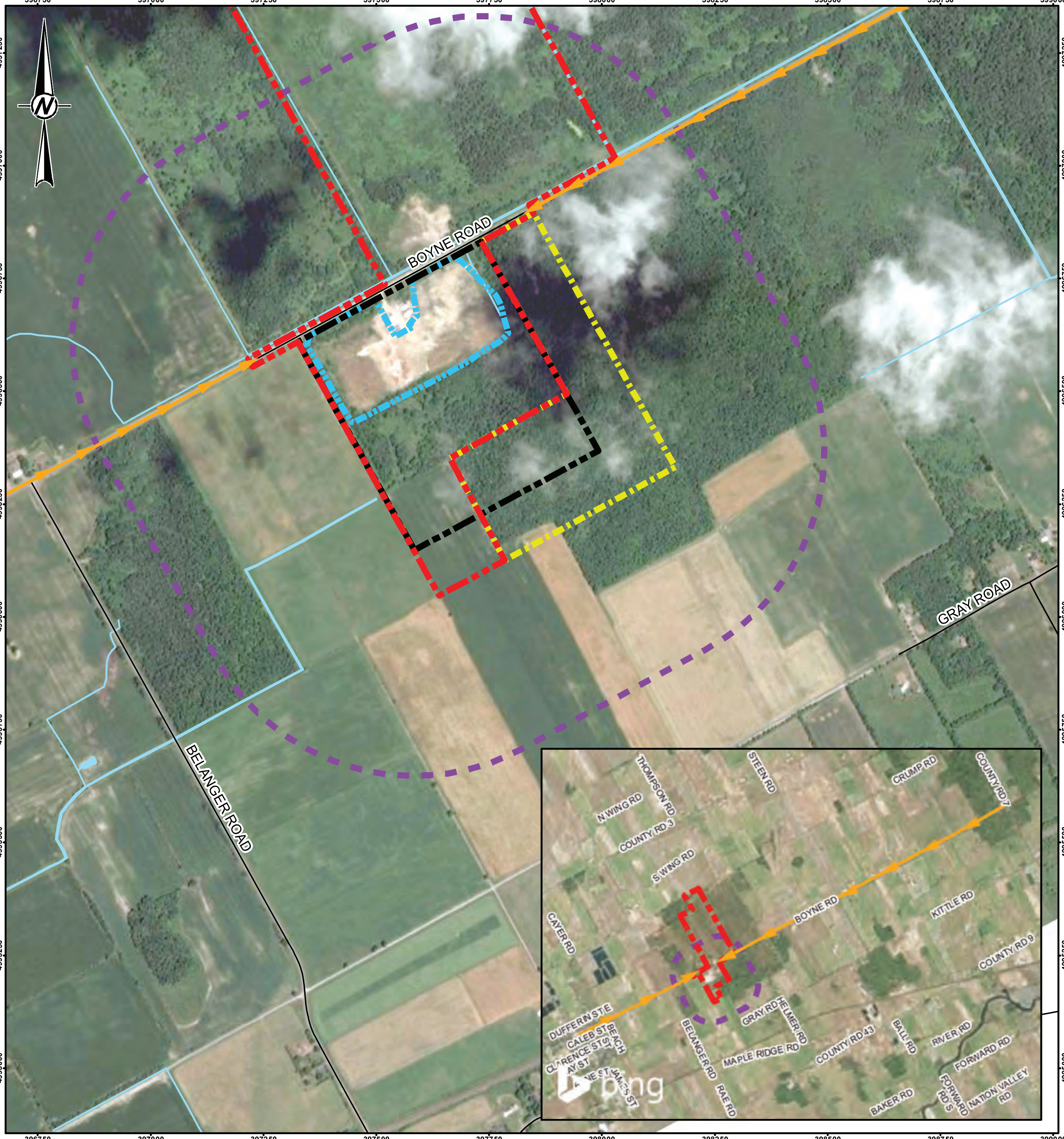
Table 8-1: Proposed Study Areas

Environmental Component/Sub-Component	Area(s) to be Studied	Rationale
Atmosphere/Air Quality	Site and Site-vicinity	Air quality and odour emissions are required to meet provincial requirements at the landfill site boundary or closest sensitive receptors. Since there are no sensitive receptors within the 500 m around the Site Study Area, the Site-vicinity Study Area will be nominally increased to extend to the nearest sensitive receptors to the east, south and west, noting that the air quality assessment will employ a grid and may extend further.
Atmosphere/ Noise	Site-vicinity	Noise emissions are required to meet provincial requirements at the closest noise sensitive receptors (existing and potential). For the purposes of this assessment, a distance of 1,500 m is considered. To assess noise due to project-related road traffic along the haul route, noise sensitive receptors within 500 m of the haul road centerlines were considered. See discussion under Transportation for a description on the Site-vicinity Study Area for the haul routes.
Geology and Hydrogeology/ Groundwater Quality	Site and Site-vicinity	Potential effects on groundwater quality have to comply with the MECP Reasonable Use Guideline (MOE, 1994) at the landfill site and CAZ boundaries.

Environmental Component/Sub-Component	Area(s) to be Studied	Rationale
Surface Water/ Surface Water Quality and Quantity	Site and Site-vicinity	Necessary to include the drainage boundaries of the subwatersheds within which the landfill site is located.
Biology/ Aquatic and Terrestrial Ecosystems	Site and Site-vicinity	Potential effects on biological resources are expected to be limited to 120 m from the Site Study Area in accordance with the provincial standard for “adjacent lands” to significant natural features in accordance with the MNRF’s Natural Heritage Reference Manual.
Land Use Planning/ Current and Planned Future Land Use	Site and Site-vicinity	Since there are provincial requirements that govern the potential emissions or discharges from the landfill site, potential effects on land use are expected to be limited to 500 m from the Site Study Area.
Agriculture	Site and Site-vicinity	Since there are provincial requirements that govern the potential emissions or discharges from the landfill site, potential effects on agriculture are expected to be limited to 500 m from the Site Study Area.
Cultural Heritage Resources /Archaeological Resources	Site	Potential disturbance of archaeological resources will be limited to areas associated with the landfill expansion.
Cultural Heritage Resources/ Built Heritage Resources and Cultural Heritage Landscapes	Site and Site-vicinity	In accordance with Ministry of Heritage, Sport, Tourism and Culture Industries requirements for cultural studies, the area of study considers properties immediately adjacent to the proposed limit of waste of the landfill expansion. All properties that fall within 500 m from the Site Study Area were considered.
Socio-economic/ Local Economy, Residents and Community	Site, Site-vicinity and Wider	To consider the potential effects of the landfill expansion within 500 m of the Site Study Area, extending to the east, south and west to the nearest sensitive receptor and on the broader community.

Environmental Component/Sub-Component	Area(s) to be Studied	Rationale
Socio-economic/Visual	Site-vicinity	Off-site vantage points from where the landfill expansion may be visible from as far as 1 km.
Transportation	Site-vicinity	To consist of the haul routes associated with the landfill, specifically Boyne Road between St Lawrence Street and the landfill and Boyne Road between County Road 7 and the landfill as shown on Figure 1-1.
Design and Operations	Site	Potential financial implications related to site development (landfill expansion) are associated with the site only.

The Site Study Area and the area extending 500 m beyond the Site Study Area are illustrated on Figure 8-1. The Wider Study Area is not depicted on this figure.



LEGEND

- ROADWAY
- WATERCOURSE
- HAUL ROUTE
- EXISTING LANDFILL FILL AREA
- SITE STUDY AREA
- 500 m SITE-VICINITY STUDY AREA
- TOWNSHIP OWNED PROPERTY
- APPROXIMATE PROPERTY BOUNDARY OF LANDFILL SITE

0 125 250 500

1:12,500 METRES

DRAFT

REFERENCE(S)

1. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: MTM ZONE 9 VERTICAL DATUM: CGVD28

CLIENT

TOWNSHIP OF NORTH DUNDAS

PROJECT

INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE

STUDY AREAS

CONSULTANT

GOLDER MEMBER OF WSP

YYYY-MM-DD	2021-05-27
DESIGNED	PLE
PREPARED	JEM
REVIEWED	YJM
APPROVED	PLE

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	0	8-1

8.2 Environmental Component Work Plans

The work plans shown herein present the scope of work undertaken to complete the EA, including the general scope of technical studies for each of the environmental components, and the way in which the comparison of 'Alternative Methods' and prediction of environmental effects for the preferred 'Alternative Method" of landfill expansion will be carried out. Environmental components for the comparison of 'Alternative Methods' are slightly different than those used for comparison of 'Alternatives To' to ensure all relevant aspects of the environment are properly addressed; the key differences are as described below:

- The surface water environmental component has been divided into the sub-components of surface water quality and surface water quantity.
- The biology environmental component has been divided into the sub-components of aquatic ecosystems and terrestrial ecosystems.
- The agriculture and land use component used for comparison of 'Alternatives To' has been split into two environmental components.
- The socio-economic environmental component has been divided into three sub-components: local economy, residents and community, and visual.
- The removal of the technical considerations environmental component and its replacement with design and operations.

Detailed work plans for biology, groundwater, surface water and atmospheric components were developed in consultation with the MECP, Conservation Authorities and MNRF as relevant and submitted for review and concurrence. Copies of these work plans are provided in Volume 4 Appendix G1. The summary table of all work plans, as noted below, was shared on the EA website with Indigenous communities and the public and they were invited to view the work plans and submit comments.

Table 8-2 describes all the work plans by environmental sub-component, noting that with the identification of landfill expansion as the preferred 'Alternative To' the rationale and indicators can be developed at a higher level of detail in this table than those used for evaluation of the 'Alternatives To'. The table also includes additional detail for data collection and field work to prepare a description of existing conditions around the landfill, comparison of 'Alternative Methods' and the prediction/assessment of potential effects for the preferred 'Alternative Method'.

Table 8-2: Summary of Work Plans for the EA

Component/ Sub-component	Rationale	Evaluation Criterion/Criteria	Indicator(s)	Data Collection and Field Work	Evaluation of 'Alternative Methods'	Prediction of Potential Effects for the Preferred 'Alternative Method'	Data Sources
Atmosphere/ Air Quality (health-related compounds and dust, odour, GHG)	Landfill expansion and associated operations can produce gases containing contaminants that degrade air quality if they are emitted to the atmosphere. Construction activities associated with landfill expansion and continued landfill operation can lead to levels of particulates (dust) in the air. Landfill operation can also result in odour effects.	• Potential effects on air quality (including dust, odour, GHG)	• Expected concentrations of air quality indicator compounds (selected regulated air contaminants to represent this type of project), including dust, at the property boundary and nearby sensitive receptors. • Expected site-related odour at off-site sensitive receptors. • Expected GHG emissions.	• Compile and interpret existing Environment Canada or MECP's air quality monitoring data and meteorological data. • Review aerial photographic mapping to identify sensitive receptors. • Review zoning maps. • It is not proposed to collect site-specific data.	• Identify the differences in potential air and odour concentrations from emission sources based on their distance and direction to nearest off-site receptors, the property boundary, and site characteristics such as height of the expanded landfill that will influence dispersion. • Identify difference in the expansion alternatives that will impact GHG generation such as the landfill configuration. • Qualitatively evaluate the differences in potential air quality, odour and GHG. • Rank each alternative based on the differences. • Describe advantages and disadvantages of the 'Alternative Methods'.	• Select air indicator compounds appropriate for the landfill expansion, expected to include suspended particulate matter (SPM), particles nominally smaller than 10 μm in diameter (PM_{10}), particles nominally smaller than 2.5 μm in diameter ($PM_{2.5}$), nitrogen oxides (Nox), sulphur dioxide (SO_2), carbon monoxide (CO), hydrogen sulphide (H_2S), vinyl chloride (C_2H_3Cl), odour. • Complete air and odour emission estimates based on published emission factors and available literature, as well as results from a site-specific landfill gas (LFG) generation model for input into the dispersion model. • Execute an air quality dispersion model for the currently approved landfill and for an expanded landfill.	• Environment Canada or MECP's regional air quality data, hourly meteorological data and climate normals. • Published emission factors (including odour). • Site-specific LFG generation model. • Preferred 'Alternative Method' landfill design and phasing plan. • Odour complaints history for the landfill site. • Applicable provincial regulations, standards and guidelines.

Component/ Sub-component	Rationale	Evaluation Criterion/Criteria	Indicator(s)	Data Collection and Field Work	Evaluation of 'Alternative Methods'	Prediction of Potential Effects for the Preferred 'Alternative Method'	Data Sources
						• Predict worst-case air quality and odour effects for sensitive receptors based on an expanded landfill operation scenario. • Calculate GHG emissions based on the expanded landfill. • If required, identify mitigation or best management practices that can be implemented into the design of the preferred alternative to allow the landfill expansion to achieve compliance with applicable air quality limits.	
Atmosphere/ Noise	Landfill expansion and associated operations will generate noise that will be emitted into the atmosphere and could impact neighbouring sensitive receptors.	• Potential effects on noise	• Noise Levels at neighbouring noise sensitive existing receptors or vacant lots (with appropriate zoning that may accommodate the future construction of sensitive noise receptors).	• Review of aerial imagery. • Review of zoning/land use mapping. • Undertake field program and/or carry out a desktop analysis to quantify existing noise levels.	• Identify existing and vacant lot noise sensitive receptors in the vicinity of the landfill. • Identify potential differences in expected noise levels based on the distance and potential line-of-site exposure of the sensitive receptors to the landfilling. Equipment/activities. • Review the direct interaction of the proposed 'Alternative Method' footprints and existing/potential. Sensitive receptors.	• Noise emission estimates based on available project-specific information, manufacturer's noise data and consultant's database of similar noise sources. • Establish applicable noise limits in accordance with accepted MECP practices.	• Landfill equipment list and expected utilization. • Preferred 'Alternative Method' landfill design and phasing plan. • Baseline noise predictions. • Manufacturer's noise data. • Consultant's database of similar noise studies. • Ministry of Transportation Ontario (MTO) / local municipal traffic count data or newer data collected to support this EA. • Applicable provincial guidelines.

Component/ Sub-component	Rationale	Evaluation Criterion/Criteria	Indicator(s)	Data Collection and Field Work	Evaluation of 'Alternative Methods'	Prediction of Potential Effects for the Preferred 'Alternative Method'	Data Sources
					• Rank each alternative based on the differences. • Describe advantages and disadvantages of the 'Alternative Methods'.	• Develop a project/site-specific three-dimensional noise prediction model in accordance with MECP and internationally accepted standards. • Using the site-specific noise model described above, model the predictable worst-case noise levels from the preferred landfill expansion at identified sensitive receptors (existing or potential), and compare them to MECP noise guidelines. • If required, identify mitigation that can be implemented into the design of the preferred alternative to allow the landfill expansion to achieve compliance with applicable noise limits. • Develop monitoring, trigger and contingency plans, if relevant.	

Component/ Sub-component	Rationale	Evaluation Criterion/Criteria	Indicator(s)	Data Collection and Field Work	Evaluation of 'Alternative Methods'	Prediction of Potential Effects for the Preferred 'Alternative Method'	Data Sources
Geology and Hydrogeology/ Groundwater Quality	Contaminants associated with the landfill expansion and associated operations could enter the groundwater and impact off-site groundwater or surface water.	• Potential effects on groundwater resources	• Expected effect on groundwater quality at the landfill site property boundary and/or compliance boundaries.	• Extensive field investigations and hydrogeological assessments have been completed for the existing landfill site since 2001. • Extensive hydraulic conductivity testing has been completed. • Review results of existing groundwater monitoring program. • Limited additional field work in the form of additional parameter analysis expected based on available information. • Renewed analysis of existing data to confirm groundwater flow direction(s), predominant impacts expected in the overburden and not the bedrock, leachate indicator parameters unique to the landfill and not the neighbouring snow storage area.	• Identify the differences between the alternatives that will affect the potential impact on off-site groundwater quality such as expanded waste footprint configuration, direction of groundwater flow, thickness of waste in the expansion. • Estimate qualitatively how the differences will potentially affect the off-site groundwater quality. • Rank each 'Alternative Method' based on the differences. • Describe advantages and disadvantages of the 'Alternative Methods'.	• Prepare a predictive model of landfill performance (contaminant transport model) as per *O. Reg.* 232/98. • Predict worst case concentrations in the overburden groundwater at the landfill and/or CAZ compliance boundaries for the key leachate indicator parameter chloride, with consideration of reasonable mitigation measures. [1,2] • Compare the predicted concentrations in the overburden groundwater to the Reasonable Use Criteria. • Evaluate potential for overburden groundwater discharge to surface water and consider potential impacts on surface water quality. • Revise and update mitigation measures, if necessary. • Compare predictive results against approved trigger mechanism and	• Published regional sources and data on regional geological and hydrogeological conditions, including source water protection reports and source water protection zones in County and Township Official Plans. • Review MNRF petroleum well records. • Provincial Quaternary and Bedrock Mapping. • Ontario Water Well Records (water supply wells are considered to be sensitive receptors in terms of potential impacts). • Boyne Road Landfill Annual Monitoring Reports. • Previous site characterization/investigation reports. • Borehole logs.

Component/ Sub-component	Rationale	Evaluation Criterion/Criteria	Indicator(s)	Data Collection and Field Work	Evaluation of 'Alternative Methods'	Prediction of Potential Effects for the Preferred 'Alternative Method'	Data Sources
						contingency plan, if required. • Update groundwater monitoring program, if required. • Predict the contaminating lifespan. • Assess the potential effects in relation to Source Water Protection.	
Surface Water/ Surface Water Quality	Contaminants associated with the landfill expansion and associated operations could seep or runoff into surface water and adversely affect water quality and aquatic life.	• Potential effects on surface water resources	• Expected effect on surface water quality in the drainage ditch along Boyne Road and within the Site-vicinity Study Area.	• Extensive field investigations and hydrogeological assessments have been completed for the existing landfill site since 2001. • Review results of existing surface water monitoring program. • Limited additional field work related to neighbouring municipal drains expected based on available information.	• Identify the differences that may impact changes in surface water quality such as expansion area layout and location. • Estimate qualitatively how the differences will affect the surface water quality. • Rank each 'Alternative Method' based on the differences. • Describe advantages and disadvantages of the 'Alternative Methods'.	• Evaluation of required construction of new on-site facilities (pond(s)) and the facility's ability to mitigate potential changes to surface water quality. • Modelling of proposed surface water facilities (pond(s)) and comparison with MECP and watershed-specific design criteria. • Update trigger mechanism and contingency plan if required. • Update surface water monitoring program if required.	• Boyne Road Landfill Design and Operations Report. • Boyne Road Landfill Annual Monitoring Reports. • Historical flow observations during sampling program. • Surface water drainage mapping. • Topographic maps. • Air photos. • Published water quality information from the MECP, Environment Canada and SNC.

Component/ Sub-component	Rationale	Evaluation Criterion/Criteria	Indicator(s)	Data Collection and Field Work	Evaluation of ‘Alternative Methods’	Prediction of Potential Effects for the Preferred ‘Alternative Method’	Data Sources
Surface Water/ Surface Water Quantity	Operations associated with the landfill expansion could alter runoff and peak flows.	• Potential effects on surface water resources	• Expected change in runoff to and peak flows in drainage features. • Expected degree of off-site effects on surface water quantity within the Site-vicinity Study Area.	• Review existing surface water management features and practices. • No additional field work expected based on available information.	• Identify the differences that may impact changes in surface water quantity such as expansion area, expansion location, proposed side slopes of the landfill, and potential effects on the existing drainage ditch adjacent to the landfill footprint. • Estimate qualitatively how the differences may potentially affect the surface water quantity. • Rank each ‘Alternative Method’ based on the differences. • Describe advantages and disadvantages of the ‘Alternative Methods’.	• Predict and assess future surface water peak flows and quantity conditions associated with the preferred landfill expansion alternative for a range of storm events (e.g., 2, 5, 10, 25, and 100 year) as required by *O.Reg.* 232/98, as well as consideration of climate change effects. • Evaluate the need for stormwater management infrastructure to meet *O.Reg.* 232/98 and prepare EA level design for stormwater management system. • Modelling of proposed stormwater management system and comparison with MECP specific design criteria.	• Boyne Road Landfill Design and Operations Report. • Boyne Road Landfill Annual Monitoring Reports. • Historical flow observations during sampling program. • Surface water drainage mapping. • Local climate data. • Topographic maps. • Air photos. • Published water quantity and flow information from the MECP, Environment Canada and SNC. • Agricultural farm drain mapping.

Component/ Sub-component	Rationale	Evaluation Criterion/Criteria	Indicator(s)	Data Collection and Field Work	Evaluation of 'Alternative Methods'	Prediction of Potential Effects for the Preferred 'Alternative Method'	Data Sources

Biology/ Aquatic Ecosystems	Landfill expansion could remove or disturb the functioning of natural aquatic habitats and species, including rare, threatened, or endangered species.	• Potential effects on natural environment features (aquatic and terrestrial ecosystems)	• Expected change in surface water quality and/or quantity within the Site Study Area and the Site-vicinity Study Area.
			• Expected impact on aquatic habitat and biota, including rare, threatened, or endangered species within the Site Study Area and the Site-vicinity Study Area.
				• Wetland boundary surveys.
				• Headwater Drainage Features assessment.
				• Fish habitat survey.
				• Fish communities survey.
					• Identify differences in potential impacts to watercourses.
					  ◦ Waste footprint likely to cause alteration or destruction of existing habitat.
					  ◦ Differences in discharge rate from stormwater management (SWM) system.
					  ◦ Change in water quality to receiving water courses.
					• Rank each alternative based on the differences.
					• Describe advantages and disadvantages of the 'Alternative Methods'.
						• Identify areas of potential disturbance including:
						  ◦ Direct habitat loss/disturbance.
						  ◦ Indirect habitat disturbance.
						  ◦ Impacts to aquatic species at risk (SAR) habitat and species.
						• Identify appropriate mitigation measures, if needed.
						• Develop monitoring, and contingency plans, if relevant.
							• United Counties of Stormont, Dundas and Glengarry Official Plan.
							• Field surveys.
							• MNRF Natural Heritage Information Centre (NHIC) Make-a-Map geographic explorer (MNRF, 2021a)
							• Existing and readily available information (including watershed studies) and mapping available through the SNC.
							• DFO Aquatic Species at Risk Maps (DFO, 2021).
							• Information contained in natural heritage related map layers from Ontario Base Map series, Natural Resource Values Information System (NRVIS) mapping and Land Information Ontario (LIO).
							• Existing high-resolution aerial imagery and mapping.

Biology/ Terrestrial Ecosystems	Landfill expansion could remove or disturb the functioning of natural terrestrial habitats and vegetation, including rare, threatened or endangered species.	• Potential effects on natural environment features (aquatic and terrestrial ecosystems)	• Expected impact on terrestrial vegetation communities, wildlife habitat, and wildlife, including rare, threatened or endangered species within the Site and Site-vicinity Study Areas.	• Botanical surveys.
				• Ecological land classification.
				• Herpetile surveys.
				• Bat surveys.
				• Breeding Bird Surveys.
				• Wetland Community Boundary Delineation.
				• Wildlife habitat and visual encounter surveys.
				• Species at Risk screening.
					• Identify differences in the alternatives that will potentially impact terrestrial features:
					  ◦ Change in the site development area for the landfill.
					  ◦ Change in the Waste Footprint Area of the landfill.
					  ◦ Impact to SAR.
					  ◦ Impact to Significant Wildlife Habitat (SWH).
					  ◦ Removal of natural vegetation.
						• Identify potential impacts to SAR, SWH, wetland woodlands, and environmentally significant areas, including:
						  ◦ Direct habitat loss/disturbance.
						  ◦ Indirect habitat disturbance.
						  ◦ Impacts to terrestrial SAR habitat and species.
							• United Counties of SDG Official Plan.
							• Field surveys.
							• MNRF NHIC Make-a-Map geographic explorer (MNRF, 2021a).
							• Existing and readily available information (including any watershed studies) and mapping available through the local Conservation Authority.

Component/ Sub-component	Rationale	Evaluation Criterion/Criteria	Indicator(s)	Data Collection and Field Work	Evaluation of 'Alternative Methods'	Prediction of Potential Effects for the Preferred 'Alternative Method'	Data Sources
					• Rank each alternative based on the differences. • Describe advantages and disadvantages of the 'Alternative Methods'.	• Vegetation removal. • Potential impacts to species • Identify appropriate mitigation measures, if needed. • Develop monitoring, and contingency plans, if relevant.	• Atlas of Breeding Birds of Ontario (Cadman, et al. 2007). • eBird online database (eBird, 2021). • Atlas of the Mammals of Ontario (Dobbyn, 1994). • Bat Conservation International (BCI, 2021). • Ontario Odonate Atlas (Jones et. al 2021). • Ontario Reptile and Amphibian Atlas (Ontario Nature, 2021). • Information contained in natural heritage related map layers from Ontario Base Map series, NRVIS mapping and LIO. • Existing high-resolution aerial imagery and mapping.
Agriculture	The agricultural land base or agricultural operations may be impacted by the landfill expansion and associated operations.	• Potential effects on existing agriculture	• Expected effect on agricultural land base and agricultural operations within the Site and Site-vicinity Study Areas.	• Review of aerial photographic mapping. • Compile parcel fabric mapping from Township. • Review Official Plans and Zoning By-Law. • Review Canada Land Inventory (CLI) mapping.	• The potential effect of the proposed landfill expansion alternatives on the existing and potential agricultural use of on-site and off-site lands will be assessed. • Differences between alternatives will be identified, for example, proximity to livestock, use of prime agricultural areas (soil capability), degree of infrastructure/investment, impact on agricultural system (fragmentation). • Rank each alternative based on the differences.	• Based on the proposed landfill operational practices and/or results of predictive assessments of potential nuisance effects as caried out by other components; the technical and operational considerations component; and groundwater and surface water considerations, the potential effects of the preferred	• Existing site-specific studies. • Applicable provincial regulations, standards and guidelines. • Provincial Policy Statement (2020). • United Counties of Stormont, Dundas and Glengarry Official Plan. • Available soils mapping. • Aerial photographic and topographic mapping. • Statistics Canada agriculture profiles. • Relevant information available from Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA)

Component/ Sub-component	Rationale	Evaluation Criterion/Criteria	Indicator(s)	Data Collection and Field Work	Evaluation of 'Alternative Methods'	Prediction of Potential Effects for the Preferred 'Alternative Method'	Data Sources
					• Describe advantages and disadvantages of the 'Alternative Methods'.	expansion method on existing and proposed on-site and off-site agricultural use will be assessed.	and Ontario Federation of Agriculture (OFA).
Cultural Heritage Resources/ Archaeological Resources	A horizontal landfill expansion has the potential to affect archaeological resources.	• Potential effects on archaeology	• Expected archaeological resources potentially affected on-site.	• Review and update existing background research including archaeological, historical, and environmental literature. • Review updated list of registered archaeological sites within 1 km of the landfill site. • Complete Stage 1 Archaeology Assessment. If necessary, complete subsequent Stages of archaeological assessment.	• Identify archaeological sites that are anticipated to be impacted by expansion alternatives. • Rank each alternative based on the differences. • Describe advantages and disadvantages of the 'Alternative Methods'.	• Archaeological sites that will be impacted by the preferred expansion alternative may require further assessment to determine spatial extent, complete a full evaluation of significance, and determine the need for strategies to mitigate impacts and provide future conservation (Stage 4 mitigation).	• Existing site-specific archaeological assessment reports. • Ontario Archaeological Sites Database. • Ministry of Tourism, Culture, and Sport (MTCS) *Standards and Guidelines for Consultant Archaeologists*. • United Counties of SDG Official Plan.
Cultural Heritage Resources/ Cultural Heritage Landscapes	Identified cultural heritage landscapes can be altered by the landfill expansion. Depending on the nature of identified cultural heritage landscapes, there could be an impact by the ongoing	• Potential effects on cultural heritage landscapes	• Expected impact on identified cultural heritage landscapes within the Site-vicinity Study Area.	• Background research of archival, published and unpublished sources, municipal heritage policies, and historic maps and aerial imagery. • Consultation with municipal heritage planner, if available. • Review of identified cultural heritage resources as part of Official Plan. • Field investigations to document and	• Identify the risk of potential direct or indirect impact using guidance and types identified in the MTCS *Ontario Heritage Tool Kit: Heritage Resources in the Land Use Planning Process.* • Rank each alternative based on the differences. • Describe advantages and disadvantages of the 'Alternative Methods'.	• Determine the potential magnitude, reversibility, extent, duration, and frequency of each type of impact, if present. • Methods to predict potential effects following guidance provided in the MTCS *Ontario Heritage Tool Kit: Heritage Resources in the Land Use Planning Process*.	• Description of proposed expansion alternatives. • Preferred landfill expansion design. • Existing site-specific studies. • Applicable provincial plans, acts, regulations, standards and guidelines, and policies. • United Counties of SDG Official Plan. • Local Historical Society, if available.

Component/ Sub-component	Rationale	Evaluation Criterion/Criteria	Indicator(s)	Data Collection and Field Work	Evaluation of 'Alternative Methods'	Prediction of Potential Effects for the Preferred 'Alternative Method'	Data Sources
	operation of the landfill.			evaluate existing conditions. • Complete a cultural heritage resources impact assessment.		• Methods to consist of identifying key vistas and views, sources of direct and indirect impact resulting from construction and operation, and preferred landfill expansion and conservation measures to reduce or avoid impact to cultural heritage landscapes.	
Cultural Heritage Resources/ Built Heritage Resources	Heritage attributes of identified built heritage resources could be impacted by the landfill expansion and associated operations.	• Potential effects on built heritage resources	• Expected impact on the heritage attributes of identified built heritage resources within the Site-vicinity Study Area.	• Background research of archival, published and unpublished sources, municipal heritage policies, and historic maps and aerial imagery. • Consultation with municipal heritage planner, if available. • Review of identified cultural heritage resources as part of Official Plan. • Field investigations to document and evaluate existing conditions. • Complete a cultural heritage resources impact assessment.	• Identify the risk of potential direct or indirect impact using guidance and types identified in the MTCS *Ontario Heritage Tool Kit: Heritage Resources in the Land Use Planning Process.* • Rank each alternative based on the differences. • Describe advantages and disadvantages of the 'Alternative Methods'.	• Determine the potential magnitude, reversibility, extent, duration, and frequency of each type of impact, if present. • Methods to predict potential effects following guidance provided in the MTCS *Ontario Heritage Tool Kit: Heritage Resources in the Land Use Planning Process*. • Methods to consist of identifying resources, sources of direct and indirect impact resulting from construction and operation, and preferred options and conservation measures to reduce	• Description of proposed expansion alternatives. • Preferred landfill expansion design. • Existing site-specific studies. • Applicable provincial plans, acts, regulations, standards and guidelines, and policies. • United Counties of SDG Official Plan. • Local Historical Society, if available.

Component/ Sub-component	Rationale	Evaluation Criterion/Criteria	Indicator(s)	Data Collection and Field Work	Evaluation of 'Alternative Methods'	Prediction of Potential Effects for the Preferred 'Alternative Method'	Data Sources
						or avoid impact to protected heritage resources or newly identified resources of cultural heritage value or interest.	
Land Use Planning/ Current and Planned Future Land Uses	Waste disposal facilities could potentially be incompatible with municipal land use policy framework.	• Potential effects on existing land use	• Expected incompatibility with existing or known future land use.	• Review aerial photographic mapping. • Compile parcel fabric mapping from Township. • Review Official Plan and Zoning By-law • Review Provincial Guidelines (e.g., Land Use Compatibility, Guideline D-1, Land Use On or Near Landfills and Dumps, Guideline D-4). • Review Provincial Policy Statement 2020. • Interviews with municipal staff to confirm development activity planned in the site-vicinity and identify potential planning issues.	• Differences between alternatives will be identified with respect to land use compatibility. • Rank each alternative based on the differences. • Describe advantages and disadvantages of the 'Alternative Methods'.	• Based on the proposed operational practices and/or results of predictive assessments of potential nuisance effects as carried out by other components and the design and operation component, the potential compatibility of the preferred method with existing and proposed surrounding land use will be assessed.	• Preferred 'Alternative Method' landfill design and phasing plan. • Existing site-specific studies. • Applicable provincial regulations, standards and guidelines. • Provincial Policy Statement (2020). • United Counties of SDG Official Plan. • Land Use Compatibility, Guideline D-1. • Land Use On or Near Landfills and Dumps, Guideline D-4. • Aerial photographic and topographic mapping • Field reconnaissance. • Discussion with Township planning department.
Socio-economic/ Local Economy	The continued operation of the landfill can influence employment and business in the wider regional area.	• Relative potential changes in employment, impacts to local commercial businesses and capital costs.	• Expected effect on local employment. • Expected effects on local businesses and commercial activity. • Expected effects on municipal finances.	• Review of current and projected employment numbers (during both construction and operation phases). • Review of municipal revenues and projected change from site expansion.	• Identify total increase in employment hours/full time equivalent positions during both construction and operational phases by alternative design. • Identify loss of potential land use for commercial purposes or residential purposes as a result of landfill expansion and	• Re-evaluate property taxes or rent paid to the municipality based on larger property parcel and any potential change in land use designation. • Qualitative assessment of impacts on local	• United Counties of SDG Official Plan. • Statistics Canada 2016 Census data. • United Counties of Stormont Dundas and Glengarry website, 2020.

Component/ Sub-component	Rationale	Evaluation Criterion/Criteria	Indicator(s)	Data Collection and Field Work	Evaluation of 'Alternative Methods'	Prediction of Potential Effects for the Preferred 'Alternative Method'	Data Sources
				• Review of land use designations and Official Plan. • Interviews with municipal staff to understand potential costs and impacts to services from expanded site (e.g., public works, emergency management systems, transportation). • Review of local business database.	associated employment and rental income, respectively. • Rank each alternative based on the differences. • Describe advantages and disadvantages of the 'Alternative Methods'.	businesses from changes at the landfill site, (e.g., loss of patronage, operational impacts). • Impacts on employment as determined by change in employment numbers and resultant economic impact at the local level. • Calculate amount of increased revenue to the Township minus any potential increased costs to determine net economic effect.	
Socio-economic/ Residents and Community	Waste disposal facilities can potentially affect the use and enjoyment of their properties by residents in the vicinity of the site.	• Potential site operational effects on sensitive off-site receptors (i.e., noise, litter, air quality)	• Displacement of residents. • Expected interference with use and enjoyment of residential properties (nuisance effects).	• Review aerial photography to identify closest residential properties. • Windshield survey of study area to identify residences and businesses (including farms) as well as any other community facilities in the site-vicinity.	• Establish closest residential receptors to each alternative design. • Rank each alternative based on the differences. • Describe advantages and disadvantages of the 'Alternative Methods'.	• Review of findings from other disciplines - noise, odour, air quality, operations (litter and vermin)- to ascertain any potential nuisance effects on sensitive receptors. • Evaluate level of nuisance effects once mitigation measures and best management practices have been implemented to determine change from baseline (current) conditions.	• Site related complaints. • Discipline findings – noise, air quality, land use, operations. • Existing site or proposed expansion related best management practices. • Statistics Canada 2016 Census data. • United Counties of SDG website, 2020

Component/ Sub-component	Rationale	Evaluation Criterion/Criteria	Indicator(s)	Data Collection and Field Work	Evaluation of 'Alternative Methods'	Prediction of Potential Effects for the Preferred 'Alternative Method'	Data Sources
						• Evaluate if the preferred alternative could cause displacement of residents.	
Socio-economic/ Visual	The landfill expansion can affect the local community by changes in the visual appearance of the site.	• Potential changes in visibility of the landfill	• Expected changes in landscape views from off-site.	• Field investigations to identify key viewpoints and obtain photos. • Use software to produce representative 3D perspective images for each viewpoint.	• Identify the differences in potential visual impacts based on the distance and direction to nearest off-site receptors, the property boundary, and site characteristics such as height of the expanded landfill. • Rank each alternative based on the differences. • Describe advantages and disadvantages of the 'Alternative Methods'.	• Prepare 3D models from each viewpoint for the preferred landfill expansion 'Alternative Method' and render them with appropriate surface material / vegetation cover (turf, meadow, trees, etc.). • Compare the landfill expansion model of the preferred 'Alternative Method' with the existing site conditions model and describe potential impacts. • Apply conceptual level mitigation measures to preferred landfill expansion alternative, if required. Identify the degree of visual impact.	• Google Earth. • Township of North Dundas aerial photos. • ACAD drawings of existing landfill and proposed expansion alternatives. • Site photos.

Component/ Sub-component	Rationale	Evaluation Criterion/Criteria	Indicator(s)	Data Collection and Field Work	Evaluation of 'Alternative Methods'	Prediction of Potential Effects for the Preferred 'Alternative Method'	Data Sources
Transportation/ Traffic	The operations at the landfill can impact the traffic in the surrounding area through changes in truck traffic to/from the landfill.	• Potential effect on road network	• Expected effect on traffic along haul routes.	• Obtain available traffic data for selected intersections and corridors within haul route study area. • Conduct traffic count estimates if recent or sufficient data does not exist.	• Assess existing traffic conditions based on haul routes and other common users. • Identify the differences in traffic operations by evaluating the alternatives for landfill expansion. • Rank each alternative based on the differences. • Describe advantages and disadvantages of the 'Alternative Methods'.	• Assess existing hourly and daily carrying capacity of the haul route study area roads. • Assess existing intersection level of service and other performance metrics for the haul route study area intersections to confirm overall intersection and critical movement performance (capacity and delay) • Assess future traffic operation and safety requirements of defined study area (adjacent roadway and haul route) conditions. • Assess potential intersection geometric requirements for mitigation. Undertake warrants to confirm any required improvements, i.e., auxiliary lane and/or intersection control requirements, as necessary.	• Turning Movement Count, average annual daily traffic (AADT), and signal timing data, if available. • Additional tonnage and resulting number of trucks to site due to expansion. • Collision history statistics, if available. • Existing site-specific and related studies, consultant observations, and available Township planning and engineering documents. • Traffic counts if necessary.

Component/ Sub-component	Rationale	Evaluation Criterion/Criteria	Indicator(s)	Data Collection and Field Work	Evaluation of 'Alternative Methods'	Prediction of Potential Effects for the Preferred 'Alternative Method'	Data Sources
Design and Operations/ Financial	Different methods of landfill expansion can have different costs based on the design and associated requirements to construct the expansion.	• Potential effects on capital costs	• Estimated costs associated with implementation of expansion alternatives.	• Existing cost information from the Township and local construction projects. • Estimates of required earthworks for each 'Alternative Method'.	• The expected cut and fill and any additional earthworks for each 'Alternative Method' will be estimated. • Expected differences in operations between alternatives. • Rank each alternative based on the differences. • Describe advantages and disadvantages of the 'Alternative Methods'.	• A summary of the design of the preferred 'Alternative Method' including best management plans will be prepared.	• Existing landfill site or proposed expansion related best management practices. • Description of proposed expansion alternatives. • Preferred 'Alternative Method' landfill design and phasing plan.

Notes:

1 Given the relatively small nature of the existing landfill and the proposed landfill expansion, selection and identification of relevant leachate indicator parameters is likely to be different than those identified in *O. Reg* 232/98. It is known that chloride is a relevant leachate indicator parameter that can be modelled at the landfill site and, if others can be identified, then one or more will be included.

2 The existing and future leachate plume in the overburden is assumed to be more extensive than the plume in the bedrock. It is acknowledged that some portion of the plume may extend into bedrock. The vertical spreading of the plume to the bedrock would result in lower concentrations in the bedrock relative to what is represented in the overburden. The leachate plume is also assumed to travel at a lower velocity in the bedrock relative to the overburden due to the lower hydraulic gradients. As such, it is assumed that if regulatory compliance is met in the overburden, compliance would also be met in the bedrock at the same distance from the disposal area.

9.0 Description of the Environment Potentially Affected for Landfill Expansion

This section presents an overview of existing environmental conditions on and in the area of the Boyne Road Landfill.

9.1 Atmosphere

This section of the EASR provides a summary of the existing environment conditions for air quality (including odour) and noise in the Site-vicinity Study Area, as described in Sections 9.1.1 and 9.1.2, respectively.

9.1.1 Air Quality

9.1.1.1 Methodology

The general approach used for assessing the atmospheric effects of the proposed landfill expansion, and documented in this assessment, supports the philosophy of the EA as a planning and decision-making process and conforms to the general methodology presented in the approved ToR. The specific study methods that will be used in the assessment of effects are described in the following sections and were summarized in Section 8.2.

9.1.1.2 Study Area

For the purposes of assessing air quality, odour and GHG; the study areas are defined in Section 8.1. Air (health-related compounds) and dust emissions are required to meet provincial requirements at and beyond the landfill site boundary. Provincial odour guidelines apply to off-site sensitive receptors. Odour emissions may travel further than 500 m, but any effects are expected to be within 1.5 km of the Site Study Area.

The locations of the closest sensitive receptors in all wind directions have been identified and reviewed for inclusion in the air quality assessment. Sensitive receptor locations were identified using the MECP definition in section 30(8) of *O.Reg.* 419/05 (Ontario, 2005) and the definition of “human receptors” in MECP guidance document “Methodology for Modeling Assessments of Contaminants with 10 Minute Average Standards and Guidelines under *O. Reg.* 419/05” (MECP, 2016). Specifically, locations where “human activities regularly occur” or that meet any of the following definitions:

- a health care facility
- a senior citizens’ residence or long-term care facility
- a child care facility
- an educational facility
- a dwelling
- a place where discharges of a contaminant may cause a risk to human health

The MECP released draft odour guidance for comment in May 2021; however, at the time of preparing this EA, this guidance has not been finalized and is therefore not considered in this study.

Sensitive receptors included in the air quality and odour assessment are illustrated on Figure 9-1. The majority of the red existing sensitive receptors identified are dwellings.

9.1.1.3 Timeframe

The air quality and odour assessments focus on the operations phase of the proposed landfill expansion.

During the post-closure phase, the only anticipated activities potentially related to emissions to the air are landfill gas, site performance monitoring, and maintenance. Once the landfill operational activities have ceased, a final landfill cover will be in place; therefore, the overall emissions from the landfill during the post-closure phase will be less than during the operational phase.

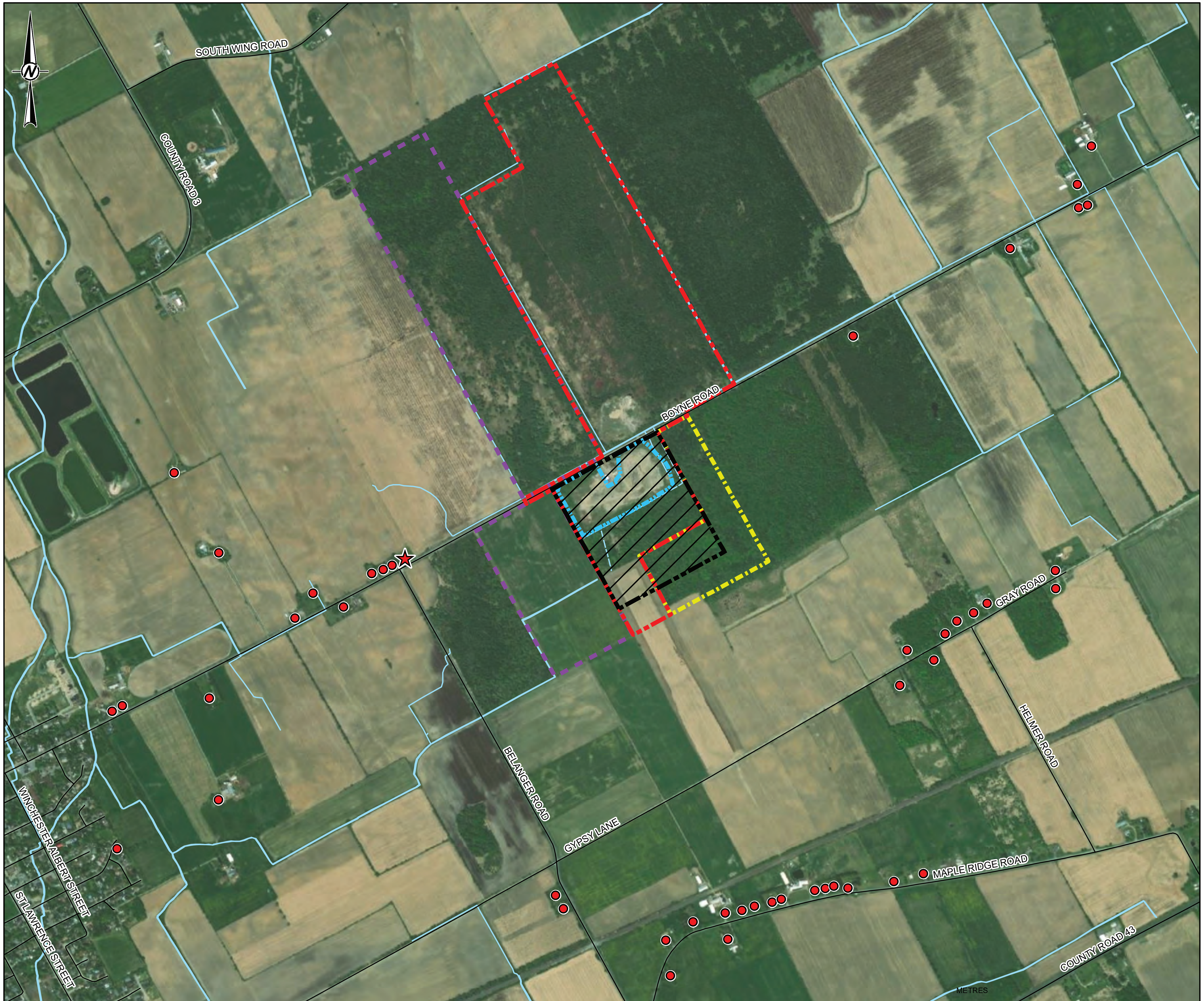
9.1.1.4 Air Quality Indicator Compounds

The assessment of air quality focuses on predicting changes in the concentrations of indicator compounds. These indicator compounds represent compounds that are typically emitted from landfills, have the highest potential to cause adverse and/or non-mitigatable effects, and for which air quality criteria exist:

- **Particulate matter**: SPM, PM_{10}, and $PM_{2.5}$
- **Combustion gases**: NO_X represented by nitrogen dioxide (NO_2), SO_2, and CO
- **Other Indicator Compounds**: H_2S, C_2H_3Cl, odour (expressed as whole odour (OU/m^3))

These compounds are associated with various landfill operations. Particulate matter is typically associated with airborne dust from vehicles travelling on on-site roads and unpaved roads/haul routes, as well as material loading and unloading activities. Products of combustion (NO_2, SO_2 and CO) are associated with the exhaust from on-site vehicles. Emissions of hydrogen sulphide and vinyl chloride are the result of breakdown of waste material within the landfill. To identify potential impacts to air quality, the predicted air quality concentrations resulting from the proposed undertaking will be compared to existing ambient air quality objectives and criteria limits for the above compounds.

Ozone (O_3) has been identified as an indicator for the proposed landfill expansion even though it will not be directly emitted as a result of the landfill expansion works and activities; however, it will be used to calculate NO_2 in the effects assessment. Ozone is not emitted directly into atmosphere but is associated with the reaction of NO_X and Volatile Organic Compounds (VOCs) (MECP, 2018c).



LEGEND

RECEPTORS

- EXISTING
- RECEPTOR WITH HIGHEST PREDICTED MAXIMUM CONCENTRATION
- INTERMITTENT WATERCOURSE
- WATERCOURSE
- ROADWAY
- APPROXIMATE PROPERTY BOUNDARY OF LANDFILL SITE
- EXISTING LANDFILL FILL AREA
- TOWNSHIP OWNED PROPERTY
- APPROXIMATE BOUNDARY OF CONTAMINANT ATTENUATION ZONE
- SITE STUDY AREA

REFERENCE(S)

1. LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2014
2. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: MTM ZONE 9 VERTICAL DATUM: CGVD28

0 190 380 760
1:15,000 METRES

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
AIR SENSITIVE RECEPTORS

CONSULTANT
GOLDER MEMBER OF WSP

YYYY-MM-DD	2022-01-30
DESIGNED	PLE
PREPARED	JEM
REVIEWED	----
APPROVED	----

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.1.2	A	9-1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 25mm

Whole odour, represented as an odour threshold value and described as “odour units” (OU/m^3), is the primary method used in Ontario to quantify the presence of odorous compounds in air. The concentration of whole odour can be measured at a facility and evaluated through the use of an odour panel. The panel is exposed to the odorant at various dilution thresholds. Due to the variability in human perception of odour, the point at which 50 percent of the panel can detect the odour is used as the threshold odour concentration. An odour unit (OU) is the number of dilutions required to reduce the odour to its detection threshold and is the emission variable used in dispersion modelling.

An odour concentration (as an OU) is not an indicator of the offensiveness of a particular odour. Offensiveness is a subjective factor that varies by individual, thus will not be considered.

9.1.1.5 Applicable Guidelines

The relevant air quality criteria to be used for screening the air quality effects of the landfill expansion are Ontario criteria and federal standards and objectives where provincial guidelines are not available. The MECP has set guidelines related to ambient air concentrations that are summarized in *Ontario’s Ambient Air Quality Criteria* (AAQC) document (MECP, 2020b). The Ontario AAQCs are characterized as desirable ambient air concentrations and they are an indicator of good quality in an area. They are not regulatory limits and therefore can be exceeded. The Ontario AAQCs are used for screening the air quality effects in environmental assessments, for studies using ambient air monitoring data, and for assessment of general air quality in a community or across the province (MECP, 2020b).

There are two sets of federal objectives and criteria: the National Ambient Air Quality Objectives (NAAQOs) and the Canadian Ambient Air Quality Standards (CAAQSs) (formerly National Ambient Air Quality Standards). Similar to the Ontario AAQCs, the NAAQOs are benchmarks that can be used to facilitate air quality management on a regional scale and provide goals for outdoor air quality that protect public health, the environment, or aesthetic properties of the environment (CCME, 1999). The federal government has established the following levels of NAAQOs (Health Canada, 1994):

- The maximum ***Desirable*** level defines the long-term goal for air quality and provides a basis for an anti-degradation policy for unpolluted parts of the country and for the continuing development of control technology.
- The maximum ***Acceptable*** level is intended to provide adequate protection against adverse effects on soil, water, vegetation, materials, animals, visibility, personal comfort, and well-being.

The CAAQSs have been developed under the *Canadian Environmental Protection Act, 1999*, and include standards for $PM_{2.5}$, NO_2, SO_2 and ozone that must be achieved by 2020 (Government of Canada, 2013). Like the Ontario AAQCs, the CAAQSs are not regulatory limits and are used as national targets for $PM_{2.5}$, NO_2, SO_2 and ozone, excluding Quebec (CCME, 2014). These more stringent standards were adopted because, as stated by the CCME (emphasis added):

> *Canadians living in <u>heavily populated and industrialized areas</u> of the country may be exposed to potentially harmful levels of outdoor air pollutants, at concentrations that exceeded established standards.* (CCME 2014)

However, the key aspect of “CAAQS Achievement” (i.e., compliance), as stated by the CCME, is (emphasis added):

> *Achievement of the CAAQS means that the measured air pollutant concentration in <u>an air zone</u> does not exceed the CAAQS numerical value.* (CCME 2014)

These values are reported based on a series of monitoring stations located in airsheds across Canada and, in this context, an “air zone” refers to a local or regional sub-region of the established provincial or territorial airsheds. Currently, Southern Ontario and Southern Quebec are treated as a single Airshed (East Central) and Southern Ontario, excluding Hamilton and Sarnia, is designated as a single air zone.

For conservatism in this assessment, the lower of the Ontario AAQCs and the CAAQS, where applicable, will be used for comparison to the maximum modelled concentrations. However, comparing the maximum predicted concentrations to the CAAQS standards is not appropriate for the following reasons:

- Neither the Site Study Area nor the Site-vicinity Study Area represent an “air zone”, the region over which the CCME states that achievement of the CAAQS is to be evaluated / compared.
- There are not heavily populated or industrialized areas located within the Site-vicinity Study Area. Therefore, there is no exposure pathway by which:
  - *Canadians living in <u>heavily populated and industrialized areas</u> of the country may be exposed to potentially harmful levels of outdoor air pollutants, at concentrations that exceeded established standards.* (CCME, 2014)

A summary of the applicable Ontario and federal objectives and criteria are listed in Table 9-1.

Table 9-1: Relevant Ambient Air Quality Criteria for Indicator Compounds

Substance	Averaging Period	Ontario Ambient Air Quality Guidelines[a] (micrograms per cubic metre (µg/m³))	Canadian Ambient Air Quality Standards[b] (µg/m³)	Desirable National Ambient Air Quality Standards and Objectives[c] (µg/m³)	Acceptable National Ambient Air Quality Standards and Objectives[c] (µg/m³)	Criteria (µg/m³)
SPM[d]	24-Hour	**120**	—	—	120	120
	Annual	**60**[e]	—	60	70	60
PM_{10}	24-Hour	**50**[f]	—	—	—	50
$PM_{2.5}$	24-Hour	27[g]	**27**[g]	—	—	27
	Annual	8.8	**8.8**	—	—	8.8
NO_2	1-Hour	**400**[h]	**79**[i]	—	400	400/79
	24-Hour	**200**[h]	—	—	200	200
	Annual	—	**22.5** [i]	**60**	100	22.5/60
SO_2	10 Minute	**180**	**—**	**—**	**—**	180
	1-Hour	**100**	170[j]	450	900	100
	24-Hour	**—**	—	**150**	300	150
	Annual	**10**	10.5[j]	30	60	10
CO	1-Hour	36,200	—	**15,000**	35,000	15000
	8-Hour	15,700	—	**6,000**	15,000	6000
O_3	1-Hour	**165**	—	100	160	165
	8-Hour	—	**118**	—	—	118

Substance	Averaging Period	Ontario Ambient Air Quality Guidelines(a) (micrograms per cubic metre ($\mu g/m^3$))	Canadian Ambient Air Quality Standards(b) ($\mu g/m^3$)	Desirable National Ambient Air Quality Standards and Objectives(c) ($\mu g/m^3$)	Acceptable National Ambient Air Quality Standards and Objectives(c) ($\mu g/m^3$)	Criteria ($\mu g/m^3$)
H_2S	10 Minute	**13**	—	—	—	13
	24-Hour	**7**	—	—	—	7
Vinyl Chloride	24-Hour	**1**	—	—	—	1
	Annual	**0.2**	—	—	—	0.2

Notes:
(a) MECP (2020)
(b) CAAQS published in the Canada Gazette Volume 147, No. 21 - May 25, 2013. Final standard phase in date of 2020 used (CCME, 2014).
(c) CCME (1999).
(d) SPM in Ontario is defined as Suspended Particulate Matter (<44 µm diameter).
(e) Geometric mean.
(f) Interim AAQC and is provided as a guide for decision making (MECP, 2020b)
(g) Compliance is based on the 98th percentile of the annual monitored data averaged over three years of measurements.
(h) Standard is for NO_X but is based on the health effects of NO_2.
(i) Canadian ambient air quality standard for NO_2 is effective from 2025. The 1-hour standard is based on the three-year average of the 98th percentile of the daily maximum 1-hour average concentration.
(j) Canadian ambient air quality standard for SO_2 is effective from 2025. The 1-hour standard is based on the three-year average of the 98th percentile of the daily maximum 1-hour average concentration.

Bolded values represent the criteria to be used in the assessment.

For odour, the MECP uses a guideline of 1 odour unit (OU/m^3) based on the 99.5 percentile on a 10-minute time averaging period to assess the potential for nuisance. One OU/m^3 is the concentration at which 50% of the population can perceive an odour; therefore, 1 OU/m^3 is typically used as an indicator for the likelihood of nuisance.

9.1.1.6 Existing Conditions

The background air quality represents the existing conditions before the proposed landfill expansion. Sources may include industrial facilities, roadways, long range transboundary air pollution, small regional sources and large industrial sources. The existing landfill emission sources may also contribute to the local air quality. The emissions sources for the existing landfill will be characterized as part of the impact assessment of this EA (in Section 13.1) for comparison to the landfill expansion impacts.

The existing air quality was characterized using publicly available monitoring station data. Field studies were not undertaken to characterize the existing air quality. Adequate data was available from existing sources to characterize regional air quality and was used to describe background air quality within the Site-vicinity Study Area; however, it may not accurately describe the local variations in concentrations that will result from emissions from existing sources at the Boyne Road landfill site. As discussed above, these emissions will be modelled in Section13.1.

9.1.1.6.1 Air Quality Monitoring Data

Background air quality was characterized using observations from the Environment and Climate Change Canada (ECCC) National Air Pollution Surveillance Network (NAPS) air quality monitoring stations (ECCC, 2019). The closest air quality monitoring station is located at 960 Carling Avenue in Ottawa, Ontario (Ottawa Central Station). Two other NAPS air quality monitoring stations were selected, Bedford and Third Street in Cornwall, Ontario (Memorial Park Cornwall Station), and 1128 de la Guerre in Saint-Anicet, Quebec (Saint-Anicet Station). The locations of these monitoring stations are indicated on Figure 5-1.

The proposed landfill expansion is located in a rural location. A wind-rose for the area is provided in Volume 2 Appendix B-1 and indicates that the predominant wind direction is from the west-northwest.

The Ottawa Central (NAPS ID 60106) is one of the closest NAPS station to the proposed landfill expansion (approximately 45 km north-northwest), so it is expected that the area of the Boyne Road Landfill will experience similar wind patterns and impacts from regional transport of compounds as this station; as such, as noted in Section 5.2, this station is located in a more urban setting and would therefore be impacted by local sources that are less typical of a rural environment. All air quality indicator compounds with the exception of CO, SO_2, and vinyl chloride are monitored at this station.

The Memorial Park Cornwall NAPS station (61201) located approximately 47 km away to the east-southeast was selected due to Cornwall's proximity to North Dundas; however, as noted in Section 5.2, this station is located in a more urban setting and would therefore be impacted by local sources that are less typical of a rural environment. All air quality indicator compounds with the exception of CO and SO_2 are monitored at this station.

The Saint-Anicet NAPS station (54401) station located approximately 76 km away was selected due to the similar rural land use and proximity to the Great Lakes/Highway 401 corridor as the proposed landfill expansion. All air quality indicator compounds are monitored at this station; however, particulate is only available for two years.

There is no monitoring data available for SPM and PM_{10}; however, the background SPM and PM_{10} concentrations can be estimated from the available $PM_{2.5}$ monitoring results. $PM_{2.5}$ is a subset of PM_{10}, and PM_{10} is a subset of SPM. Therefore, it is reasonable to assume that the ambient concentrations of SPM will be greater than corresponding PM_{10} levels, and PM_{10} concentrations will be greater than the corresponding levels of $PM_{2.5}$. The mean levels of $PM_{2.5}$ in Canadian locations are found to be about 54% of the PM_{10} concentrations and about 30% of the SPM concentrations (Lall et al., 2004). By applying this ratio, it is possible to estimate the background SPM and PM_{10} concentrations for the study area of interest.

Hydrogen sulphide is not measured at any of the above three stations; therefore, the 1-hour background concentration was taken from the ECCC's draft screening Assessment for H_2S (ECCC, 2017) and converted to the relevant averaging periods using MECP recommended methodologies in the *Air Dispersion Modelling Guideline for Ontario* (MECP, 2017)

Background air quality data was primarily taken from the Saint-Anicet Station as this is the most representative station closest to the Site Study Area. A copy of the full Background air quality study is included as Volume 2 Appendix B-1.

The background air quality is provided in Table 9-2 and compared to the air quality criteria identified in Section 9.1.1.5. All background concentrations to be used in the assessment are below the relevant air quality criteria.

Table 9-2: Background Air Quality

Indicator	Averaging Period	Air Quality Criteria (µg/m³)	Background Concentrations (µg/m³)	Percentage of Air Quality Criteria (%)
SPM	24-hour	120	38.58	32.15%
SPM	Annual	60	21.50	35.83%
PM_{10}	24-hour	50	21.44	42.87%
$PM_{2.5}$	24-hour	27	11.58	42.87%
$PM_{2.5}$	Annual	8.8	6.45	73.29%
NO_2	1-Hour	400 / 79	9.40	2.35%/11.91%
NO_2	24-Hour	200	8.91	4.46%
NO_2	Annual	32	4.93	15.42%
SO_2	10-min	180	4.32	2.40%
SO_2	1-Hour	100	2.62	2.62%
SO_2	24-Hour	150	3.06	2.04%
SO_2	Annual	10	1.12	11.25%
CO	1-Hour	15,000	343.57	2.29%

Indicator	Averaging Period	Air Quality Criteria (µg/m³)	Background Concentrations (µg/m³)	Percentage of Air Quality Criteria (%)
CO	8-Hour	6,000	343.57	5.73%
O_3	1-Hour	165	84.39	51.14%
O_3	8-Hour	123.6	91.25	73.83%
H_2S	10-min	13	0.84	6.46%
H_2S	24-hour	7	0.21	3.00%
Vinyl Chloride	24-Hour	1	0.0038	0.38%
Vinyl Chloride	Annual	0.2	0.0015	0.76%

9.1.1.6.2 Review of Existing Odour Complaints Data

Odour complaints may occur from nearby residents of a landfill. As of the date of this report, the Boyne Road Landfill has not received an odour complaint related to its operations.

9.1.2 Noise

The following methodology was carried out to characterize the existing acoustic environment:

- identification of Study Areas including noise sensitive receptors
- determination of applicable noise criteria
- determination of existing ambient noise levels without the Boyne Road Landfill in the vicinity of the Boyne Road Landfill and along the Haul Routes

This sub-section presents a characterization of the existing acoustic environment. The characterization of the existing environment serves as the baseline condition for which the potential noise impacts of the Boyne Road Landfill proposed expansion will be assessed.

The methodology used for the noise assessment was based on the MECP publications *"Noise Guidelines for Landfill Sites"* (Landfill Guidelines) (MECP, 1998) and *"Environmental Noise Guideline Stationary and Transportation Sources – Approval and Planning Publication NPC-300"* (NPC-300) (MECP, 2013). These guidelines outline the sound level limit criteria for evaluating landfilling operations and ancillary facilities (i.e., stationary noise sources). A description of key noise concepts is presented in Volume 2 Appendix C-1.

9.1.2.1 Point(s) of Reception

Points of Reception (POR(s)) were identified for the noise assessment within the Site-vicinity Study Area defined for noise. A desktop review was completed using orthoimagery, readily available public information and information provided by the Township to identify potential PORs in the vicinity of the Boyne Road Landfill where human activity is expected to occur. PORs were identified in general accordance with NPC-300. NPC-300 defines PORs as sensitive land uses with human activity, including dwellings, campsites or campgrounds, sensitive institutional uses (e.g., educational, nursery, hospital, healthcare, community centre, place of worship, or detention centre), or sensitive commercial uses (e.g., hotel or motel).

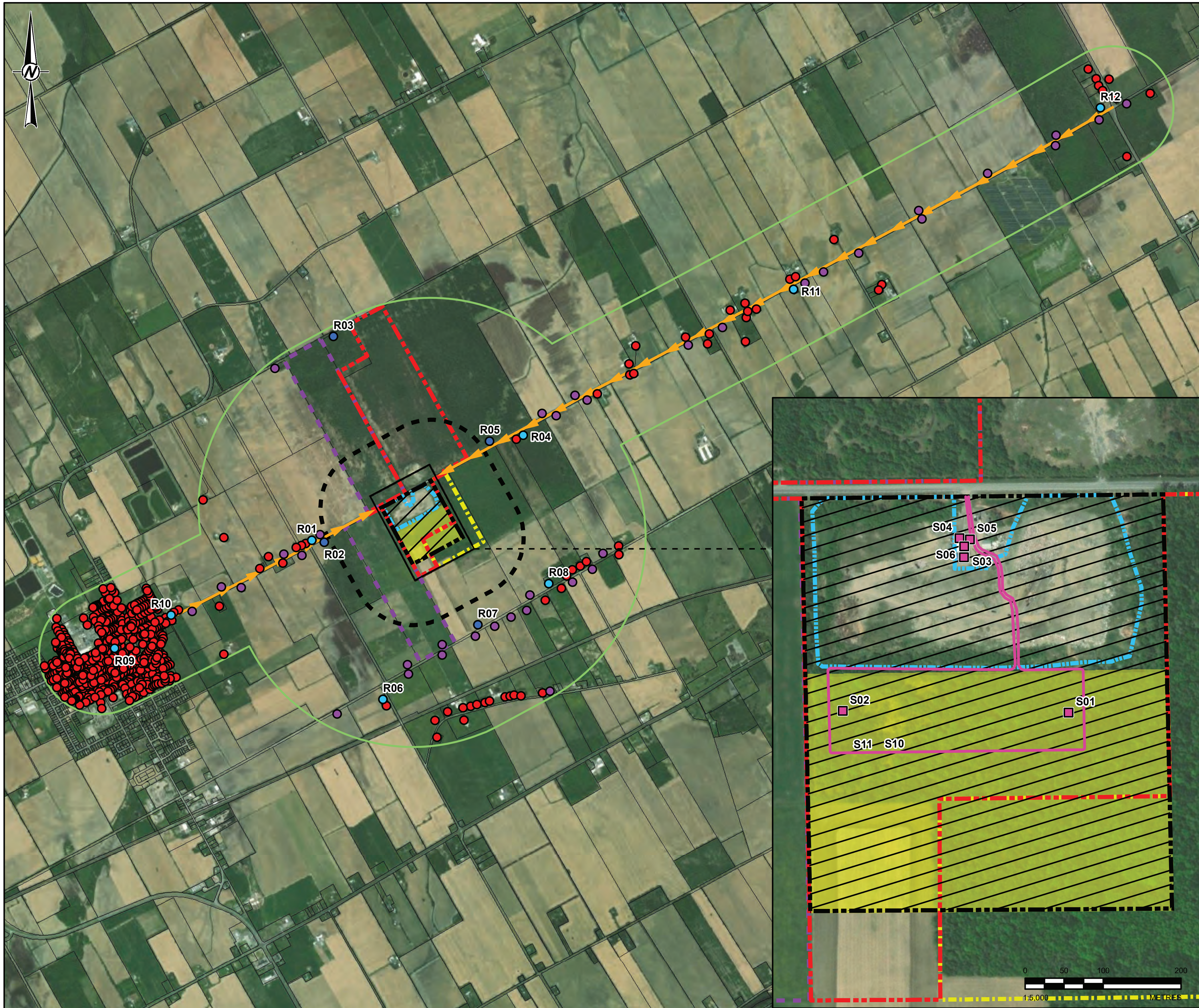
Existing PORs are located in all directions from the Boyne Road Landfill with the greatest concentration of existing PORs located approximately 2 km west of the Boyne Road Landfill in the Village of Winchester. There are accessible vacant lands located in the vicinity of the Landfill and therefore, in accordance with NPC-300, these were identified as vacant PORs. Existing and vacant PORs were identified for the noise assessment within the Site-vicinity Study Area defined for noise. It is noted that the Village of Winchester is more than 2000 m from the Landfill but within 500 m of the Haul Route. The following are key aspects regarding the land use and identification of noise sensitive PORs:

- Most lands within the Site-vicinity Study Area defined for noise are zoned as “Rural District” according to the Township’s Official Plan. This land use designation allows for noise sensitive uses.
- The Township currently follows the United Counties of Stormont, Dundas, and Glengarry Official Plan (the Official Plan) (SDG, 2018). The Official Plan states “*Development within 500 metres of an existing waste management system shall generally be discouraged unless supported by an appropriate study or studies which confirm that there will be no negative impacts on the proposed development related to current uses/activities associated with the normal operation of the waste management system*.” The Township will be revisiting their zoning bylaws in 2022, designating a minimum separation distance of 500 m between the Boyne Road Landfill property boundary and noise sensitive land uses as defined in NPC-300 (Landfill 500 m Buffer Zone). In the interim, the Township has adopted this condition.
- The land directly adjacent and to the east of the Landfill is owned by the Township and is vacant. The Township will not permit noise sensitive land uses on these lands even though zoned as “Rural District” since they are within the Landfill 500 m Buffer Zone.
- There are vacant lands located to the northwest, west and southwest identified as CAZ. These lands are not owned by the Township, but the Township has control over the groundwater rights through easement agreements; as such, a water supply well cannot be drilled on these lands. With the absence of a municipal water source, this CAZ eliminates the potential for development on these vacant lands for a noise sensitive use. Therefore, the Township will not permit noise sensitive land uses on these CAZ vacant lands since potable water supply is not permitted and they are within the Landfill 500 m Buffer Zone.
- As per NPC-300, noise levels are to be predicted for both existing and vacant PORs that do not meet the interim zoning requirement above (i.e., within the Landfill 500 m Buffer Zone). The Township provided a letter to the MECP providing assurances that the Township has adopted the interim zoning requirement. A copy of the letter to the MECP is provided in Volume 2 Appendix C-2.

Figure 9-2 presents all of the PORs that were identified within the Site-vicinity Study Area and Haul Routes. The most sensitive of these PORs, in all directions from the Site and Haul Route, were carried forward in the assessment to capture the greatest potential impacts. A total of 12 of the identified PORs were selected as being representative of the most sensitive PORs in the Site-vicinity Study Area with respect to the Boyne Road Landfill for further assessment, which are summarized in Table 9-3. Representative PORs were not identified within the Landfill 500 m Buffer Zone.

Table 9-3: Summary of Noise Assessment Representative Points of Reception Locations

Point of Reception ID	Description	UTM Coordinates (NAD83, Zone 18T)
R01	Residence 700 m west of the Boyne Road Landfill and 30 m from the Haul Route	396756 mE 4996343 mN
R02	Vacant lot 500 m west of the Boyne Road Landfill and along the Haul Route	396857 mE 4996327 mN
R03	Vacant lot 1400 m north of the Boyne Road Landfill	396933 mE 4998014 mN
R04	Residence 850 m east of the Boyne Road Landfill and 50 m from the Haul Route	398490 mE 4997203 mN
R05	Vacant lot 900 m east of the Boyne Road Landfill and along the Haul Route	398215 mE 4997156 mN
R06	Residence 1250 m southwest of the Boyne Road Landfill	397339 mE 4995038 mN
R07	Vacant lot 900 m south of the Boyne Road Landfill	398119 mE 4995650 mN
R08	Residence 1150 m southeast of the Boyne Road Landfill	398699 mE 4995987 mN
R09	Residence 2500 m west of the Boyne Road Landfill and 20 m from the Haul Route	395138 mE 4995456 mN
R10	Residence 1950 m west of the Boyne Road Landfill and 20 m from the Haul Route	395603 mE 4995729 mN
R11	Residence 3350 m east of the Boyne Road Landfill and 40 m from the Haul Route	400708 mE 4998402 mN
R12	Residence 6300 m east of the Boyne Road Landfill and 45 m from the Haul Route	403222 mE 4999890 mN



LEGEND

RECEPTORS

- EXISTING
- VACANT
- REPRESENTATIVE - EXISTING
- REPRESENTATIVE - VACANT
- NOISE SOURCE
- NOISE SOURCE
- HAUL ROUTES (NOISE STUDY AREA)
- LOT BOUNDARY
- PROPOSED LANDFILL EXPANSION AREA
- NOISE SITE-VICINITY STUDY AREA
- APPROXIMATE PROPERTY BOUNDARY OF LANDFILL SITE
- EXISTING LANDFILL FILL AREA
- TOWNSHIP OWNED PROPERTY
- CONTAMINANT ATTENUATION ZONE
- SITE STUDY AREA
- 500 m AROUND PROPERTY ZONED FOR WASTE DISPOSAL

REFERENCE(S)

1. LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2014
2. SERVICE LAYER CREDITS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY
3. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: MTM ZONE 9 VERTICAL DATUM: CGVD28

0 400 800 1,600

1:32,000 METRES

CLIENT

TOWNSHIP OF NORTH DUNDAS

PROJECT

INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE

NOISE ASSESSMENT – EXISTING CONDITIONS AND IMPACT ASSESSMENT

CONSULTANT

GOLDER MEMBER OF WSP

YYYY-MM-DD	2022-02-14
DESIGNED	PLE
PREPARED	JEM/MG
REVIEWED	----
APPROVED	----

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	A	**9-2**

25mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:

9.1.2.2 Noise Criteria

The Landfill Guidelines and NPC-300 outline the sound level limit criteria for evaluating landfilling operations and ancillary facilities (i.e., stationary noise sources), respectively.

The noise assessment was carried out at the representative PORs identified within the Site-vicinity Study Area, as discussed in Section 9.1.2.1. All representative PORs identified in this noise assessment are conservatively described as being located in a Class 3 area, as defined in NPC-300 as a rural area with an acoustical environment that is generally dominated by natural sounds. Note, PORs within the Village of Winchester may be best identified in a Class 2 area, as defined in NPC-300, but in completing a conservative assessment, a Class 3 designation was applied for the purposes of the EA Study.

The sound level limits for the Boyne Road Landfill landfilling operations are established in the Landfill Guidelines as 55 decibels (dBA) and 45 dBA during the daytime period (i.e., 7:00 a.m. to 7:00 p.m.) and nighttime period (i.e., 7:00 p.m. to 07:00 a.m.) respectively.

The Landfill Guidelines also outline the protocol for evaluating off-site vehicle traffic (i.e., Haul Routes) for which there are no specific sound level limits. In accordance with the Landfill Guidelines, the potential noise impact of off-site vehicles on the existing noise environment is described qualitatively based on a quantitative assessment of the potential increase to the one hour equivalent sound level ($L_{eq,1hr}$), as described in Table 9-4.

Table 9-4: Landfill Guidelines Qualitative Noise Impact Ratings for Off-site Vehicles

Sound Level Increase (dB)	Qualitative Rating
1 to 3 inclusive	Insignificant
3 to 5 inclusive	Noticeable
5 to 10 inclusive	Significant
10 and over	Very significant

The sound level limits for the Boyne Road Landfill ancillary facilities are established in accordance with NPC-300 for the daytime (7:00 a.m. to 7:00 p.m.), evening (7:00 p.m. to 11:00 p.m.), and nighttime (11:00 p.m. to 7:00 a.m.) periods. In assessing steady sounds from stationary noise sources, the MECP has established exclusionary Plane of Window (POW) and outdoor sound level limits for Class 3 areas. The POW is typically assessed at the center of a window (i.e., for a two-storey home, typically it would be at a height of 4.5 m above grade). An outdoor location is assessed at a location within 30 m of a dwelling façade at a height of 1.5 m above grade and within the property of the dwelling. The POW sound level limit for the noise sensitive receptors in a Class 3 area is described as follows:

> *The sound level limit at a POW POR is set as the higher of either the applicable exclusionary limit of 45 dBA in the daytime period of 07:00-19:00, 40 dBA in the evening period of 19:00-23:00 and 40 dBA in the night-time period of 23:00-07:00, or the minimum background sound level that occurs or is likely to occur during the time period corresponding to the operation of the stationary source under impact assessment.*

The outdoor sound level limit for the noise sensitive receptors in a Class 3 area is described as follows:

> *The sound level limit at an outdoor POR is set as the higher of either the applicable exclusionary limit of 45 dBA in the daytime period of 07:00-19:00 and 40 dBA in the evening period of 19:00-23:00, or the minimum background sound level that occurs or is likely to occur during the time period corresponding to the operation of the stationary source under impact assessment. In general, the outdoor POR will be protected during the night-time as a consequence of meeting the sound level limit at the adjacent POW.*

Note that for vacant lands, the location of the POR was assessed in accordance with NPC-300; either at the centre of the vacant lot, or within a 1 hectare portion of the vacant lot located in a manner consistent with the existing zoning by-law and the typical building pattern in the area, at a height of 4.5 m above grade.

The $L_{eq,1hr}$ MECP exclusionary sound level limits for steady sounds from stationary noise sources at a POR in a Class 3 area are summarized in Table 9-59-5 and used to assess compliance of the Boyne Road Landfill. The potential noise levels at each of the existing residences were predicted at both the POW and outdoor POR, but only the results from the location with the highest levels (i.e., POW or outdoor) are shown in the result tables.

Table 9-5: Sound Level Limits for Class 3 Area – Steady Stationary Sources

	POW MECP Exclusionary Sound Level Limit ($L_{eq,1hr}$, dBA)	**Outdoor MECP Exclusionary Sound Level Limit ($L_{eq,1hr}$, dBA)**
Time Period	**Class 3**	**Class 3**
Daytime (7:00 a.m. – 7:00 p.m.)	45	45
Evening (7:00 p.m. – 11:00 p.m.)	40	40
Nighttime (11:00 p.m. – 7:00 a.m.)	40	not applicable

For impulsive sounds from a stationary source, measured in dBAI, the sound level limit at a POR expressed in terms of the Logarithmic Mean Impulse Sound Level (L_{LM}) is the higher of: the applicable exclusionary level limit given in Table 9-6 and Table 9-7 for the POW and outdoor POR, or the background sound level for that POR.

Table 9-6: Stationary Sources (Impulsive Sounds) – Exclusionary Sound Level Limit Values of Logarithmic Mean Impulse Sound Level (L_{LM}, dBAI) POW of Noise Sensitive Spaces

Actual Number of Impulses in Period of One-Hour	Class 1 Area (7:00 a.m.- 11:00 p.m.)/ (11:00 p.m.- 7:00 a.m.)	Class 2 Area (7:00 a.m.- 11:00 p.m.)/ (11:00 p.m.- 7:00 a.m.)	Class 3 Area (7:00 a.m.- 11:00 p.m.)/ (11:00 p.m.- 7:00 a.m.)	Class 4 Area (7:00 a.m.- 11:00 p.m.)/ (11:00 p.m.- 7:00 a.m.)
9 or more	50/45	50/45	45/40	60/55
7 to 8	55/50	55/50	50/45	65/60
5 to 6	60/55	60/55	55/50	70/65
4	65/60	65/60	60/55	75/70
3	70/65	70/65	65/60	80/75
2	75/70	75/70	70/65	85/80
1	80/75	80/75	75/70	90/85

Table 9-7: Stationary Sources (Impulsive Sounds) – Exclusionary Sound Level Limit Values of Logarithmic Mean Impulse Sound Level (L_{LM}, dBAI) Outdoor POR

Time of Day	Actual Number of Impulses in Period of One-Hour	Class 1 Area	Class 2 Area	Class 3 Area	Class 4 Area
7:00 a.m. – 11:00 p.m.	9 or more	50	50	45	60
	7 to 8	55	55	50	65
	5 to 6	60	60	55	70
	4	65	65	60	75
	3	70	70	65	80
	2	75	75	70	85
	1	80	80	75	90

Impulsive sounds from stationary noise sources are currently not expected at the Boyne Road Landfill. Administrative controls as part of the normal landfill site operations are expected to minimize any potential impulsive sounds (i.e., tailgate slamming, equipment driving over ruts in on-site roadways, movement of waste containers). Therefore, due to the inherent administrative controls, it is expected that impulsive noise will not be a substantial noise source on-site and, accordingly, was not further assessed.

9.1.2.3 Existing Noise Levels

9.1.2.3.1 Methodology

A desktop assessment was completed to; establish the existing conditions in the noise Site-vicinity Study Area and assess the potential impacts due to the Boyne Road Landfill. Existing noise levels in the Site-vicinity Study Area are influenced by human activities, vehicle traffic, existing landfill operations and sounds of nature.

For this noise assessment, the establishment of existing conditions focused on the expected existing noise levels along the off-site Haul Routes as required by the MECP. To establish the expected existing noise levels for the haul route assessment, the assessment of existing traffic along the Haul Routes, without the existing landfill traffic, was undertaken.

The noise predictions for road traffic along the Haul Routes were carried out using the MECP's Ontario Road Noise Analysis Method for Environment and Transportation (ORNAMENT), which is the basis of the DOS-based STAMSON modelling software provided by the MECP. Road traffic was assessed over a one-hour period, corresponding to the time of the greatest predicted impact due to the Boyne Road Landfill.

Existing and anticipated Boyne Road Landfill noise levels due to road traffic were established using existing (2021) and future (2048, with and without the landfill) peak hour traffic provided in the Traffic Impact Study prepared for the Boyne Road Landfill (Sections 9.9 and 13.9). To assess the greatest predicted impact, an hourly background road traffic noise level is required during the hour when this occurs, which may differ from when the existing road traffic peak hour occurs. Therefore, the Annual Average Daily Traffic (AADT) is typically required to calculate hourly background road traffic volumes and respective noise levels. For the purposes of the noise assessment, it was assumed that peak hour traffic presented in the Traffic Impact Study is representative of 10% of the AADT, a generally accepted practice. The hourly traffic breakdown for existing traffic (in the absence of the existing landfill) was assumed using data provided in the US Environmental Protection Agency (US EPA) software Motor Vehicle Emissions Simulator. The medium and heavy truck percentages were assumed using the City of Ottawa's *Environmental Noise Control Guidelines* (City of Ottawa, 2016). Speed limits were provided in the Traffic Impact Study.

Based on information provided in the Traffic Impact Study, background road traffic volumes in the Site-vicinity Study Area are expected to grow faster than the expected Boyne Road Landfill traffic over the Township's waste management planning period (i.e., 25 years, from 2023 to 2048). Therefore, the year 2023 was considered for the noise assessment, where the expected change in noise levels due to Boyne Road Landfill traffic is expected to be greatest over background traffic levels. Existing Boyne Road Landfill traffic was removed from the existing (2021) traffic data based on guidance from the MECP for the purposes of this assessment. This is considered to be a conservative approach to the haul route analysis. The background 2023 traffic was calculated from the 2021 existing traffic (without the landfill traffic), considering the 15% COVID-19 adjustment and the 1% growth rate considered in the Traffic Impact Study. Peak hour Boyne Road Landfill traffic for 2023 was back-calculated from the projected 2048 peak hour traffic provided in the Traffic Impact Study, using the expected increase in Boyne Road Landfill traffic from 2023 to 2048 of 5.5%. It was assumed that the relative distribution of Boyne Road Landfill vehicles (i.e., percentage of cars/medium trucks/heavy trucks) will not change with the proposed expansion. Peak hour Boyne Road Landfill traffic was modelled for the hours between 8:00 a.m. and 10:00 a.m. and 2:00 p.m. and 4:00 p.m., based on information provided in the Traffic Impact Study. The road traffic modelling results, further discussed in Section 13.1.2. indicated the predictable worst case hour was from 2:00 p.m. to 3:00 p.m..

A summary of the road traffic data is provided in Table 9-8.

Table 9-8: Summary of 2023 Background and Boyne Road Landfill Road Traffic Data

Road Segment	Speed Limit (km/hr)	2023 Background Traffic (Without Landfill)			2023 Boyne Road Landfill Traffic	2023 Boyne Road Landfill Traffic
		AADT	% of AADT During Hour with Worst Case Impacts[1]	% Car / Medium Truck / Heavy Truck	Peak Hour Traffic	% Car / Medium Truck / Heavy Truck
Main Street between St. Lawrence Street and Ottawa Street	50	3860	6%	88 / 7 / 5	29	65 / 15 / 20
St. Lawrence Street South of Main Street	50	3512	6%	88 / 7 / 5	14	65 / 15 / 20
Boyne Road Between Ottawa Street and the Boyne Road Landfill	80	1056	6%	88 / 7 / 5	29	65 / 15 / 20
Boyne Road Between the Boyne Road Landfill and County Road 7	80	1056	6%	88 / 7 / 5	9	65 / 15 / 20
County Road 7 North of Boyne Road	80	1558	6%	88 / 7 / 5	1	65 / 15 / 20
County Road 7 South of Boyne Road	80	1750	6%	88 / 7 / 5	9	65 / 15 / 20

Notes: [1]Hour with worst case predicted noise impact due to the Boyne Road Landfill is the 2:00 p.m. to 3:00 p.m. hour, as described in Section 13.1.2

9.1.2.3.2 Results

As discussed in Section 9.1.2.3.1, existing noise levels in the Site-vicinity Study Area are influenced by human activities vehicle traffic, existing landfill operations and sounds of nature. As described in Section 9.1.2.2, the Site-vicinity Study Area is conservatively described as a Class 3 area. Existing conditions in the Site-vicinity Study Area are generally consistent with a Class 3 area, however based on the existing traffic volumes on specific roads in the area, it is expected that existing conditions near some roads may be elevated.

For this noise assessment, existing conditions were determined only for the haul route assessment as required by the MECP. Only representative PORs with existing noise sensitive land uses that were within 500 m of the Haul Routes were assessed.

Predicted 2023 road traffic noise levels without landfill traffic are presented in Table 9-9 for the predictable worst case hour (i.e., the hour when Boyne Road Landfill impacts are predicted to be the greatest).

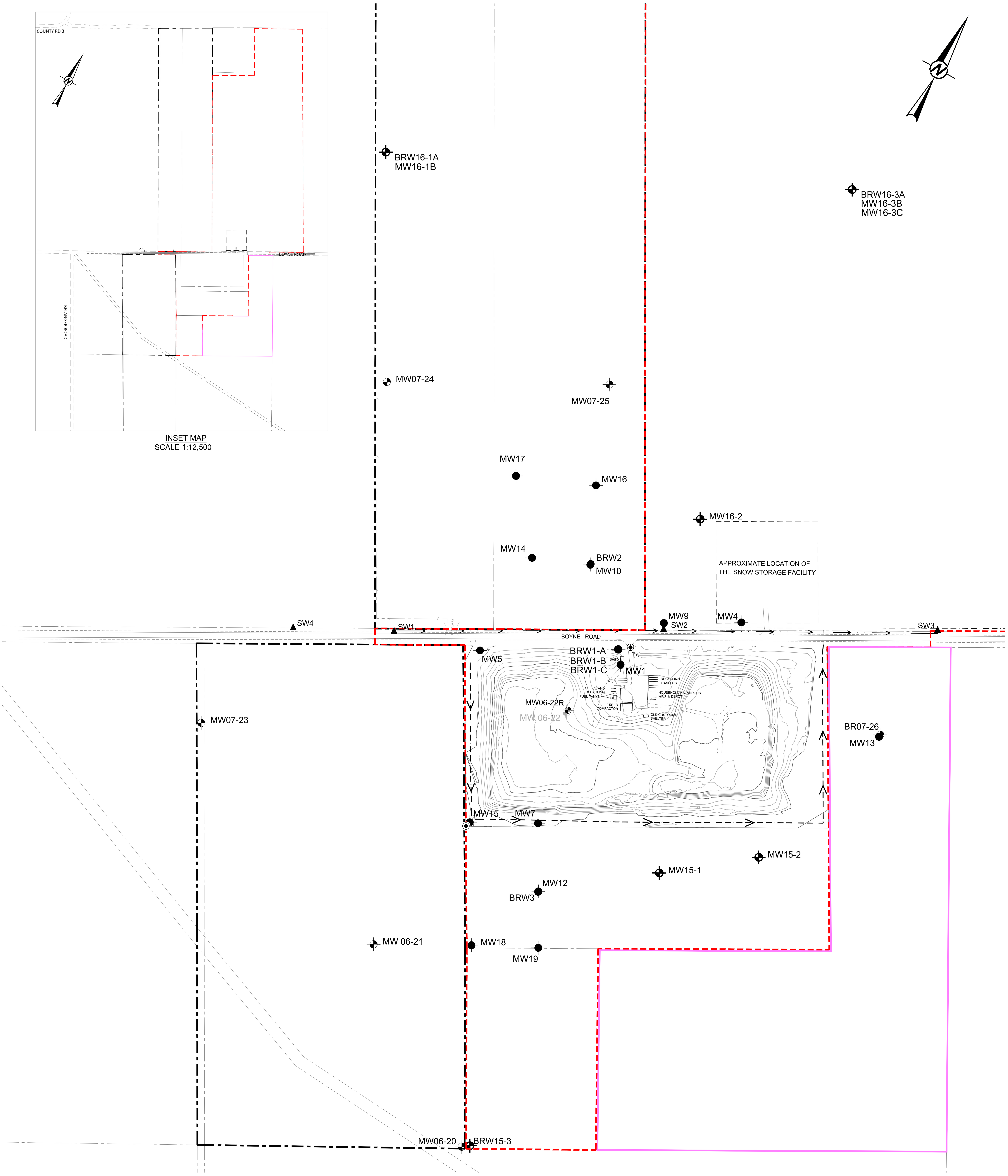
Table 9-9: Predicted 2023 Haul Route Noise Levels Without Existing Landfill Traffic

Receptor	2023 One-Hour Road Traffic Noise Level – Without Existing Landfill Traffic (dBA)
R01	56
R04	52
R09	60
R10	58
R11	53
R12	54

Notes: Hour with worst case predicted noise impact due to the Boyne Road Landfill is the 2:00 p.m. to 3:00 p.m. hour, as described in Section 13.1.2

9.2 Geology and Hydrogeology

Numerous subsurface and hydrogeological investigations and groundwater monitoring programs have been completed at the Boyne Road Landfill since 1991, which has resulted in a thorough understanding of the geological and hydrogeological setting of the existing landfill. Landfill site conditions have been determined based on published resources and subsurface conditions encountered during borehole drilling programs, monitoring well installations in overburden and bedrock, in situ hydraulic conductivity testing, groundwater level measurements and groundwater sampling and analysis. An ongoing annual groundwater monitoring program has been completed at the landfill site since 1991. A plan of the Boyne Road Landfill site showing all borehole and monitoring well locations is provided on Figure 9-3.



LEGEND

- DESTROYED MONITORING WELL NO LONGER IN USE
- APPROXIMATE BOREHOLE LOCATION IN PLAN, ESTABLISHED BY GOLDER ASSOCIATES LTD.
- APPROXIMATE BOREHOLE LOCATION IN PLAN, ESTABLISHED BY OTHERS
- APPROXIMATE SURFACE WATER SAMPLING LOCATION IN PLAN
- GEO-REFERENCING POINTS
- 85.0 GROUND SURFACE CONTOURS (M), BASED ON RESULTS OF THE SURVEYS CONDUCTED IN 2008, 2010, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019 AND 2020
- APPROXIMATE PROPERTY BOUNDARY OF LANDFILL SITE
- APPROXIMATE BOUNDARY OF CONTAMINANT ATTENUATION ZONE
- ADDITIONAL LAND OWNED BY TOWNSHIP
- APPROXIMATE LOCATION OF PERIMETER DITCH AND INFERRED FLOW DIRECTION
- INFERRED FLOW DIRECTION IN THE DRAINAGE DITCH ALONG BOYNE ROAD

NOTES

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE

1. BASE PLAN SUPPLIED IN ELECTRONIC FORMAT BY STANTEC CONSULTING LTD.
2. 2008 AND 2010 SURVEYS COMPLETED BY STANTEC CONSULTING LTD.
3. MAY 2012, JULY 2013, NOVEMBER 2014, DECEMBER 2015, NOVEMBER 2016, DECEMBER 2017, DECEMBER 2018 AND NOVEMBER 2019, APRIL 2020 AND DECEMBER 2020 SURVEYS COMPLETED BY GOLDER ASSOCIATES LTD.
4. COORDINATE SYSTEM: MTM ZONE 9 NAD83

0 100 200
1:2,500 METRES

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

CONSULTANT

GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-08-31
PREPARED	ABD
DESIGN	RM
REVIEW	PS
APPROVED	PAS

TITLE
BOYNE LANDFILL SITE PLAN

PROJECT No.	PHASE/TASK	Rev.	FIGURE
1648253	2.0/2.2.0	0	9-3

9.2.1 Geology

9.2.1.1 Regional Geology

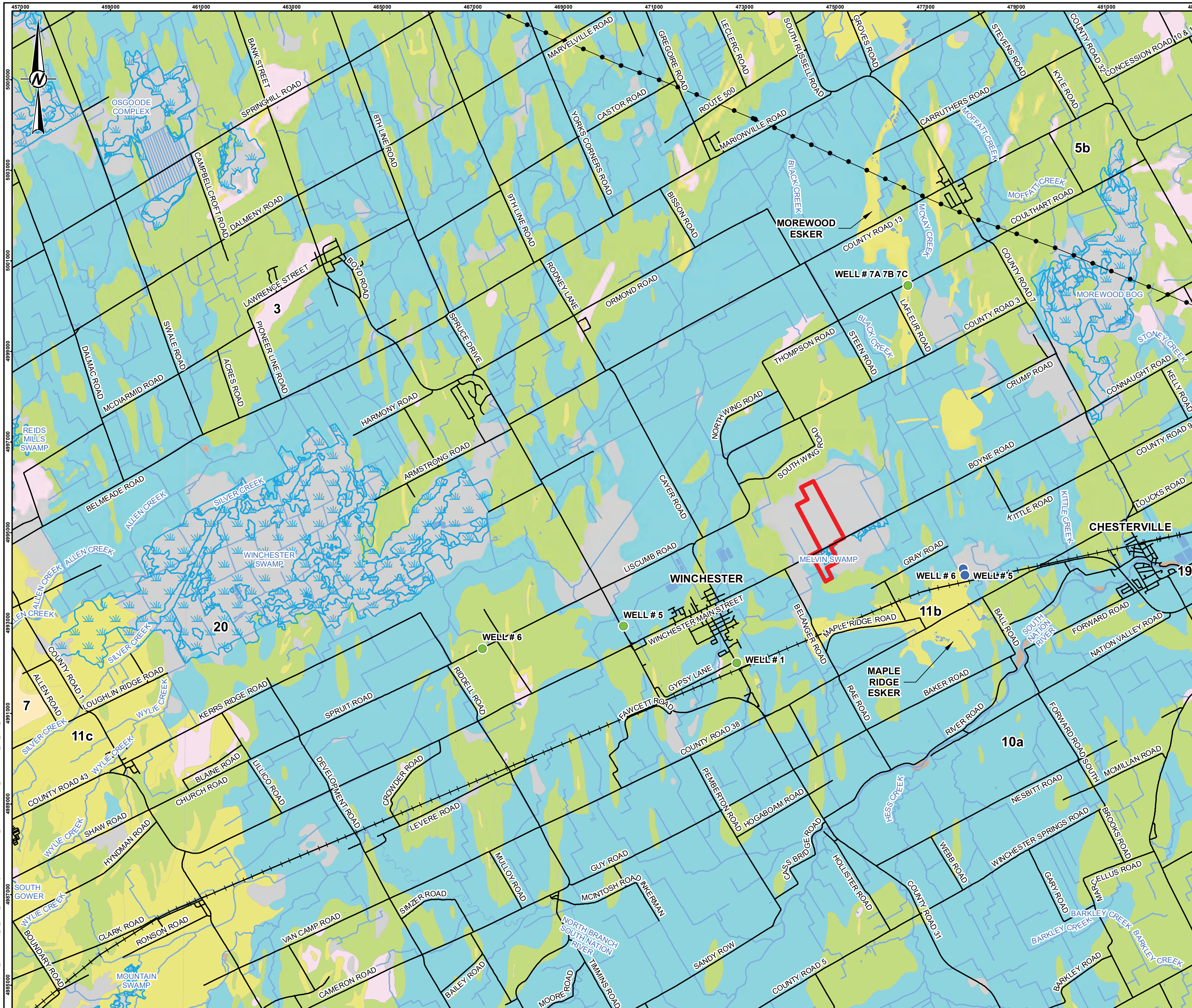
Published geological maps indicate that overburden in the area of the Boyne Road Landfill site consists of: organic deposits comprised primarily of peat; underlain by offshore marine deposits comprised of clay, silty clay, and silt; underlain by silty sand and sandy silt till (Geological Survey of Canada, 1982). The overburden geology in the Wider Study Area is shown on Figure 9-4. Published geological maps (refer to Figure 9-5) indicate that bedrock in the Wider Study Area consists mainly of limestone of the Bobcaygeon and Gull River Formations (Ontario Geological Survey, 2007; Ministry of Natural Resources, 1985).

The topography in the general area in which the Boyne Road Landfill site is situated is generally flat lying to undulating. Ground surface elevations in the Site Study Area typically range from approximately 73.5 to 75.0 masl, but have historically ranged from 71.41 to 77.69 masl since monitoring biannually began in 2005. The stratigraphic sequence is derived from recently deposited materials of glacial, glacio-fluvial and marine origins. Spatially the most dominant units consist of glacial tills and marine clays, with a thickness ranging between a few m to 20 m. The glacial tills in the Wider Study Area tend to be stony and sandy and are generally characterized as silty sands.

There are the occurrences of glacio-fluvial deposits within the Wider Study Area. These long and narrow ice-contact stratified drifts are north-south trending features comprised of well-sorted coarse sands and gravels that deposited in melt-water channels within glaciers that covered the area long ago. The most prominent features within the Wider Study Area are the Morewood Esker (part of the Vars-Winchester Esker Complex) and the Maple Ridge Esker, both of which are labelled on Figure 9-4. There is also the Loughlin Ridge located approximately 11 km west of Winchester.

The Vars-Winchester Esker has been the subject of investigations by the Geological Survey of Canada, using geophysical methods to locate and characterize the esker where it is not present at surface but is buried beneath marine clay deposits. These studies have been focused on sections of the Vars-Winchester esker in the Russell- Embrun area, north of the Morewood Esker section within the Township.

The Morewood Esker is a north-south linear feature that is some 7.5 km long by approximately 250 m wide at the surface (average subsurface width of the esker is ~800 m). The presence of the esker is reflected by topography and the position of a number of sand and gravel pits located along the esker. The esker material generally consists of a highly permeable and transmissive 100 to 200 m wide esker core of well sorted sand and gravel, cobbly gravels and sandy gravels. The core is flanked by finer soils, grading from sands to silts and clays. The esker is entrenched into the glacial till and its base is generally at or near the underlying bedrock surface; the sandy flanks of the esker area frequently overlain by marine clays. The surficial signature of the esker core is delineated in places by a small topographical ridge reworked by nearshore processes (former beach). Elsewhere the presence of the esker core is only inferred and may be discontinuous in places (Cummings and Russell, 2007; Golder, 1995 and 2003).



LEGEND

- CHESTERVILLE WELL LOCATION
- WINCHESTER WELL LOCATION
- ROADWAY
- RAILWAY
- UTILITY LINE
- WATERCOURSE
- WATERBODY
- WETLAND
- APPROXIMATE BOUNDARY OF BOYNE RD LANDFILL SITE

OGS SURFICIAL GEOLOGY

- 3. **PALEOZOIC BEDROCK**
- 5b. **TILL:** STONE-POOR, SANDY SILT TO SILTY SAND-TEXTURED TILL ON PALEOZOIC TERRAIN
- 7. **GLACIOFLUVIAL DEPOSITS:** RIVER DEPOSITS AND DELTA TOPSET FACIES
- 10a. **FINE-TEXTURED GLACIOMARINE DEPOSITS:** SILT AND CLAY, MINOR SAND AND GRAVEL; MASSIVE TO WELL LAMINATED
- 11b. **COARSE-TEXTURED GLACIOMARINE DEPOSITS:** SAND, GRAVEL, MINOR SILT AND CLAY; LITTORAL DEPOSITS
- 11c. **COARSE-TEXTURED GLACIOMARINE DEPOSITS:** SAND, GRAVEL, MINOR SILT AND CLAY; FORESHORE AND BASINAL DEPOSITS
- 19. **MODERN ALLUVIAL DEPOSITS:** DAY, SILT, SAND, GRAVEL, MAY CONTAIN ORGANIC REMAINS
- 20. **ORGANIC DEPOSITS:** PEAT, MUCK, MARL

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. ONTARIO GEOLOGICAL SURVEY 2010. SURFICIAL GEOLOGY OF SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MISCELLANEOUS RELEASE--DATA 128-REV
2. LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2018
3. SERVICE LAYER CREDITS:
4. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: UTM ZONE 18, VERTICAL DATUM: CGVD28

0 1,000 2,000 4,000

1:85,000 METRES

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
SURFICIAL GEOLOGY

CONSULTANT

GOLDER MEMBER OF WSP

YYYY-MM-DD	2022-01-28
DESIGNED	----
PREPARED	BR
REVIEWED	BH
APPROVED	PAS

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	0	9-4

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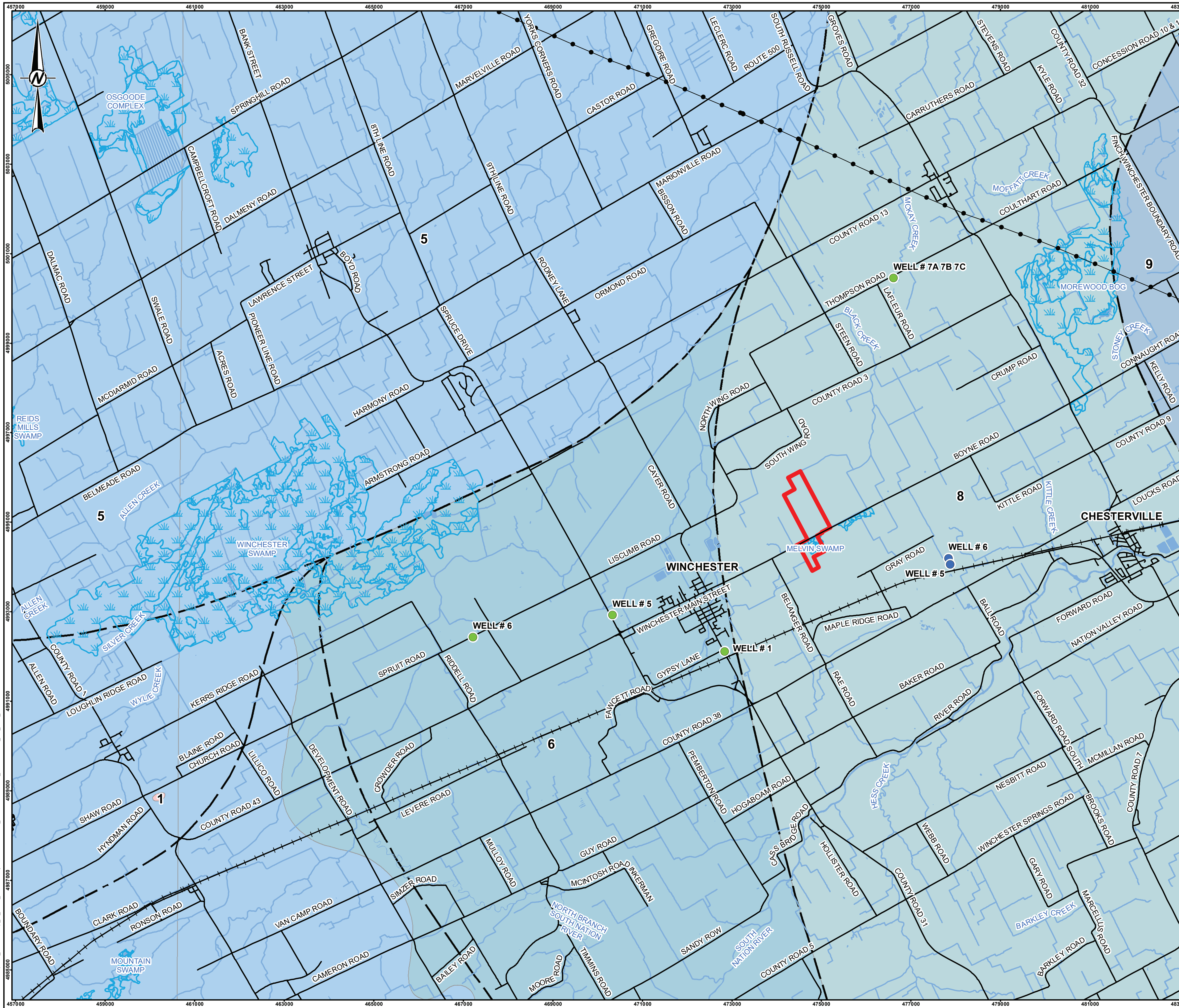


LEGEND

- CHESTERVILLE WELL LOCATION
- WINCHESTER WELL LOCATION
- ROADWAY
- RAILWAY
- UTILITY LINE
- WATERCOURSE
- WATERBODY
- WETLAND
- FAULT
- APPROXIMATE BOUNDARY OF BOYNE RD LANDFILL SITE

OGS BEDROCK GEOLOGY

- 9: BOBCAYGEON FORMATION - LIMESTONE, WITH MINOR SHALES IN UPPER PART
- 8: GULL RIVER FORMATION - LIMESTONE, WITH DOLOSTONE BEDS TOWARDS BASE
- 6: ROCKCLIFFE FORMATION - SANDSTONE, SHALE, LIMESTONE, DOLOSTONE
- 5: OXFORD FORMATION - DOLOSTONE, MINOR SHALE AND SANDSTONE
- 1: PRECAMBRIAN

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. ARMSTRONG, D.K. AND DODGE, J.E.P. 2007. PALEOZOIC GEOLOGY OF SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MISCELLANEOUS RELEASE--DATA 219
2. LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2018
3. SERVICE LAYER CREDITS:
4. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: UTM ZONE 18, VERTICAL DATUM: CGVD28

0 1,000 2,000 4,000

1:85,000 METRES

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
BEDROCK GEOLOGY

CONSULTANT

GOLDER MEMBER OF WSP

YYYY-MM-DD	2022-01-28
DESIGNED	----
PREPARED	BR
REVIEWED	BH
APPROVED	PAS

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	0	9-5

The Maple Ridge Esker is comprised of an assortment of sand, gravel, clay, ice-contact stratified drift, and till, and has been referred to as a terminal moraine. This esker deposit is oriented east-west and its eastern end portion is located approximately 4 km west of Chesterville. Its surface expression is approximately 3 km in length and between 0.2 and 1.5 km wide. The core of the esker consists of coarse sand and gravel with gravel content increasing towards the north. In the southern portion of the esker, glacial till exists (Golder, 2003a). Several sand pits are present towards the east end of the Maple Ridge Esker.

As illustrated on Figure 9-4, there is no surficial feature reflecting the presence of the Vars-Winchester Esker in the intervening land area that extends 4 km north-south between the southern end of the Morewood Esker and the north side of the Maple Ridge Esker. Previous investigations in this intervening area between these two esker features as part of several previous studies to provide additional groundwater supplies for Winchester and Chesterville have found that the overburden is of generally limited thickness, and the soil conditions encountered are not the coarse granular core or finer sand flanks that are characteristic of the esker. The geophysical studies used to locate the esker where it is buried beneath clay soil deposits were not carried out in this intervening area. Although the Vars-Winchester Esker is shown as being present in this intervening area in published information (Cummings and Russell, 2007), it has not been encountered in previous targeted investigations, suggesting that it may be discontinuous in this area of the Township.

9.2.1.2 Boyne Road Landfill Geology

Based on subsurface conditions encountered during borehole drilling programs (refer to Figure 9-3 for borehole and monitoring well locations) completed at the landfill site, overburden in the area consists of the following:

- A topsoil/peat unit (between 0 and 2 m in thickness). This unit is generally thickest to the north of Boyne Road.
- A silt/clay unit at surface or underlying topsoil/peat where present (generally between 0 and 3 m in thickness). However, the thickness of this unit appears to increase to the north and east of the Site-vicinity Study Area, with a maximum thickness of 5.8 m encountered at BH16-3.
- A silty sand/sandy silt till (between 0.9 and 6.0 m in thickness) was encountered where boreholes were advanced through the base of the silt/clay unit. A 1.9 m thick sequence of sand and gravel was encountered at the top of surface of this unit at BH16-3.

Bedrock, consisting of limestone (interbedded with shale), has been encountered at between 1.4 and 11.6 mbgs. The greatest depth to bedrock encountered during the drilling of on-site boreholes was encountered at BH16-3, located to the northeast of the landfill site about midway through the Township-owned lands north of Boyne Road. The least depth to bedrock was observed to the south of the existing fill area at MW15-1 and MW15-2, where auger refusal was encountered at 1.7 mbgs and 1.4 mbgs, respectively.

The position of the Boyne Road Landfill relative to the mapped overburden and bedrock geology is shown on Figures 9-4 and 9-5, respectively.

Available borehole logs are included in Volume 2 Appendix D-1.

9.2.2 Hydrogeology

9.2.2.1 Regional Aquifers

The following sub-sections outline the general characteristics of both the bedrock and overburden aquifers in the Wider Study Area.

9.2.2.1.1 Bedrock Aquifers

Groundwater flow in the bedrock aquifers is controlled by and occurs along and through fractures and bedding plane features (secondary porosity). The contact zone between the upper weathered bedrock surface and the overburden materials (basal till) has an enhanced permeability and thus has a higher hydraulic conductivity than the lower, more massive bedrock. The Gull River Formation, the most predominant bedrock in the Wider Study Area, is regionally known to have low transmissivities and potable quality at a regional scale. Individual water supplies in the mostly rural Township obtain their water from drilled wells completed at various depths in the bedrock. There are also three wells completed in bedrock that form part of the water supply for the Village of Winchester located west of the village (refer to Wells #1, 5 and 6 on Figure 9-4).

The bedrock aquifers in the Wider Study Area are largely overlain by several metres of low permeability clays and silts that act as an aquitard by storing water and transmitting it slowly to the aquifer. Thus, the bedrock aquifers in the Wider Study Area are considered mostly to be confined/semi-confined. A review of the water level information within the MECP Water Well Information System (WWIS) indicates that, on a regional scale, flow in the bedrock is from southwest to northeast. On a more local scale, groundwater flow in the bedrock is generally towards the rivers that exist within the Wider Study Area (East Castor River and South Nation River).

Recharge to the bedrock aquifers likely occurs where the bedrock outcrops, where the overburden is thin, or in areas where relatively permeable sediments are in contact with the bedrock. The main recharge areas are expected to be in areas of topographic highs. Some recharge occurs from storage in the overlying aquitard. Recharge through the aquitard may occur in areas of local topographic lows where depression-focused recharge may occur.

9.2.2.1.2 Overburden Aquifers

The overburden in the Wider Study Area is mainly comprised of marine clay and glacial till. The hydraulic conductivity of the clay is very low, and water is transmitted very slowly through the matrix of the clay. The clay is considered an aquitard and not suitable for the development of a water supply. Even though the glacial till has a higher hydraulic conductivity than the marine clays, it is perhaps only capable of providing adequate well yields for an individual water supply in very localized areas.

The coarse grained glaciofluvial deposits within the Morewood Esker (~8 km northeast of Winchester), and the Maple Ridge Esker (~4 km west of Chesterville), and potentially the Loughlin Ridge (~11 km west of Winchester) form excellent local aquifers. Wells constructed within these deposits typically have high yields of potable water. The Morewood Esker, the

Maple Ridge Esker and the Loughlin Ridge are principally unconfined, but confined conditions could persist where the marine clays overlay the coarse-grained materials on the margins of the deposits, or where the deposits are entirely buried (if present). These aquifers are recharged by infiltrating precipitation (diffuse) and by the surface ponds created by gravel extraction operations (locally) below the water table. The majority of recharges occurs along the length of the esker feature where the coarse granular central core and sandy flanks of the eskers are exposed at the surface (Cummings and Russell, 2007). The permeable material that comprises the core of the eskers is underlain by less permeable till and/or bedrock. Previous hydrogeological evaluations completed for the wellfield in the Morewood Esker (Golder, 2003; Golder and Sauriol, 2005) and the Maple Ridge Esker (Golder, 2003a), indicate that it is likely that the two eskers have some inflow from an adjacent source such as permeable material overlying the bedrock that then is connected to the eskers, although this has not been conclusively determined.

9.2.2.2 Boyne Road Hydrogeology

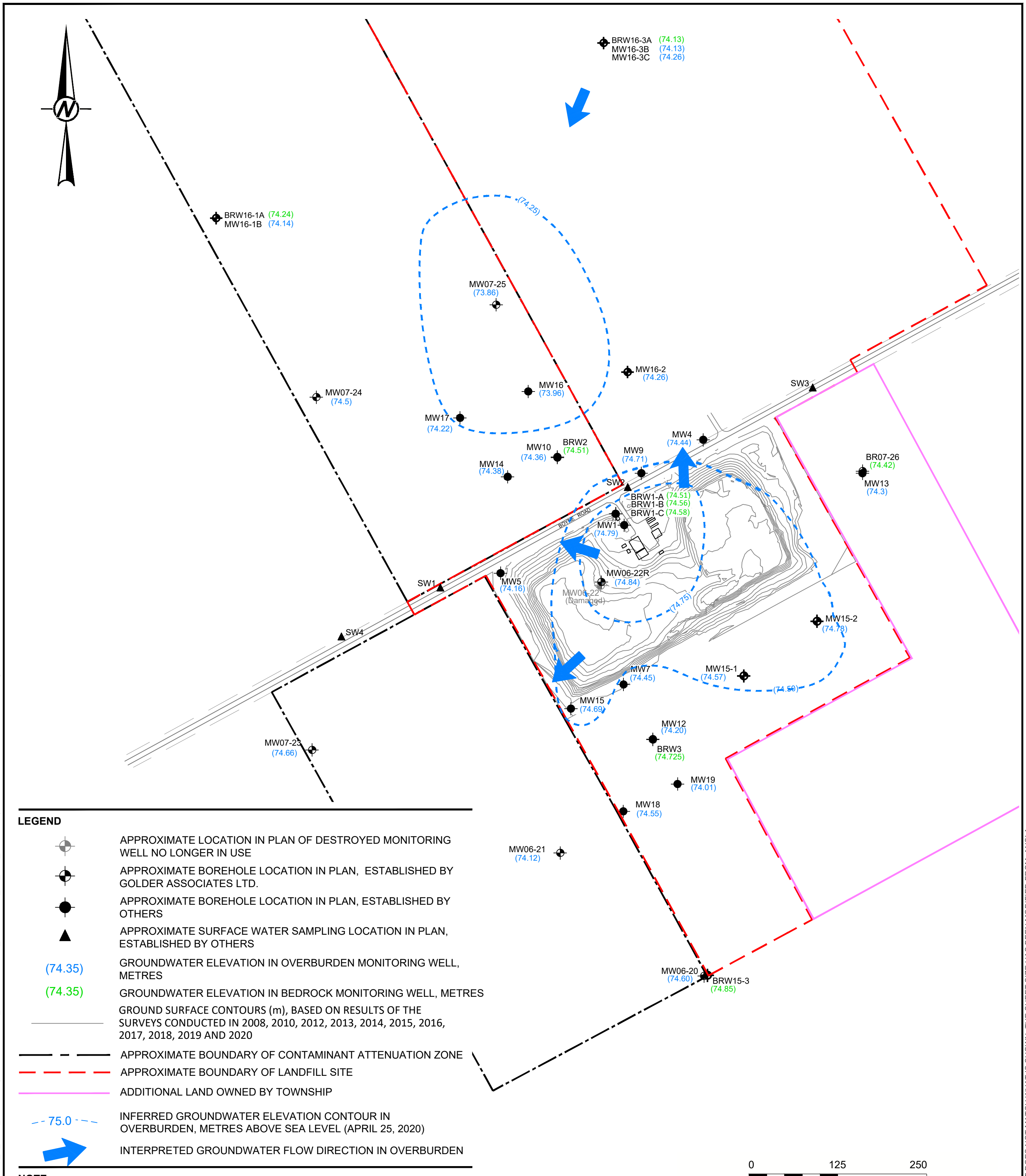
9.2.2.2.1 Groundwater Elevations and Groundwater Flow Directions

Topography in the Site and Site-vicinity Study Areas is flat; as a result, hydraulic gradients, and groundwater flow directions may vary temporarily/seasonally and can be influenced by very slight variations in groundwater elevations. Based on review of topographic maps of the Wider Study Area, the regional groundwater flow direction is expected to be north, toward the East Castor River (located approximately 4 km to the north).

Groundwater levels have been measured biannually in monitoring wells at the landfill site since 2005. This data base shows that the water levels are fairly consistent over time, as are the seasonal variations in interpreted groundwater flow direction(s) and hydraulic gradients, and the estimated average groundwater velocity.

Within the Site Study Area, groundwater elevations may be influenced by leachate buildup within the waste mound, resulting in a local groundwater divide in close proximity to the landfill. Data from both historical groundwater elevations and historical groundwater chemistry indicate that local groundwater mounding associated with the waste pile has been influencing local groundwater flow direction in the Site Study Area. However, the radial groundwater flow caused by the mounding does not affect groundwater flow patterns beyond the immediate vicinity of the waste pile. Groundwater flow in the area to the north of the Site Study Area is generally to the north, and groundwater flow in the area to the south of the Site Study Area is generally to the south. These flow directions can be variable with flow to the north occasionally being to the northeast and flow to the south occasionally being to the southwest or southeast. Contours generated from groundwater elevations measured at the landfill site and in the Site-vicinity Study Area in the overburden in April and August 2020 (which are consistent with historical trends) are presented in on Figures 9-6 and 9-7, respectively.

Groundwater elevation in the bedrock show very minimal spatial variation. Historically, groundwater levels at BRW1 and BRW3 indicated that groundwater flow was to the south in the area immediately south of the landfill site. Further south of the landfill site, groundwater levels at BRW3 and BRW15-3 indicated the bedrock groundwater flow was to the north. Groundwater flow directions in the bedrock have been observed to vary historically.



NOTE

1. ALL LOCATIONS ARE APPROXIMATE

0 125 250

1:7,500 METRES

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-08-31
PREPARED	ABD
DESIGN	RM
REVIEW	PS
APPROVED	PAS

TITLE
GROUNDWATER FLOW IN OVERBURDEN, APRIL 2020

PROJECT No.	PHASE/TASK	Rev.	FIGURE
1648253	2.0/2.2.0	0	9-6

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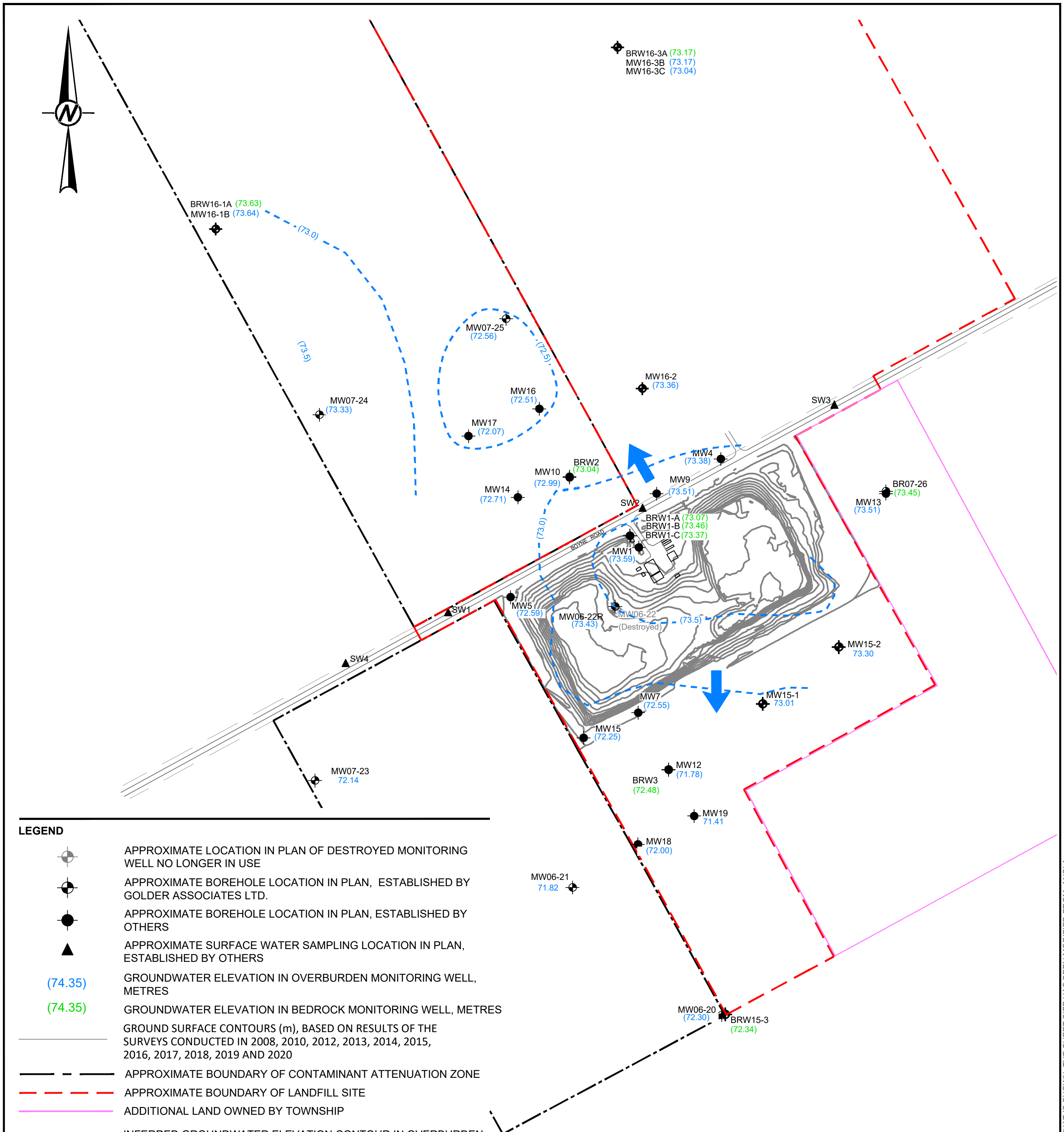

LEGEND

- APPROXIMATE LOCATION IN PLAN OF DESTROYED MONITORING WELL NO LONGER IN USE
- APPROXIMATE BOREHOLE LOCATION IN PLAN, ESTABLISHED BY GOLDER ASSOCIATES LTD.
- APPROXIMATE BOREHOLE LOCATION IN PLAN, ESTABLISHED BY OTHERS
- APPROXIMATE SURFACE WATER SAMPLING LOCATION IN PLAN, ESTABLISHED BY OTHERS
- (74.35) GROUNDWATER ELEVATION IN OVERBURDEN MONITORING WELL, METRES
- (74.35) GROUNDWATER ELEVATION IN BEDROCK MONITORING WELL, METRES
- GROUND SURFACE CONTOURS (m), BASED ON RESULTS OF THE SURVEYS CONDUCTED IN 2008, 2010, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019 AND 2020
- APPROXIMATE BOUNDARY OF CONTAMINANT ATTENUATION ZONE
- APPROXIMATE BOUNDARY OF LANDFILL SITE
- ADDITIONAL LAND OWNED BY TOWNSHIP
- 75.0 INFERRED GROUNDWATER ELEVATION CONTOUR IN OVERBURDEN, METRES ABOVE SEA LEVEL (AUGUST 20, 2020)
- INTERPRETED GROUNDWATER FLOW DIRECTION IN OVERBURDEN

NOTE

1. ALL LOCATIONS ARE APPROXIMATE

0 125 250

1:7,500 METRES

CLIENT

TOWNSHIP OF NORTH DUNDAS

CONSULTANT

GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-08-31
PREPARED	ABD
DESIGN	RM
REVIEW	PS
APPROVED	PAS

PROJECT

INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE

GROUNDWATER FLOW IN OVERBURDEN, AUGUST 2020

PROJECT No.	PHASE/TASK	Rev.	FIGURE
1648253	2.0/2.2.0	0	9-7

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9.2.2.2.2 Hydraulic Gradients

Based on groundwater elevations measured in overburden monitoring wells, the horizontal hydraulic gradient in the area of the waste mound (in the general direction of the interpreted horizontal groundwater flow) is typically measured at approximately 0.005 m/m.

North of the waste mound area (in the main interpolated direction of horizontal groundwater flow), hydraulic gradients in the order of 0.001 – 0.01 m/m are typically measured. South of the waste mound, lower hydraulic gradients in the order of 0.001 – 0.003 m/m are observed, with a negative (northwards) hydraulic gradient occasionally measured at the southern-most boundary of the Site Study Area. Hydraulic gradients to the east and west of the landfill site are much lower than the north or south direction, typically in the order of 0.0005 m/m.

Horizontal gradients in the bedrock have historically been weak and variable in direction.

Vertical hydraulic gradients from the overburden to the bedrock vary by location; with upwards, downwards and negligible vertical gradients being observed across the Site Study Area. The bedrock monitoring well located in the area of the waste mound features three groundwater screens, BRW1-A, BRW1-B and BRW1-C. Historically, weak and oscillating gradients in bedrock are observed at this location, with overall downward vertical hydraulic gradients being typically observed.

9.2.2.2.3 Horizontal Hydraulic Conductivity

Estimates of horizontal hydraulic conductivity of overburden materials in the area of the Site Study Area, as determined based on the results of slug tests and grain size distribution analysis completed as part of previously completed studies, are presented below in Table 9-10. The geometric mean horizontal hydraulic conductivity (based on slug test analysis) for the monitoring wells included in the table below is 2.1 x 10^{-3} cm/second.

Table 9-10: Summary of Horizontal Hydraulic Conductivity Measurements from OMM (1991)

Monitoring Well	Testing Method	Depth Interval (metres)	Hydraulic Conductivity (cm/second)
MW1	Laboratory Index Properties Slug Test Grain Size Distribution Laboratory Index Properties	3.05 – 3.66 (silt) 6.42 – 7.92 (till) 4.57 – 5.18 (till) 6.10 – 6.71 (till)	2.3×10^{-7} 1.0×10^{-2} 1.9×10^{-5} 8.0×10^{-5}
MW2	Grain Size Distribution Grain Size Distribution	1.52 – 2.13 (silt) 3.05 – 3.66 (till)	1.0×10^{-9} 5.8×10^{-5}
MW3	Slug Test Slug Test	4.30 – 6.70 (till) 4.30 – 6.70 (till)	1.5×10^{-3} 1.3×10^{-3}
MW4	Slug Test	7.30 – 8.80 (till)	1.4×10^{-3}
MW5	Slug Test Slug Test	2.80 – 4.30 (till) 2.80 – 4.30 (till)	1.3×10^{-3} 3.4×10^{-3}
MW6	Slug Test	3.14 – 4.70 (till)	1.6×10^{-3}

Hydrogeological investigations conducted at the landfill site in 2015 and 2016 included slug tests in eight monitoring wells screened in the silty sand or sandy silt till, three monitoring wells screened in the clay/silt, and five monitoring wells screened in the limestone bedrock. The results of analyses of these tests are summarized in Table 9-11 below. The resulting geometric mean for the overburden monitoring wells of 3×10^{-4} cm/s is one order of magnitude lower than the value previously reported by OMM (1991), and likely reflects the higher silt and clay content in the soils adjacent to the most recently installed monitoring wells.

Table 9-11: Summary of Horizontal Hydraulic Conductivity Measurements from 2015 and 2016

Monitoring Well	Geological Unit	Hydraulic Conductivity (cm/second)
MW16-3C	Clayey Silt	3×10^{-7}
MW16-1B	Till/Clayey Silt	2×10^{-5}
MW16-2	Till/Clayey Silt	5×10^{-5}
MW16-3B	Sandy Silt with Gravel	3×10^{-5}
15-1	Till	8×10^{-3}
MW06-20	Till	1×10^{-3}
MW06-21	Till	8×10^{-4}
MW07-23	Till	7×10^{-3}
MW16	Till	4×10^{-3}
MW18	Till	2×10^{-3}
MW5	Till	2×10^{-3}
15-3	Limestone	3×10^{-4}
BR07-26	Limestone	6×10^{-4}
BRW16-1A	Limestone	3×10^{-5}
BRW16-3A	Limestone	3×10^{-3}
BRW2	Limestone	1×10^{0}

9.2.2.2.4 Groundwater Velocity

The average linear groundwater velocity in the overburden, in the area of the waste mound was calculated based on the geometric mean hydraulic conductivity (3.0×10^{-4} cm/s), the average observed horizontal hydraulic gradient in the interpreted direction of groundwater flow (0.005 m/m), and an assumed average porosity of 35 percent. For unconsolidated deposits such as silts and sands, typical porosity values range from 25 to 50 percent (Freeze and Cherry, 1979). An average porosity of 35 percent is assumed for the overburden deposits in the area of the landfill site. In 2020, the average linear groundwater velocity in the vicinity of the waste mound is estimated to be about 1 m/yr. and has ranged between 0.9 and 45 m/yr. (as measured between 2007 and 2020) but is typically within the range of 1 – 4 m/yr.

The average linear groundwater velocity in the overburden in the areas north and south of the waste mound is lower than what is measured within the waste mound vicinity; the groundwater velocities estimated in August 2020 were 0.33 m/yr, 0.23 m/yr, and 0.02 m/yr in the north, south, and west directions of groundwater flow from the waste mound respectively. Higher reported groundwater velocities in previous years have been the result of higher historical groundwater levels observed at MW06-22 and the associated higher horizontal hydraulic gradients in the area of the waste mound. Recent reporting has indicated a lower degree of mounding in MW06-22R and lower groundwater velocities. Based on the upper bound of the typical groundwater velocity (4 m/yr), it is estimated that the leachate plume could be expected to have travelled approximately 220 m from the waste fill area during the 55 years of operation at the landfill site (as of 2020). This slow groundwater velocity is as expected considering the low horizontal hydraulic gradients (reflective of the flat topography) and the clay and till soils in the area of the landfill.

9.2.2.2.5 Groundwater Quality and Leachate Indicators

Monitoring wells MW13 and BR07-26 (to the east of the Site Study Area) have been established as representative of background water quality in the overburden and the bedrock, respectively. Monitoring well MW06-22 and the replacement well MW06-22R are screened in the silty sand unit immediately below the waste mound and have been used as indicators of leachate strength at the landfill site. Based on a comparison of background groundwater quality, leachate quality and mobility of the leachate parameters, leachate indicator parameters for the landfill site are alkalinity, aluminum, ammonia, barium, biological oxygen demand (BOD), boron, chloride, cobalt, conductivity, dissolved organic carbon (DOC), hardness, iron, manganese, phenols, potassium, sodium, and total dissolved solids (TDS). Use of chloride as a leachate indicator parameter is complicated due to the additional sources of chloride such as road salting activities along Boyne Road and the snow storage facility northeast of the landfill site. Based on the relatively low concentrations of chloride observed at the background monitoring locations, chloride remains a useful leachate indicator parameter for monitoring locations upgradient (south) of Boyne Road and the snow storage facility.

Sampling of groundwater quality at the Boyne Road Landfill site is conducted twice annually and reported annually and includes the analysis of general chemistry, metals, and volatile organic compounds. Current assessment of the groundwater program concludes that the existing landfill is currently in compliance with the Reasonable Use Concept and MECP Guideline B-7 (MOE, 1994). With reference to the monitoring well locations shown on Figure 9-3, a summary of the 2020 groundwater assessment is presented below:

- To the west of the landfill site, landfill leachate impacts have been delineated, with monitoring well MW07-23 interpreted to be potentially impacted leachate.
- To the south of the landfill site, landfill leachate impacts have been delineated with MW06-20 interpreted to be potentially impacted and BRW15-3 interpreted to be not impacted by landfill leachate.
- To the north of the landfill site, landfill leachate impacts have been delineated. Monitoring wells at the northern extent of the monitoring network have been interpreted to not be impacted by landfill leachate (MW07-24, MW16-1A, MW16-1B, MW16-3A, MW16-3B and MW16-3C).

- Concentrations of leachate indicator parameters at each monitoring location have been generally consistent for the last several years with the exception of increasing trends in the concentrations of several parameters at MW1, MW5, MW16, BRW1-B, and BRW2, all of which are located on the landfill Site Study Area or within the buffer/CAZ in areas relatively close to the waste footprint.
- Within locations monitored in the bedrock there is limited leachate impact except at BRW2 and BRW3, which are located within 100 m of the waste footprint and are interpreted to be impacted by landfill leachate.

The 2020 groundwater monitoring and reporting program assessment indicates that a total of eleven locations are interpreted as impacted by landfill leachate. These locations are located in close proximity of the waste footprint, or within the existing landfill property located north, south, and southwest of the waste footprint. The extent of possible leachate impacts on groundwater based on monitoring is in reasonably good agreement with that from the estimate based on average groundwater velocity.

9.2.2.2.6 PFAS Sampling Results in Groundwater Quality

Groundwater samples were collected for the analysis of perfluoroalkyl and polyfluoroalkyl substances (PFAS) compounds in August 2021. Groundwater samples were obtained at five locations: MW06-22R, MW07-23, MW06-20, MW07-25, and MW4. These locations were selected to characterize PFAS quality in the source leachate (MW06-22R), in the vicinity of the snow storage facility (MW4), and to check for the presence of downgradient PFAS in the north, west, and south directions from the waste footprint (MW07-25, MW07-23 and MW06-20, respectively).

The PFAS results are summarized in Table-9-12. Multiple PFAS compounds were detected in leachate quality well MW06-22R. The sum of the select PFAS compound concentrations tentatively identified by the MECP in this sample is 1423.8 ng/L. No PFAS compounds were detected in the samples collected at MW4 and MW06-20. Trace PFAS compounds were detected at MW07-23 and MW07-25; the groundwater samples from these locations had a summation of select PFAS compound concentrations of 0.45 ng/L and 20.62 ng/L, respectively. With the exception of the leachate quality well, all locations reported sums of select PFAS compound concentrations below the MECP suggested drinking water value of 70 ng/L. This indicates that, where present, PFAS compounds are in the groundwater in the immediate vicinity of the waste mound and not migrating in downgradient directions on-site or off-site at concentrations of potential concern to off-site groundwater users.

Table 9-12: Summary of August 2021 PFAS Sampling at Boyne Road Landfill

PFAS Compound	Unit	MW06-22R	MW07-23	MW06-20	MW07-25	MW4
4:2 Fluorotelomer sulfonic acid	ng/L	<4.8	<0.43	<0.43	<0.43	<0.44
6:2 Fluorotelomer sulfonic acid	ng/L	**77**	<1.7	<1.7	<1.7	<1.7
8:2 Fluorotelomer sulfonic acid	ng/L	<9.7	<0.87	<0.86	<0.86	<0.87
Perfluorobutanesulfonic acid	ng/L	**26**	<0.43	<0.43	**1.1**	<0.44
Perfluorobutanoic acid	ng/L	**170**	<1.7	<1.7	**14**	<1.7
Perfluorodecanesulfonic acid	ng/L	<4.8	<0.43	<0.43	<0.43	<0.44
Perfluorodecanoic acid	ng/L	**7.8**	<0.43	<0.43	<0.43	<0.44
Perfluorododecanesulfonic acid	ng/L	<4.8	<0.43	<0.43	<0.43	<0.44
Perfluorododecanoic acid	ng/L	<4.8	<0.43	<0.43	<0.43	<0.44
Perfluoroheptanesulfonic acid	ng/L	<4.8	<0.43	<0.43	<0.43	<0.44
Perfluoroheptanoic acid	ng/L	**180**	<0.43	<0.43	**4.0**	<0.44
Perfluorohexadecanoic acid	ng/L	<9.7	<0.87	<0.86	<0.86	<0.87
Perfluorohexanesulfonic acid	ng/L	**150**	<0.43	<0.43	**1.2**	<0.44
Perfluorohexanoic acid	ng/L	**420**	<0.43	<0.43	**8.6**	<0.44
Perfluorononanesulfonic acid	ng/L	<4.8	<0.43	<0.43	<0.43	<0.44
Perfluorononanoic acid	ng/L	**16**	<0.43	<0.43	<0.43	<0.44
Perfluorooctadecanoic acid	ng/L	<9.7	<0.87	<0.86	<0.86	<0.44
Perfluorooctanesulfonamide	ng/L	<4.8	<0.43	<0.43	<0.43	<0.44
Perfluorooctanesulfonic acid	ng/L	**120**	<0.43	<0.43	**0.52**	<0.44
Perfluorooctanoic acid	ng/L	**530**	**0.45**	<0.43	**6.3**	<0.44
Perfluoropentanesulfonic acid	ng/L	**8.4**	<0.43	<0.43	<0.43	<0.44
Perfluoropentanoic acid	ng/L	**230**	<0.43	<0.43	**13**	<0.44
Perfluorotetradecanoic acid	ng/L	<4.8	<0.43	<0.43	<0.43	<0.44
Perfluorotridecanoic acid	ng/L	<4.8	<0.43	<0.43	<0.43	<0.44
Perfluoroundecanoic acid	ng/L	<4.8	<0.43	<0.43	<0.43	<0.44
Sum of detected Select MECP PFAS Compounds	ng/L	1423.8	0.45	0	20.62	0

Notes:
Red Text indicates select MECP PFAS Compounds; non-detects were treated as zero concentrations
Bold Text indicates detection of PFAS Compounds

9.2.2.3 Groundwater Supply and Source Water Protection

The Township relies on groundwater from drilled wells for potable water supply. The Villages of Winchester and Chesterville each have communal water supplies from high capacity drilled overburden wells located within the Morewood Esker (refer to Winchester Wells 7a, b and c on Figure 9-4) and Maple Ridge Esker (refer to Chesterville Wells 5 and 6 on Figure 9-4), respectively. The remainder of the Township relies on individual wells that generally obtain their water from zones within the bedrock.

The North Dundas Drinking Water System (System) supplies treated water to Winchester and Chesterville. The System derives its water supply from three communal wells completed in bedrock within and to the west of Winchester (Winchester Wells No. 1, 5 and 6), and two well fields completed in overburden sediments, comprised of three communal wells (Winchester Wells No. 7a, 7b, and 7c) and two communal wells (Chesterville Wells No. 5 and 6). The locations of the wells are illustrated on Figure 9-4. Each of the bedrock wells and the well fields are equipped with its own disinfection system and pumping facility located in a pump house that either contains the well head (Winchester Wells No. 1, 5, 6 and Chesterville Well No. 5) or is located near the well heads (Chesterville Well No. 6 and Winchester Wells No. 7a, 7b and 7c). The disinfecting system injects sodium hypochlorite solution into the water. The pumping facilities use either a submersible or a turbine pump to deliver water to the distribution system. The Ontario Clean Water Agency is the operating authority of the System.

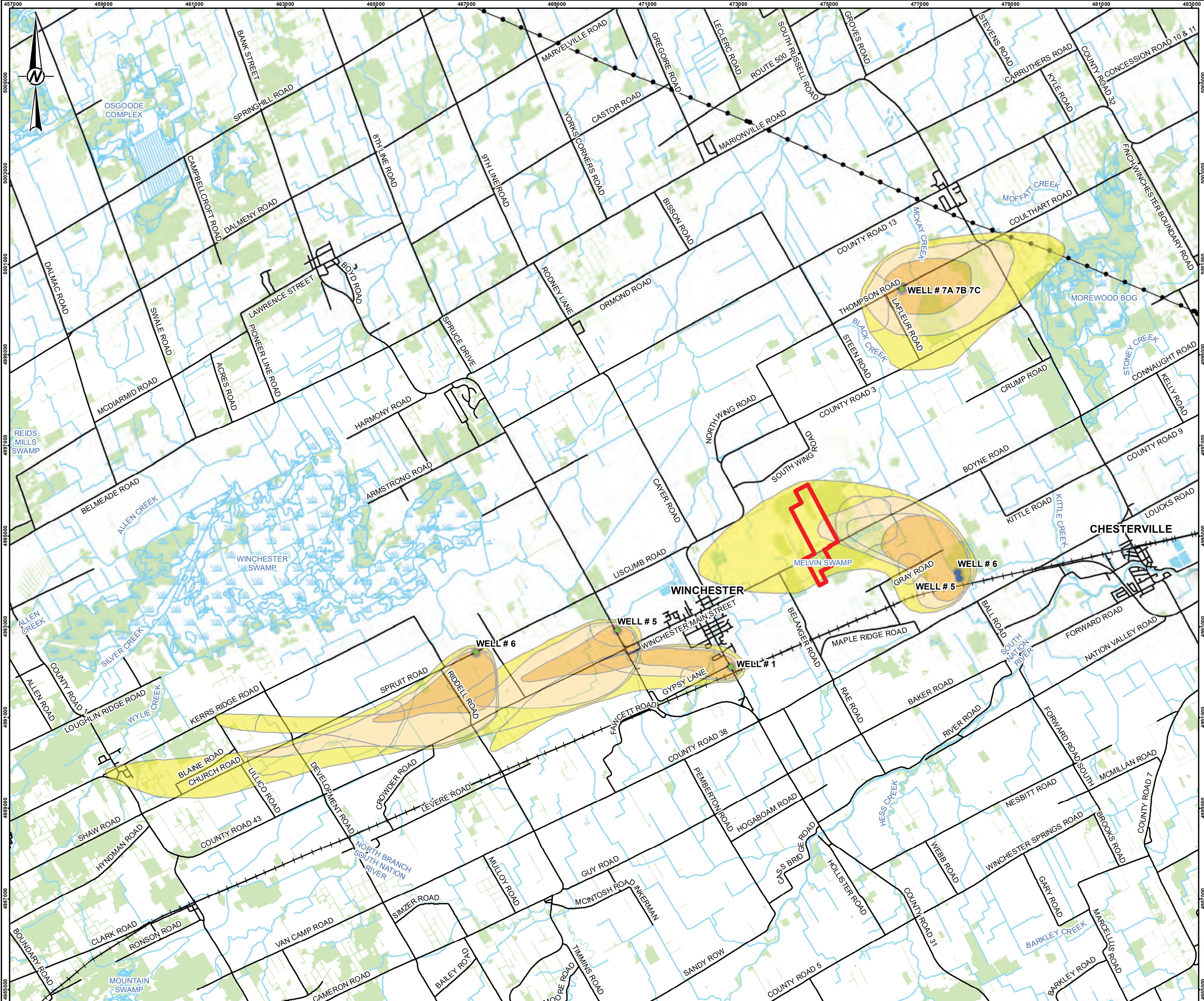
As part of source protection planning undertaken by the RRC and SNC an Assessment Report for the South Nation Source Protection Area was completed. As part of the Assessment Report, a Wellhead Protection Area (WHPA) Study and a vulnerability assessment was completed for each of the Winchester and Chesterville communal wells.

The following four wellhead protection zones were defined for each well:

- Zone A – 100 metre radius pathogen security/prohibition zone
- Zone B – 2-year horizontal Time of Travel (ToT) pathogen management zone
- Zone C – 5-year ToT dense non-aqueous phase liquid /contaminant protection zone
- Zone D – 25-year ToT secondary protection zone

These zones are used to assist in identifying the various levels of potential risks faced by municipal supply wells from pathogens and chemical contaminants. Figure 9-8 shows the capture zones that comprise the WHPAs for each of the wells in the System.

The Boyne Road Landfill exists within the existing WHPA-D of the Chesterville wellfield with a vulnerability score of 4. The current Source Protection Plan (SNC and RRC, 2016a) for the Chesterville wellfield indicates that the provincial policies concerning waste only apply to WHPAs A and B and portions of WHPA-C for which the vulnerability score is 8 or higher. Waste sites are not prohibited within WHPA-D. Additionally, the groundwater flow direction of leachate impacted groundwater is not indicated to be traveling eastward (as discussed in Section 9.2.2.2.1) towards the Chesterville Wells.



LEGEND

- CHESTERVILLE WELL LOCATION
- WINCHESTER WELL LOCATION
- ROADWAY
- RAILWAY
- UTILITY LINE
- WATERCOURSE
- WATERBODY
- WETLAND
- WOODED AREA
- APPROXIMATE BOUNDARY OF BOYNE RD LANDFILL SITE

DRINKING WATER SOURCE PROTECTION AREAS

- WELLHEAD PROTECTION AREA (WHPA) A
- WELLHEAD PROTECTION AREA (WHPA) B
- WELLHEAD PROTECTION AREA (WHPA) C
- WELLHEAD PROTECTION AREA (WHPA) D

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2018
2. WELLHEAD PROTECTION AREAS DIGITIZED FROM SOUTH NATION CONSERVATION GEOPORTAL WEBSITE.
3. SERVICE LAYER CREDITS:
4. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: UTM ZONE 18, VERTICAL DATUM: CGVD28

0 1,000 2,000 4,000
1:85,000 METRES

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
WELLHEAD PROTECTION AREAS

CONSULTANT
GOLDER MEMBER OF WSP

YYYY-MM-DD	2022-01-28
DESIGNED	----
PREPARED	BR
REVIEWED	BH
APPROVED	PAS

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	0	9-8

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 25mm

The definition of the current WHPA's is based on groundwater modelling, and so reflects the approach taken to the modelling. From review of the modelling approach used for the Chesterville communal wells No. 5 and 6 (SNC and RRC, 2016a; WESA, 2006), the area of the Melvin Swamp located immediately north of Boyne Road opposite the landfill area was defined as a regional recharge area. As such, the modelling defined the recharge area for these wells as the Melvin Swamp, which is reflected in the shape and extent of the capture zones of these wells that swings northwest towards the Swamp. However, this simplified modelling approach did not take into account that the majority of the recharge to these esker features (in this case the Maple Ridge Esker) occurs from direct precipitation on areas of the permeable esker core materials that are exposed at surface (as previously described in Section 9.2.1.1). Also, as previously described in Section 9.2.1.1, previous investigations in the intervening area between the Morewood and Maple Ridge Eskers have not been able to locate the esker (either exposed or buried). It is interpreted, therefore, that the majority of the recharge to the Maple Ridge Esker is much more local and occurs on the mapped esker itself. The potential for an actual connection between the groundwater in the area of the Boyne Road landfill and recharge to Chesterville wells No. 5 and 6 (to which the source water protection requirements currently apply) is unlikely to be as reflected by the capture zones of the WHPA.

The Boyne Road Landfill is not interpreted to be having an impact on the Winchester, Chesterville, or nearby residential wells due to its location within the geological setting, the local hydrogeology and its remote location from residents.

9.3 Surface Water

The following provides a description of the existing surface water conditions in the area of the Boyne Road Landfill site.

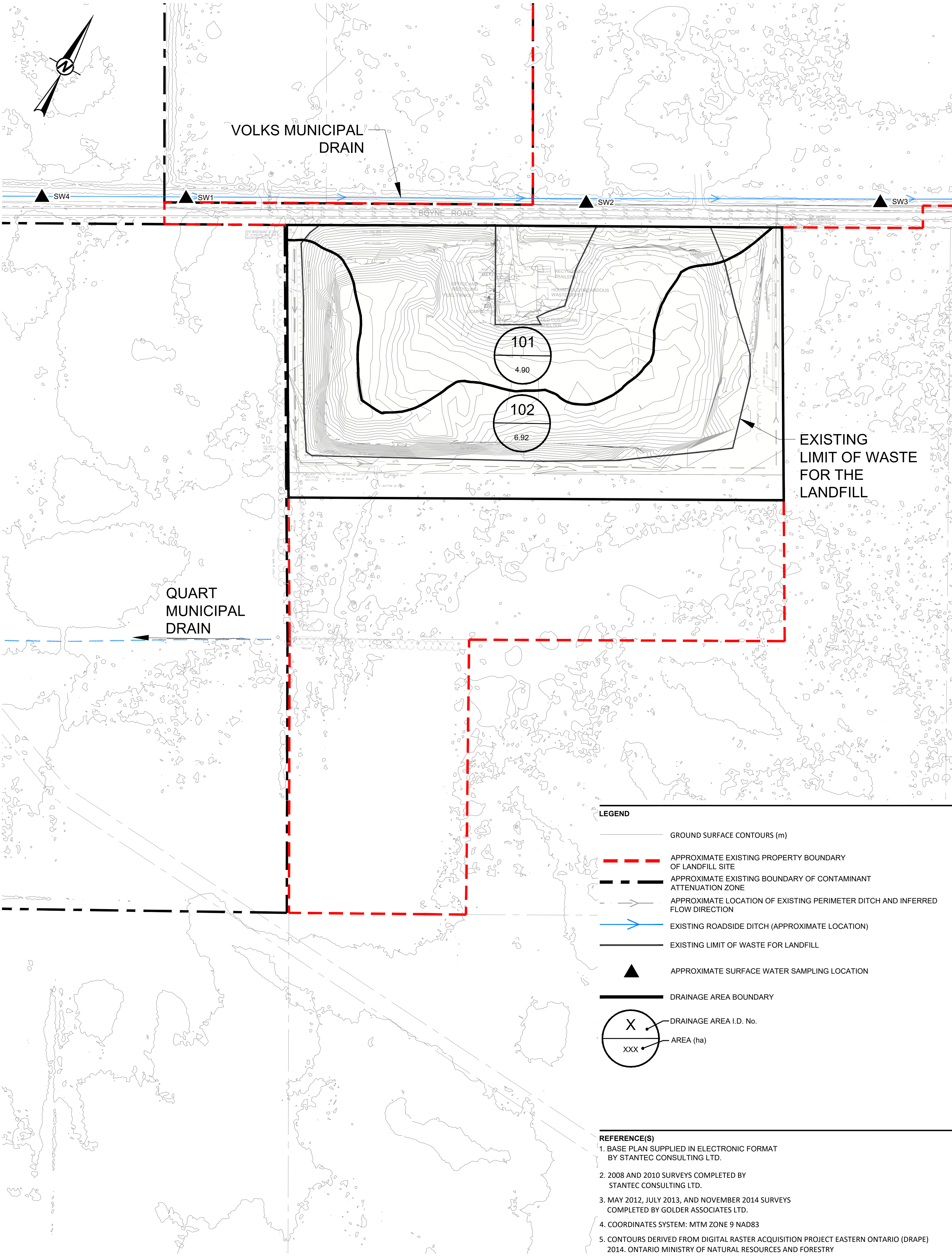
9.3.1 Drainage

The surface water Site-vicinity Study Area is located in a rural agricultural area of flat to undulating farmland. Drainage in this area is via a network of constructed municipal drains, primarily the Volks Municipal Drain and the Quart Municipal Drain (historically known as the Irving-Quart Drain or Irving Drain). The area directly east and south of the existing landfill mound is forested with a shallow groundwater level.

Drainage along the northern extents of the landfill mound is directed towards the Boyne Road ditch along the south side of the road. This includes the operations area of the landfill, which is centrally located along the north of the current disposal area. The remainder of the landfill drains to a constructed drainage ditch (perimeter drain) that was constructed along the west, south, and east boundaries of the approved disposal area of the landfill site (fill area) in 1991, as indicated on Figure 9-9. Surface water runoff from the fill area drains into this perimeter drain, which then discharges to the south roadside ditch along Boyne Road. The roadside ditch flows east and then is directed north, under Boyne Road via a culvert located near the northeast corner of the landfill. The roadside ditch along the north side of Boyne Road is part of the Volks Municipal Drain and flows east and discharges into Black Creek, approximately 1.5 km east of the landfill Site Study Area. Black Creek is a tributary of the East Castor River.

The upstream extent of the Quart Municipal Drain is located southwest of the fill area, outside of the landfill site property, and within the landfill site's contaminant attenuation zone to the west. The Quart drain adjacent to the landfill has been historically observed as dry and does not connect to the drainage course identified as Reach 4 in the biological assessment (refer to Section 9.4.2) or the perimeter drain that services the landfill fill area.

Path: \\golder.gds\complexdata\office\ottawa\Active\Spatial_IM\Township_of_North_Dundas\BoyneRoadLandfill\99_PROJ\1648253\40_PROD\Phase_2.0_Task_2.1.4\ | File Name: 1648253-2214-CN-0001.dwg



LEGEND

- GROUND SURFACE CONTOURS (m)
- APPROXIMATE EXISTING PROPERTY BOUNDARY OF LANDFILL SITE
- APPROXIMATE EXISTING BOUNDARY OF CONTAMINANT ATTENUATION ZONE
- APPROXIMATE LOCATION OF EXISTING PERIMETER DITCH AND INFERRED FLOW DIRECTION
- EXISTING ROADSIDE DITCH (APPROXIMATE LOCATION)
- EXISTING LIMIT OF WASTE FOR LANDFILL
- APPROXIMATE SURFACE WATER SAMPLING LOCATION
- DRAINAGE AREA BOUNDARY
- X — DRAINAGE AREA I.D. No.
- XXX — AREA (ha)

REFERENCE(S)

1. BASE PLAN SUPPLIED IN ELECTRONIC FORMAT BY STANTEC CONSULTING LTD.
2. 2008 AND 2010 SURVEYS COMPLETED BY STANTEC CONSULTING LTD.
3. MAY 2012, JULY 2013, AND NOVEMBER 2014 SURVEYS COMPLETED BY GOLDER ASSOCIATES LTD.
4. COORDINATES SYSTEM: MTM ZONE 9 NAD83
5. CONTOURS DERIVED FROM DIGITAL RASTER ACQUISITION PROJECT EASTERN ONTARIO (DRAPE) 2014. ONTARIO MINISTRY OF NATURAL RESOURCES AND FORESTRY

DRAFT

0 50 100
1:3,000 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
A	2022-01-11	ISSUED FOR CLIENT REVIEW	MHK	ZS/ABD	MHK	DVK

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

CONSULTANT
GOLDER
MEMBER OF WSP

OTTAWA
1931 ROBERTSON ROAD
OTTAWA, ONTARIO
CANADA
[+1] (613) 592 9600
www.golder.com

TITLE
PRE-DEVELOPMENT DRAINAGE AREA PLAN

PROJECT NO.	PHASE/TASK	REV.	of	FIGURE
1648253	2.0/2.2.0	A		9-9

25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

9.3.2 Surface Water Quantity

The north drainage area for the landfill mound is about 4.9 ha. The southern portion of the waste mound that drains to the perimeter ditch is about 6.92 ha. The area directly south of the mound, which is the location for the proposed expansion, is part of a deciduous swamp area where water is close to surface for the majority of the year. Due to the generally flat lying topography and lack of detailed topographic survey information in the area south of the existing landfill, it is difficult to determine the surface flow direction in this area and how much of the area directly drains to the perimeter ditch around the landfill and/or how much flows in other directions.

9.3.3 Surface Water Quality

There are four landfill surface water monitoring stations located within the drainage ditch (Volks Drain) along the north side of Boyne Road (opposite the disposal area). SW1 and SW4 are located upstream of the landfill site (with SW4 being the furthest upstream), SW2 is located opposite (north) of the disposal area, and SW3 is located downstream of the landfill site. The locations of the surface water monitoring stations are also shown on Figure 9-9. Surface water monitoring stations are not located within the perimeter drain along the west, south, and east boundaries of the fill area, as surface water within it has continually been observed to be stagnant.

Surface water quality is regularly sampled in the Volks Drain as part of the Boyne Road Landfill Site monitoring program, with similar surface water programs having been completed at the landfill site since 1992.

The ongoing annual surface water monitoring program indicates that there are periodic impacts on surface water quality in the roadside ditch from landfill leachate, either due to landfill site runoff or the seepage of leachate-impacted groundwater into the Volks Drain. The Provincial Water Quality Objectives (PWQO) (MOE, 1994a) and the Canadian Water Quality Guidelines for freshwater aquatic life (CWQG) (CCME, 2007) have historically been used as the assessment criteria in the evaluation of surface water from the landfill. Two provincial policies relate directly to the protection or restoration of satisfactory surface water quality (MOE, 1994a). Policy 1 states that, where water quality is better than the PWQO, it shall be maintained at or above the objective. Policy 2 states that water quality that does not meet the PWQO shall not be further degraded and all practical measures shall be taken to upgrade the water quality to the objectives. An upper tolerance limit (UTL) calculation using background surface water quality data at SW1 is used to evaluate if Policy 2 conditions exist. Surface water quality in the roadside ditch along Boyne Road is evaluated for compliance with these policies. Landfill leachate indicator parameters identified in the monitoring well representative of leachate at the Boyne Road Landfill Site are also used to characterize and assess the surface water quality observed in the roadside ditch.

In 2020, surface water was sampled at surface water stations SW1, SW2, SW3, and SW4 in April, August, and November. Concentrations of nitrate, total phosphorus, iron, and phenols at background surface quality monitor SW1 did not meet the assessment criteria in 2020 and hence some of these parameters may be considered Policy 2 parameters at this location. However, concentrations of these parameters that do not meet the assessment criteria downstream of the Site Study Area do not necessarily indicate landfill leachate impact. In 2020, a number of parameters exceeded the PWQO (Policy 1) at downstream stations. However, not all of these parameters are interpreted to be landfill leachate indicator parameters and, as such, assessment criteria exceedances for non-leachate indicator parameters are interpreted to be at least partially attributable to a secondary source(s).

During the 2020 monitoring sessions the only leachate indicator parameters found to exceed the assessment criteria at downstream locations SW2 or SW3 were iron in all sessions, chloride in August and November, and phenols in April and August. Iron concentrations exceeded the assessment criteria at upstream monitoring locations SW1 and SW4 in August 2020, and no measured downstream iron concentrations exceeded the UTL (Policy 2) in any 2020 monitoring session. Chloride exceeded the assessment criteria and UTL at SW4 in August and November 2020, and no measured downstream chloride concentrations exceeded the UTL (Policy 2). Phenols exceeded the assessment criteria at SW1 and SW4 in August 2020, and a downstream exceedance of the UTL was measured in August 2020.

It is noted that the ditch containing the surface water monitoring locations receives runoff and groundwater discharge from the poorly drained areas of Boyne Road, which is underlain by organic peat soils known to contain elevated iron and phenols (and other parameters associated with degrading vegetation). The influence of road salt applied to Boyne Road and possibly the snow storage area located northeast of the landfill may also contribute to the presence of chloride, hardness and conductivity in the roadside drainage ditch. Thus, the drainage ditch is considered to have been in compliance with provincial surface water management policies (Policy 2) during the 2020 monitoring sessions. This 2020 surface water compliance assessment is consistent with historical assessments at the landfill site.

Surface water quality is also reported by the Provincial (Stream) Water Quality Monitoring Network for the Castor River at an upgradient location from the Site Study Area, near the Township of Russell. The water quality data observed here is generally comparable to the water quality observed at local background stations SW1 and SW4.

A surface water quality sample was attempted to be collected from the Quart Municipal Drain in June 2021 following a rain event, but there was insufficient water available in the ditch to collect a sample. This ditch has historically been observed as dry.

9.4 Biology

9.4.1 Methodology

A high level methodology for the assessment of biology existing conditions was provided in Section 8.2 and is outlined in further detail in the report sections below.

9.4.1.1 Desktop Assessment

Golder conducted a desktop review of published natural heritage data and information available for the Site and the Site-vicinity Study Areas. This information served to identify significant natural features, SAR as well as S1 – S3 (extremely rare – rare to uncommon) species known to be present. Information sources consulted included:

- MNRF NHIC Make-a-Map geographic explorer for S1-S3 species reported in the Study Area, and natural areas information queries (MNRF, 2021a)
- Existing and readily available information (including any watershed studies) and mapping available through the SNC
- UCSDG Official Plan (UCSDG, 2018)
- Atlas of Breeding Birds of Ontario (Cadman, et al., 2007)
- eBird online database (eBird, 2021)
- Atlas of the Mammals of Ontario (Dobbyn, 1994)
- Bat Conservation International (BCI, 2021)
- Ontario Odonate Atlas (Jones et. al., 2021)
- Ontario Reptile and Amphibian Atlas (Ontario Nature, 2021)
- DFO Aquatic Species at Risk Maps (DFO, 2021)
- Information contained in natural heritage related map layers from Ontario Base Map series, NRVIS mapping and LIO
- Existing high-resolution aerial imagery and mapping

A formal information request was also submitted to the MNRF. The information received in the response from the MNRF (Volume 4, Appendix G2) has been incorporated into this report, as appropriate.

9.4.1.2 Species at Risk Screening

A SAR screening was completed for the Site and Site-vicinity Study Areas and focused on the review of records and range maps pertaining to species that are designated as threatened or endangered under the Ontario *Endangered Species Act*, 2007 (ESA) (Ontario, 2007), and species that are listed as endangered or threatened under Schedule 1 of the *Species at Risk Act*, 2002 (SARA) (Canada, 2002) that may occur in the vicinity of the Site-vicinity Study Area.

Data from the field surveys described below were used in combination with the desktop data to determine a final probability of SAR and/or SAR habitats being present within the Site and Site-vicinity Study Area.

9.4.1.3 Field Surveys

Field surveys were undertaken on the Site and the Site-vicinity Study Area, to the extent feasible considering land access, as outlined in Table 9-13.

Table 9-13: Survey Dates and Type

Year	Date(s)	Survey Type(s)
2015	July 19	Biological Site Reconnaissance
2018	May 30	Nocturnal Anuran Survey, Eastern Whip-poor-will Survey; Plant Community and Wetland Survey; Visual Encounter Survey (VES)
	June 3	Eastern Whip-poor-will Survey
	June 8	Breeding Bird Survey; Plant Community Survey; VES
	June 21	Breeding Bird Survey; Bat Habitat and Detector Set-up and Bat Habitat Survey; Plant Community Survey; VES
	June 26	Nocturnal Anuran Survey; Eastern Whip-poor-will Survey, VES
	October 4	Fish Habitat Survey; VES
2020	April 1	Headwater Drainage Features Assessment (Visit 1)
2020	April 14	Nocturnal Anuran Survey
	May 13	Headwater Drainage Features Assessment (Visit 2)
	July 17	Headwater Drainage Features Assessment (Visit 3), Fish Community Survey
	September 19	Fish Community Survey, Plant Community Survey
2021	February 11	Bat Roost Habitat Survey

9.4.1.3.1 Terrestrial Surveys

Botanical Surveys, Ecological Land Classification and Wetland Boundaries

Three plant community surveys were conducted at the Site Study Area and accessible Site-vicinity Study Area in spring, early and late summer. During these surveys, the Site Study Area was assessed using Ecological Land Classification (ELC) standard protocols (Lee et al., 1998) to map the plant communities. Locations of any plant SAR encountered were mapped using a hand-held GPS. The plant community surveys were timed to capture the active period for the majority of native plant species, and a list of all plant species encountered at the Site Study Area was compiled. General notes on near-surface soil characteristics were collected, as per the methodologies of ELC.

Efforts to locate butternut trees (*Juglans cinerea*) were focused on the landfill site. Butternut health assessments were to be undertaken on any butternut trees identified on the Site Study Area by qualified Butternut Health Assessors (i.e., certified by the MNRF). The assessments were to be performed according to standardized MNRF protocols (MNRF, 2013b) and using the methods as outlined in Butternut Health Assessment Guidelines (MNRF, 2014a) and Butternut Health Assessment in Ontario (FGCA, 2010), with all relevant information entered into the standard Butternut Data Collection Forms (1 and 2). The calculations and analysis were to be performed using the Butternut Retainable Tree Analysis electronic table, updated by the MNRF in 2013.

In addition to the ELC and plant surveys, habitat structure and features specific to the habitat requirements of the SAR identified in the desktop assessment on the Site Study Area were also noted, if present.

Boundaries of the wetlands on the Site Study Area were determined according to the protocols of the Ontario Wetland Evaluation System (OWES) (MNRF, 2014).

9.4.1.3.2 Breeding Bird Surveys

Two early morning breeding bird surveys were conducted on the Site Study Area in June 2018, following standard protocols (Sauer et al., 2008; Cadman et al., 2007). Surveys were conducted at point-count stations distributed throughout all habitats on the Site Study Area (including potential SAR habitat) and occurred between 30 minutes before sunrise and 10:00 a.m. to encompass the period of maximum bird song. A list of all species was compiled, and the locations of any SAR were marked using a hand-held GPS.

Eastern whip-poor-will (*Caprimulgus vociferus*) is known to occur in the vicinity of the Site Study Area. Golder conducted three visits in 2018 to survey for this species, following the draft MNRF methodology (MNRF, 2014b). These surveys consisted of nocturnal point counts from vantage points throughout the Site Study Area. Surveys were conducted during suitable conditions as identified by the protocol.

9.4.1.3.3 Herpetile Surveys

Two anuran (frog and toad) call-count surveys were conducted during early summer 2018 to capture mid- and late-season calling anurans. An April call-count survey was conducted in 2020 to capture early-calling species. The surveys followed the point count methodology outlined in the Marsh Monitoring Program (Bird Studies Canada, 2003). Stations were distributed across the Site Study Area, based on the locations of potential breeding habitat, and following spacing requirements in the methodology.

9.4.1.3.4 Bat Surveys

Bat surveys were conducted on the Site Study Area and included the use of acoustic bat detectors (Wildlife Acoustics SM3BAT+®). Two bat detectors were deployed and programmed to record bat calls for at least 10 consecutive nights, as per MNRF recommended protocols (MNRF, 2011). Each station was located to provide coverage of the Site Study Area and target areas where bats would most likely be roosting, commuting or feeding. The microphones were programmed to record from 30 minutes before sunset to

30 minutes after sunrise. The data were analyzed and auto-classified using SonoBat 4.2.1 nnE. The Sonobat program is specifically intended for discrimination of bats to the species level wherever possible, and validation of the species-level classification was conducted by Golder's bat acoustic specialist.

After the acoustic data was analyzed, Golder performed a search for individual trees in the vicinity of each acoustic monitoring station that may provide suitable bat maternity roost habitat. These searches were performed in winter (i.e., leaf-off conditions), allowing for a clear view of each tree, which assists in locating cavities, hollows, etc. that may be used for roosting.

9.4.1.3.5 Wildlife Habitat and Visual Encounter Surveys

During all field surveys, area searches for wildlife (VES) were conducted, including for those species groups not specifically targeted through the surveys described above. These VES were conducted following recommended procedures (McDiarmid, 2012; Bookhout, 1994; Pyle, 1984), where possible. All species observed (including direct observations, calls, tracks and other signs) were recorded. Specific attention was paid to searching for suitable habitat for S1 – S3 species, as well as micro-habitats that may provide significant wildlife habitat (e.g., vernal pools, rock outcrops, seeps and springs, etc.).

9.4.1.3.6 Aquatic Surveys

Headwater Drainage Features Assessment

Golder completed field investigations to confirm the flow and connection of the surface water features on the Site Study Area and to complete a Headwater Drainage Features (HDF) assessment. This assessment evaluated and classified each feature following the Evaluation, Classification, and Management of Headwater Drainage Features Guidelines (the Guidelines) developed by the Toronto and Region Conservation Authority and Credit Valley Conservation (TRCA and CVC, 2014). The assessment is based on data collected in the on-site surface water features according to Ontario Stream Assessment Protocol (OSAP) Section 4 Module 11 – Unconstrained Headwater Sampling (Gorenc and Stanfield, March 2017). Information gathered included basic measurements (wetted width and depth; feature width; bankfull depth; flow rates; etc.) as well as information on substrates, sediment deposition, barriers to fish movement, riparian conditions, etc.

Fish Habitat Survey

Golder conducted a fisheries habitat assessment in the fall of 2018 to characterize aquatic features and potential fish habitat within the Site Study Area. A second spring habitat assessment was performed in 2020 overlapping with HDF investigations. Golder has developed technical procedures for measuring and characterizing fish habitat in watercourses and waterbodies.

Examples of habitat features that were assessed, if encountered, are:

- channel unit type (riffle, run, pool, flat etc.)
- location of potential obstacles and barriers to fish passage
- representative bankfull widths, wetted widths and water depths
- evidence of groundwater seeps
- dominant substrate type
- in-stream cover, overhead cover
- aquatic macrophyte growth
- riparian cover and surrounding land use

If encountered, habitat characteristics were documented through digital photographs of both typical and sensitive features. In-situ field water quality information was collected in each of the watercourses on the Site Study Area, and included temperature, dissolved oxygen, pH and conductivity.

Fish Community Surveys

The objective of the fish community survey was to identify fish species that utilize the watercourses at the Site Study Area and their relative abundance (proportion of catch). Prior to undertaking fish community surveys in 2018 and 2020, Golder obtained a license to collect fish for scientific purposes from the MNRF. An attempt to conduct fish community surveys was conducted in fall 2018, then again in mid-summer and early fall 2020. Conditions encountered during each visit ranged from very shallow to dry, and fish community surveys were not possible.

9.4.1.4 Analysis of Significance and Sensitivity and Impact Assessment

An assessment was conducted to determine the significance and sensitivity of natural features as well as significant species observed or determined to have the potential to exist on the Site or the Site-vicinity Study Areas. The assessment was completed by comparing natural environment data collected through background material and the field surveys to published resources, and through a detailed analysis using the methods and criteria outlined in the Natural Heritage Reference Manual (NHRM) (MNRF, 2010), Significant Wildlife Habitat Technical Guide (SWHTG) (MNRF, 2000) and the Significant Wildlife Habitat Ecoregion Criterion Schedules (SWHECS) (MNRF, 2015).

9.4.1.5 Assessment of Wildlife Risk Potential

Golder completed an assessment of wildlife risk potential at the Site and the Study-vicinity Areas in accordance with the Wildland Fire Risk Assessment and Mitigation Reference Manual (MNRF, 2017). Golder's assessment employed the evaluation matrix provided in Appendix 4 of MNRF (2017). As part of the assessment, to feed into the evaluation matrix, Golder compared the forest habitats at the Site Study Area against the characteristics of hazardous forest types (Table 4-1 of MNRF, 2017).

9.4.2 Aquatic Ecosystems

9.4.2.1 Surface Water Features

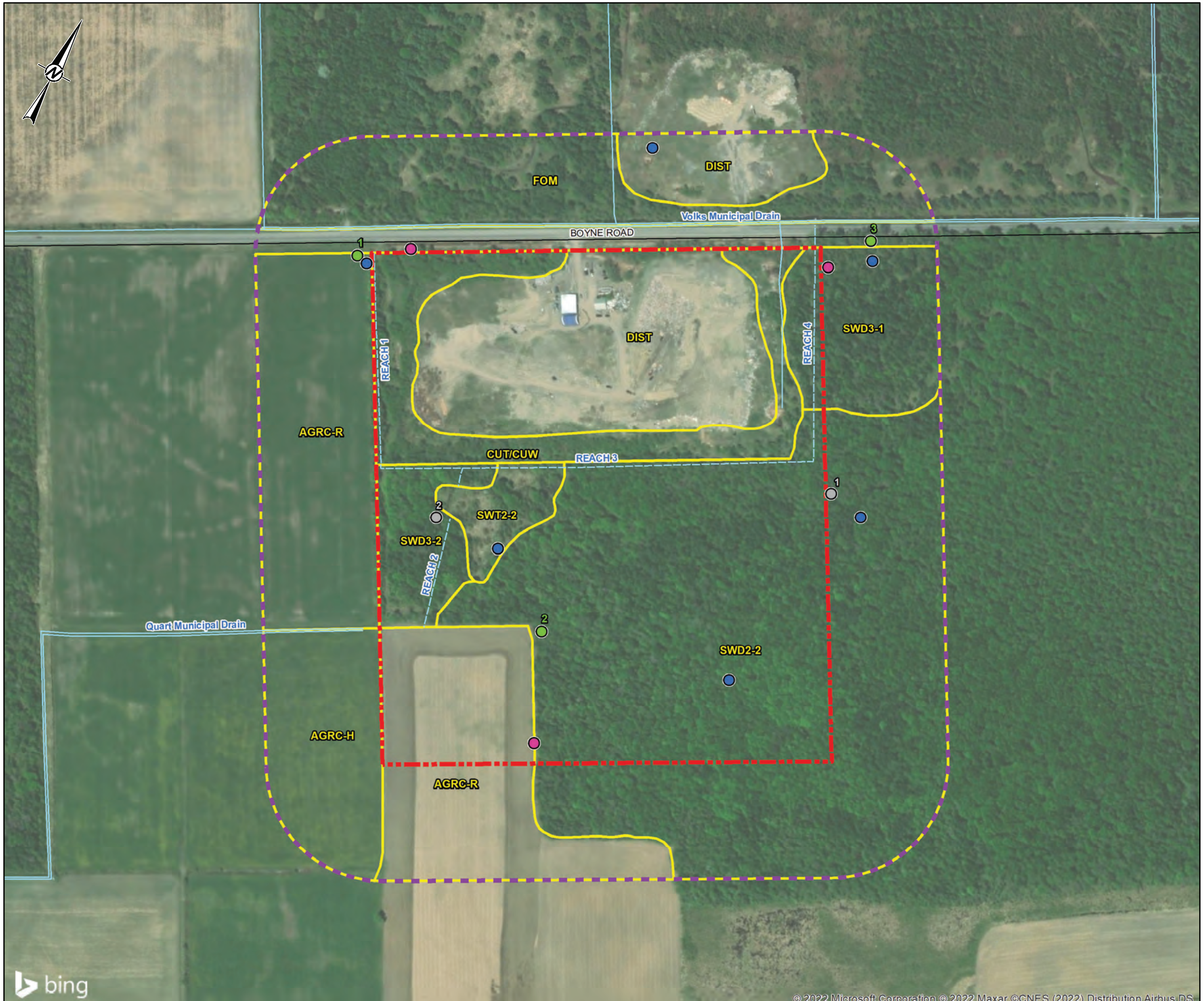
There is a constructed watercourse (perimeter ditch) that follows the perimeter of the current landfill, flowing south along the western side of the landfill site (Reach 1), then east across the landfill site (Reach 3), then north along the eastern side of the landfill site (Reach 4) before connecting through a culvert under Boyne Road with Volks Municipal Drain, that runs along the north side of Boyne Road (Figure 9-10). There is another channelized watercourse/ditch (Reach 2) that flows into the perimeter ditch from the south (Figure 9-10), west of the Site Study Area within the Site-vicinity Study Area is the Quart Municipal Drain.

9.4.2.1.1 Reach 1

Reach 1 is an intermittent channelized stream/ditch that flows south from Boyne Road, along the western side of the landfill area on the landfill site before turning east, through a culvert under an access road, where it meets up with Reach 3. During the April 2020 survey, this reach had low flow, with a depth of 100 to 200 millimetres (mm). Wetted width was 1.5 m and bankful width was 2.2 m. Substrate was silt, clay, and organics. During the May 2020 survey, there was no visible flow, and water depth was 50 to 100 mm. Very little to no instream habitat features were observed, with the exception of some downed woody debris and a small proportion of emergent vegetation such as grasses. This reach was dry during the July and September 2020 surveys. Refer to Table 9-14 for basic water quality parameters.

9.4.2.1.2 Reach 2

Reach 2 is an intermittent channelized stream/ditch that flows from a tile drain in a row crop field towards the south of the landfill site, where it runs north through a culvert under an access road before meeting up with Reach 3. During the April 2020 survey, this reach had low flow, with a depth of 100 to 140 mm. Wetted width was 1.9 m and bankfull width was 2.5 m. Substrate was silt, clay, and organics. During the May 2020 survey, there was no visible flow, with some portions of the streambed was dry. Very little to no instream habitat features were observed, with the exception of some downed woody debris and a small proportion of emergent and submerged plants such as grasses and forbs. This reach was dry during the July 2020 and September 2020 surveys. Refer to Table 9-14 for basic water quality parameters.



LEGEND

- BAT SURVEY STATION
- BREEDING BIRD SURVEY STATION
- AMPHIBIAN CALL-COUNT SURVEY STATION
- EASTERN WHIP-POOR-WILL SURVEY STATION
- WATERCOURSE
- INTERMITTENT WATERCOURSE
- ROADWAY
- SITE STUDY AREA
- 120 m STUDY AREA
- ECOLOGICAL LAND CLASSIFICATION

AGRC-R: AGRICULTURAL ROW CROP
AGRC-H: AGRICULTURAL HAYFIELD
CUT/CUW: DECIDUOUS THICKET/OPEN WOODLAND
DIST: DISTURBED
FOM: MIXED FOREST
SWD2-2: GREEN ASH - MAPLE MINERAL DECIDUOUS SWAMP
SWD3-1: RED MAPLE MINERAL DECIDUOUS SWAMP
SWD3-2: SILVER MAPLE MINERAL DECIDUOUS SWAMP
SWT2-2: WILLOW MINERAL THICKET SWAMP

REFERENCE(S)

1. LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2014
2. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: MTM ZONE 9 VERTICAL DATUM: CGVD28

DRAFT

0 40 80 160
1:4,000 METRES

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
ECOLOGICAL LAND CLASSIFICATION AND BIOLOGICAL SURVEY STATION LOCATIONS

CONSULTANT

GOLDER MEMBER OF WSP

YYYY-MM-DD	2022-01-28
DESIGNED	----
PREPARED	JEM
REVIEWED	----
APPROVED	----

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	A	9-10

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
25mm

9.4.2.1.3 Reach 4

Reach 4 is an intermittent channelized stream/ditch that parallels the eastern boundary of the existing landfill, flowing north through a culvert under Boyne Road into Volks Municipal Drain. During the April 2020 survey, this reach had low to moderate flow, with a depth of 100 to 200 mm. Wetted width was 3.7 m and bankfull width was 4.2 m. Substrate was silt, clay, and organics. During the May 2020 survey, there was low flow. Very little to no instream habitat features were observed, with the exception of some downed woody debris and a small proportion of submerged, emergent, and overhanging vegetation such as grasses, forbs, and multi-cellular algae. This reach was primarily dry during the July 2020 and September 2020 surveys, with water being restricted to isolated pockets of 2 to 5 centimetres (cm) in July. Refer to Table 9-14 for basic water quality parameters.

9.4.2.1.4 Volks Municipal Drain

Volks Municipal Drain is a permanent channelized stream that flows along the northern side of Boyne Road opposite the landfill area. This is the receiving feature of the on-site watercourse/perimeter ditch. Targeted surveys were not completed in this feature; however, it was observed to have low-moderate flow in April 2020, with low to no flow in July 2020 and September 2020. This feature was heavily vegetated during the July and September surveys, with dense aquatic vegetation, including submerged, floating, and emergent plants. Bankfull widths range from approximately 2.5 m to 4.5 m in the Site-vicinity Study Area.

9.4.2.1.5 Quart Municipal Drain

The Quart Municipal Drain has been historically observed as dry and does not connect to the perimeter ditch which services the landfill fill area. Although historically dry, the designed drainage of the ditch is towards the west and would also not permit flow into Reach 2. The feature is characterized as a linear depression, heavily vegetated with various grasses and goldenrods. It is approximately 3-4 m wide with a depth of approximately 0.5 m.

Table 9-14: Basic Water Quality Parameters of On-site Water Features

Water Feature	Air Temperature °C	Water Temperature °C	Dissolved Oxygen (mg/l)	pH	Specific Conductivity (µs)
Reach 1 *April 2020*	4	4.4	5.17	7.45	962
Reach 2 *April 2020*	4	3.7	14.05	8.4	910
Reach 3 *April 2020*	5	4.5	8.28	8.58	935
Reach 4 *April 2020*	5	3.8	6.34	7.93	921

Water Feature	Air Temperature °C	Water Temperature °C	Dissolved Oxygen (mg/l)	pH	Specific Conductivity (µs)
Reach 1 *May 2020*	10	5.9	6.9	8.8	758
Reach 2 *May 2020*	10	7.7	6.02	8.14	808
Reach 3 *May 2020*	10	8.6	8.52	8.13	1293
Reach 4 *May 2020*	11	6.5	6.22	7.68	638

9.4.2.1.6 Headwater Drainage Features Assessment

A Headwater Drainage Features Assessment was undertaken for each reach of the on-site watercourse/perimeter ditch according to the Guidelines (TRCA and CVC, 2014). Using the information collected during the field investigations, the following four characteristics of the reaches were classified according to the Guidelines:

- Hydrology
- Riparian conditions
- Fish and fish habitat
- Terrestrial habitat

The results of the classifications for each reach are presented in Volume 2 Appendix F-1. Figure 2 of the Guidelines provides a flow-chart that allows the assessor to input the various classifications determined for each of the four characteristics for each reach and arrive at a management recommendation for that reach. Based on the flow-chart, the management recommendations for each of the four reaches is “conservation”.

According to the Guidelines, a management recommendation of “conservation” entails maintaining, relocating or enhancing the feature and its riparian zone; maintain or replace on-site flows; maintain or replace external flows; use natural channel design techniques to maintain or enhance over-all productivity of the reach; and ensure downstream connection is maintained.

9.4.2.2 Fish Habitat

The watercourse/perimeter ditch on the landfill site is considered fish habitat, as it connects downstream with fish-bearing waters (Black Creek via Volks Municipal Drain) (Figure 9-10). Black Creek is described as a drain of unknown thermal regime, and containing fish including Banded Killifish (*Fundulus diaphanus*), Blacknose Shiner (*Notropis heterolepis*), Central Mudminnow (*Umbra limi*), Creek Chub (*Semotilus atromaculatus*), Fallfish (*Semotilus corporalis*), Pumpkinseed (*Lepomis gibbosus*), Rock Bass (*Ambloplites rupestris*), Spottail Shiner (*Notropis hudsonius*), Tadpole Madtom (*Noturus gyrinus*), and White Sucker (*Catostomus commersonii*) (MNRF, 2021b). On most visits, several schools of small-bodied fish were observed in Volks Municipal Drain, north of Boyne Road in the Site-vicinity Study Area. No barriers to fish passage between Volks Municipal Drain and the watercourse/perimeter ditch on the landfill site were seen during periods of high water; however no fish were observed or captured in the watercourse/perimeter ditch on the landfill site. The Quart Municipal Drain does not appear to represent fish habitat as it has historically been observed to be dry and does not connect to the perimeter ditch on the Site Study Area.

9.4.2.3 Aquatic Endangered and Threatened Species

No aquatic endangered or threatened species were identified as being potentially present in the watercourse/perimeter ditch at the Site Study Area, or the Volks Municipal Drain, during the desktop review of published information, or through the field surveys performed for this study.

9.4.3 Terrestrial Ecosystems

9.4.3.1 Ecological Land Classification

The Site Study Area consists of deciduous and thicket swamp, thicket, open woodland, agricultural fields, and the existing active landfill. The Site-vicinity Study Area includes the landfill site, plus additional forest, agricultural fields, and disturbed areas.

During the field surveys conducted on the Site Study Area, nine upland and wetland plant communities were identified based on the ELC system (Lee et al., 1998), including disturbed areas. Plant communities are shown on Figure 9-10 and are described in Table 9-15.

Table 9-15: Plant Communities on the Site and Site-vicinity Study Areas

Plant Community	Description	SRANK[a]
TERRESTRIAL		
CUT/CUW Deciduous Thicket/Open Woodland	This community includes areas with varying levels of disturbance, immediately surrounding the active landfill. It is a mix of early successional trees such as poplar (*Populus* spp.), shrubs such as buckthorns (*Rhamnus* spp.), and willows (Salix spp.), interspersed with small weedy meadows and disturbed areas. This also includes the vegetated berm that surrounds the landfill.	N/A
FOM Mixed Forest	This community is a forest outside of the landfill site, north of Boyne Road. It was not accessed as part of the survey but appears to be a mix of immature trees including trembling aspen (*Populus tremuloides)* and eastern white cedar (*Thuja occidentalis*). Based on imagery, there appear to be some trails and other areas of disturbance throughout.	N/A
WETLAND		
SWD 2-2 Green Ash – Maple Mineral Deciduous Swamp	This community makes up the majority of the natural area on the Site and Site-vicinity Study Areas and is contiguous with a large forest to the south and east of the Site-vicinity Study Area. It is an immature to semi-mature forest on moist soils that consist of shallow to moderate organics over silty clay. The canopy is closed to partially open and is dominated by green ash (*Fraxinus pensylvanica*), with associates such as silver maple (*Acer saccharinum*), red maple (*Acer rubrum*), and white elm (*Ulmus americana*). The understory and groundcover ranges from sparse to moderate with a mix of seedling trees as well as shrubs, graminoids forbs, and ferns; such as swamp red currant (*Ribes triste*), bladder sedge (*Carex intumescens*), spotted jewelweed (*Impatiens capensis*), and royal fern (*Osmunda regalis*). No signs of flooding occurs; however; the water table is at or close to the surface well into early summer. There are small upland inclusions within this community where species less tolerant of moisture such as sugar maple (*Acer saccharum)* occur. Downed woody debris is abundant, and snags and cavity trees are occasional.	N/A

Plant Community	Description	SRANK[a]
SWD 3-1 Red Maple Mineral Deciduous Swamp	This community is in the northeastern corner of the Site and Site-vicinity Study Areas. It is similar to SWD 2-2 but it is less mature with a higher component of red maple with a more open canopy. The understory and ground cover are dense to moderate, and there are areas where spring pooling occurs. There are pockets of deeper organic substrates in this community, although overall it is dominated by mineral clay soils. Downed woody debris is occasional, and snags and cavity trees are rare.	N/A
SWD 3-2 Silver Maple Mineral Deciduous Swamp	This community is small piece of degraded swamp along the western edge of the landfill site. It is immature on moist soils that consist of shallow organics over clay. The canopy is partially open and is dominated by silver maple with associates such as green ash and trembling aspen. The understory and groundcover are moderate to dense with a very dense forb and fern layer that includes species such as stinging nettle (*Utrica dioica*) and sensitive fern (*Onaclea sensibilis*). This area may have undergone flooding historically, however; anthropogenic drainage features in the area appear to have diverted spring run off, at least in part. Downed woody debris, snags, and cavity trees are occasional.	N/A
SWT 2-2 Willow Mineral Thicket Swamp	This community is a small thicket swamp south of the existing landfill. It is a mosaic of thickets and open meadow marsh on moderately deep organic substrates over clay. It is dominated by shrubs such as slender willow (*Salix petiolaris*), and speckled alder (*Alnus incana*), interspersed with dense and tall grasses and forbs such as reed canary grass (*Phalaris arundinacea),* stinging nettle, and Canada goldenrod (*Solidago canadensis*). There are no signs of flooding in recent years, however; the water table is at or close to the surface well into early summer.	N/A

Plant Community	Description	SRANK[a]
ANTHROPOGENIC		
AGRC-H Agricultural Hayfield	This community includes a hayfield along the western boundary of the Site-vicinity Study Area. Hayfields were not accessed but appear to be dominated by graminoid hay such as Timothy (*Phleum pratense*) and smooth brome (*Bromus inermis*).	N/A
AGRC-R Agricultural Row Crop	This community includes a portion of an agricultural field that overlaps with the southern portion of the Site Study Area, and another along the western edge of the Site-vicinity Study Area. It is used for a crop rotation of cash crops such as soya and corn.	N/A
DIST – Anthropogenic Disturbance	This community includes the active landfill and a snow storage area north of Boyne Road. Plants in these areas are primarily early successional and “waste species” typical of heavily disturbed landscapes.	N/A

Notes:

[a] SRANK is a provincial –level rank indicating the conservation status of a species or plant community and is assigned by the NHIC in Ontario (NHIC, 2015). SRANKs are not legal designations but are used to prioritize protection efforts in the Province. SRANKs for plant communities in Ontario are defined in the Significant Wildlife Habitat Technical Guide (MNRF, 2000). Ranks 1-3 are considered extremely rare to uncommon in Ontario; Ranks 4 and 5 are considered to be common and widespread. N/A indicates a community that has not been ranked.

No rare plant communities were identified on the Site or the Site-vicinity Study Areas.

9.4.3.2 Vascular Plants

A total of 160 vascular plants were identified on the Site Study Area during the field surveys. For a list of plants identified within the Site Study Area refer to Volume 2 Appendix F-2. No provincially rare plants, or plant SAR, as designated under the ESA or SARA, were observed on the Site Study Area.

9.4.4 Wildlife

A list of all wildlife encountered on the Site Study Area during field surveys is provided in Volume 2 Appendix F-3.

9.4.4.1 Bumblebees, Dragonflies, and Butterflies

A total of 10 insect species were identified during the field surveys. This included common species such as hobomok skipper (*Poanes hobomok*), common eastern bumblebee (*Bombus impatiens*), and white-faced meadowhawk (*Sympetrum obtrusum*). No SAR or provincially rare insects were identified on the Site Study Area, and no unusual concentrations were noted.

9.4.4.2 Herpetiles

A total of six herpetile species were identified in the Site-vicinity Study Area. All anurans were either individuals on the Site Study Area or associated with wetlands to the north of the landfill site. No breeding frog habitat was identified on the Site Study Area, or in the Site-vicinity Study Area. A single individual eastern garter snake (*Thamnophis sirtalis)* was observed. No turtles or notable turtle habitat was observed during surveys. No SAR or provincially rare herpetiles were observed on Site or the Site-vicinity Study Areas.

9.4.4.3 Birds

A total of 37 bird species were identified in the Site-vicinity Study Area. This includes a mix of open habitat, edge, wetland, and forest species such as song sparrow (*Melospiza melodia*), red-winged blackbird (*Agelaius phoeniceus*), and red-eyed vireo (*Vireo olivaceus*). A single singing male of wood thrush (*Hylocichla mustelina*) and two singing eastern wood-pewee (*Contopus virens*) were observed within the Green Ash – Maple Mineral Deciduous Swamp (SWD 2-2) in the south-eastern corner of the Site and Site-vicinity Study Areas. Wood thrush is designated as threatened under the SARA, and special concern under the ESA. Eastern wood-pewee is designated as special concern under both the SARA and the ESA.

For more information on eastern wood-pewee and wood thrush, refer to Section 9.4.4.5.4.

9.4.4.4 Mammals

A total of 10 species of mammals were identified on the Site Study Area. This included species that are common in the region such as white-tailed deer (*Odocoileus virginianus*) and red squirrel (*Tamiasciurus hudsonicus*). Many mammals appear to be attracted to the active landfill, and trails leading to and from were evident. Several species of bat were identified from acoustic data collected and are discussed below.

9.4.4.4.1 Bats

Acoustic bat data collected at BAT01 indicated a moderate to high level of overall bat activity at this station. A total of five species were recorded at this station, including (in order of abundance), big brown bat (*Eptesicus fuscus*), little brown myotis (*Myotis lucifugus*), hoary bat (*Lasiurus cinereus*), silver-haired bat (*Lasionycteris noctivagans*) and eastern red bat (*Lasiurus borealis*). Of the 1,629 bat passes recorded, 55 (approximately 3%) were determined to be little brown myotis, which is considered endangered under the SARA and ESA.

Acoustic data collected at BAT02 indicated a moderate level of overall bat activity at this station. A total of four species were recorded at this station, including (in order of abundance), big brown bat, little brown myotis, eastern small-footed myotis (*Myotis leibii*), and hoary bat. Of the 720 bat passes recorded, 69 (approximately 10%) were little brown myotis and 5 (approximately 0.7%) were eastern small-footed myotis, which is also considered endangered under the SARA and the ESA.

The winter bat maternity roost search identified several large trees that could be providing roost habitat to bats (Figure 9-10). The trees identified were mature and contained features that may provide suitable roost habitat for little brown myotis, including cavities, hollows, loose or peeling bark, etc.

For more information on little brown myotis and eastern small-footed myotis, refer to Section 9.4.4.5.6.

9.4.4.5 Significant Terrestrial Natural Features

9.4.4.5.1 Provincially Significant Wetlands

Significant wetlands are areas identified as provincially significant by the MNRF using evaluation procedures established by the province, as amended from time to time (MMAH, 2020). Wetlands are assessed based on a range of criteria, including biology, hydrology, societal value and special features (MNRF, 2014).

Based on the desktop assessment there are no Provincially Significant Wetlands (PSW) identified on the Site or the Site-vicinity Study Areas. The wetlands on the Site and in the Site-vicinity Study Areas are mapped by the province as unevaluated and evaluated non-significant (Melvin Swamp). Evaluated non-significant wetlands have been evaluated in accordance with the provincial evaluation system (MNRF, 2014) and found to not meet the criteria for provincial significance. The boundaries of these wetlands have been refined by Golder in the field, using standard ELC techniques, and are mapped on Figure 9-11.

Field surveys completed by Golder have not identified any features or functions associated with the wetlands on the Site or in the Site-vicinity Study Areas that would warrant a re-evaluation under OWES, or a designation as PSW.

9.4.4.5.2 Significant Woodlands

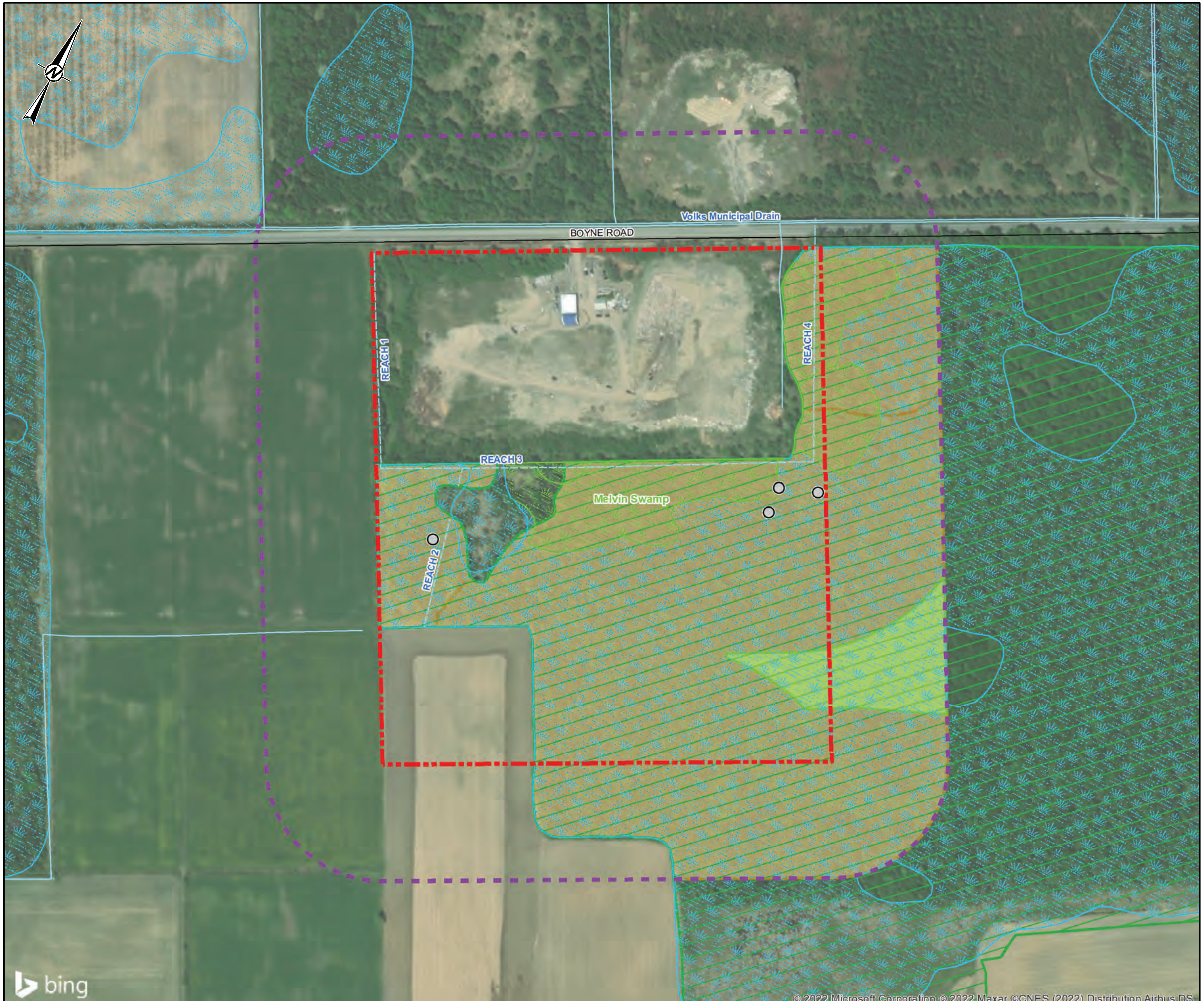
The responsibility for identifying significant woodlands is in transition from local municipalities to the Province (MMAH, 2020), but both authorities may be used for guidance. If the local planning authority has not undertaken to identify significant woodlands in their jurisdiction, then the NHRM (MNR, 2010) provides guidance on determining significance of woodlands.

The UCSDG has undertaken this exercise, and the County Official Plan (Schedule B1; 2018) indicates that the woodlands on the Site and in the Site-vicinity Study Areas are significant. The boundaries of the significant woodlands as mapped in UCSDG (2018) have been refined based on Golder’s in-field observations (Figure 9-11).

9.4.4.5.3 Significant Valleylands

Significant valleylands should be defined and designated by the planning authority. General guidelines for determining significance of these features are presented in the NHRM (MNRF, 2010). Recommended criteria for designating significant valleylands under the Provincial Policy Statement (PPS) include prominence as a distinctive landform, degree of naturalness, importance of its ecological functions, restoration potential, and historical and cultural values.

No significant valleylands were identified on the Site or the Site-vicinity Study Areas, as topography in the vicinity is flat.



LEGEND

- SUITABLE MATERNITY ROOST TREES FOR LITTLE BROWN MYOTIS
- FISH HABITAT - PERMANENT
- FISH HABITAT - INTERMITTENT
- ROADWAY
- UNEVALUATED WETLAND
- EVALUATED NON-PSW WETLAND
- SIGNIFICANT WILDLIFE HABITAT - INTERIOR FOREST
- SIGNIFICANT WILDLIFE HABITAT - WOOD THRUSH AND EASTERN WOOD-PEWEE
- SIGNIFICANT WOODLAND
- SITE STUDY AREA
- 120 m STUDY AREA

REFERENCE(S)

1. LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2014
2. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: MTM ZONE 9 VERTICAL DATUM: CGVD28

DRAFT

0 40 80 160
1:4,000 METRES

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
SIGNIFICANT NATURAL FEATURES

CONSULTANT
GOLDER MEMBER OF WSP

YYYY-MM-DD	2022-01-28
DESIGNED	----
PREPARED	JEM
REVIEWED	----
APPROVED	----

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	A	9-11

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
25mm

9.4.4.5.4 Significant Wildlife Habitat

Significant wildlife habitat (SWH) is one of the more complicated natural heritage features to identify and evaluate. The NHRM includes criteria and guidelines for designating SWH. There are two other documents, the SWHTG and the Significant Wildlife Habitat Mitigation Support Tool (SWHMiST) (MNR, 2000 and MNRF, 2014d), that can be used to help decide what areas and features should be considered significant wildlife habitat. These documents were used as reference material for this study.

There are four general types of significant wildlife habitat: seasonal concentration areas, rare vegetation communities or specialized habitats for wildlife, species of conservation concern, and animal movement corridors. The specific habitats considered in this report are evaluated based on the criteria outlined in the SWHECS for ecoregion 6E (MNRF, 2015). All types of SWH are discussed below in relation to the Site and the Site-vicinity Study Areas.

Seasonal Concentration Areas

Seasonal concentration areas are those areas where large numbers of a species congregate at one particular time of the year. If a SAR, or if a large proportion of the population may be lost if significant portions of the habitat are altered, all examples of certain seasonal concentration areas may be designated.

The SWHTG for ecoregion 6E identifies the following types of seasonal concentrations of animals that may be considered significant wildlife habitat, and outlines means of identifying such habitat. They are:

- Waterfowl stopover and staging areas (aquatic and/or terrestrial)
- Shorebird migratory stopover areas
- Raptor wintering areas
- Bat hibernacula
- Bat maternity roost colonies
- Turtle wintering areas
- Snake hibernaculum
- Colonially nesting bird breeding habitat (bank and cliff)
- Colonially nesting bird breeding habitat (tree / shrub)
- Colonially nesting bird breeding habitat (ground)
- Migratory butterfly stopover areas
- Landbird migratory stopover areas
- Deer yarding and winter congregation areas

No areas suitable for supporting waterfowl during migration times (stopover and staging) were identified during field surveys. No terrestrial stopover or staging habitat was observed on the Site or the Site-vicinity Study Areas.

Shorebird stopover sites are typically well-known and have a long history of use. There are no areas of suitable shorebird foraging habitat on the Site or the Site-vicinity Study Areas. In addition, no concentrations of shorebirds or presence of the listed species was identified during the field surveys.

Ideal raptor wintering areas are generally located in mature mixed or coniferous woodlands that abut windswept fallow fields or pastures that do not get covered by deep snow. There are no suitable habitats on the Site or the Site-vicinity Study Areas for raptor winter feeding and roosting.

Although the Site and Site-vicinity Study Areas are mapped as potential karst topography (where caves may be more likely to occur) (MNDM, 2016) no suitable areas of bat hibernacula were observed in the Study Area. Based on the field surveys, no portions of the Site Study Area provide the necessary number (>10/ha) of large (>25cm diameter at breast height) wildlife trees to be considered significant maternity roost habitat; however, this habitat type may be present within the mature forests within the Site-vicinity Study Area (off-site).

No potential turtle over-wintering habitat was observed on the Site or the Site-vicinity Study Area, as no standing water of suitable depth or hydroperiod was present.

Snake hibernacula and evidence of snake congregations were searched for during field surveys on the Site Study Area. No evidence of snake congregation was observed during field surveys, and no structures in the Site-vicinity Study Area were deemed suitable for potential hibernacula.

There are no banks or cliffs suitable for colonial bird nesting habitat on the Site or the Site-vicinity Study Areas.

Colonially nesting tree / shrub breeding habitats consist of heronries, while colonially nesting ground bird breeding habitat consist of rocky islands and peninsulas where species such as gulls and terns nest. No such habitats are present on the Site or the Site-vicnity Study Areas, and no heronries were identified during the field surveys.

The Site and Site-vicinity Study Areas are not located within 5 km of Lake Ontario, and therefore does not meet the criteria for significant migratory butterfly stopover habitat.

The Site and Site-vicinity Study Areas are not located in close enough proximity (i.e., within 5 km) to the Great Lakes to provide suitable landbird migratory stopover areas.

Deer management is an MNRF responsibility. There are no deeryards mapped by the MNRF at the Site or the Site-vicinity Study Areas, and the habitat on the Site Study Area is not suitable for deer yards (i.e., lacking a conifer component).

Rare Vegetation Communities or Specialized Habitats for Wildlife

Rare Vegetation Communities

Rare vegetation communities are those that are considered rare in the province, such as sand barrens, alvars, savannah and tallgrass prairie. It is assumed that these habitats are at risk and that they are also likely to support additional wildlife species that are considered significant. Generally, communities assigned an SRANK of S1 to S3 (extremely rare to rare-uncommon) by the NHIC qualify as rare.

None of the plant communities identified on the Site Study Area are ranked S1 to S3 (i.e., rare) by the NHIC. In addition to those communities considered rare by the NHIC, old-growth forests are considered rare. No old growth forests were identified on the Site or the Site-vicinity Study Areas.

Specialized Habitats for Wildlife

Specialized habitats for wildlife are microhabitats that provide a critical resource to some groups of wildlife. The SWHTG for ecoregion 6E defines specialized habitats that may be considered significant wildlife habitat, and outlines means of identifying such habitats. They are:

- Waterfowl nesting areas
- Bald eagle and osprey nesting, foraging and perching habitat
- Woodland raptor nesting habitat
- Turtle nesting areas
- Seeps and springs
- Amphibian breeding habitat (woodland)
- Amphibian breeding habitat (wetland)
- Woodland area sensitive bird breeding habitat

Waterfowl nesting areas consist of upland habitats extending 120 m from swamp and marsh habitats where waterfowl nesting is known to occur. To qualify as SWH, the wetlands must meet size criteria and contain certain numbers of listed species of waterfowl. No such habitats are present on the Site or the Site-vicinity Study Areas.

Bald eagle and osprey nesting, foraging and perching habitat may be identified where an active nest is present, and includes the surrounding habitats. No active nests of either species were identified on the Site or Site-vicinity Study Areas.

Woodland raptor nesting habitat was not identified as no raptor nests were observed during field surveys. Further, to meet the SWHECS criteria for this habitat type, there must be > 10 ha of interior forest habitat (measured 200 m from any edge) present. This is not present on the Site or Site-vicinity Study Areas.

The SWHECS indicates that exposed mineral soils in open sunny areas must be present to support turtle nesting. While this habitat type is present on the Site and in the Site-vicinity Study Area (i.e., agricultural fields), there is no suitable turtle habitat on the Site or in the Site-vicinity Study Area. Surface water features on the Site and Site-vicinity Study Areas were seen to hold water only in early spring, and no evidence of turtle nesting was observed during field surveys.

No evidence of groundwater seepage or springs were observed on the Site or Site-vicinity Study Areas.

To be considered woodland or wetland amphibian breeding habitat according to the SWHECS, wetlands must be at least 500 m^2 in area and contain certain species richness and abundance. It was determined that wetlands on the Site and in the Site-vicinity Study Area are considered ‘woodland’ breeding habitat, according to the SWHECS. Wetlands on the Site and in the Site-vicinity Study Area were surveyed for breeding amphibians, and it was determined that none of these features meet the criteria for significant amphibian breeding habitat (woodland).

The forested habitats on the Site and in the Site-vicinity Study Area provide approximately 1.5 ha of significant wildlife habitat for area-sensitive breeding birds (measured 200 m from the edge) (Figure 9-11). Additional interior forest habitat is present outside the Site-vicinity Study Area, within the contiguous forest that extends to the east.

Habitat for Species of Conservation Concern

Habitat for species of conservation concern (SOCC) includes habitat for three groups of species:

- Species that are rare, those whose populations are significantly declining, or have a high percentage of their global population in Ontario.
- Species listed as special concern under the ESA.
- Species listed as threatened or endangered under SARA.

Rare species are considered at five levels: globally rare, nationally rare, provincially rare, regionally rare, and locally rare (i.e., in the municipality). This is also the order of priority that should be attached to the importance of maintaining species. Some species have been identified as being susceptible to certain practices, and their presence may result in an area being designated significant wildlife habitat. The final group of species of conservation concern includes species that have a high proportion of their global population in Ontario. Although they may be common in Ontario, they are found in low numbers in other jurisdictions.

Three SOCC were assessed as being present, or having the potential to be present, on the Site and in the Site-vicinity Study Area (Volume 2 Appendix F-4): monarch (*Danaus plexippus*); eastern wood-pewee and wood thrush. Although monarch has not been observed on the Site Study Area, suitable habitat is present in the form of flowering plants and trees for roosting. As suitable habitat, including roadsides, pastures and meadows being abundant in the planning area, the Site and Site-vicinity Study Areas are not considered SWH for this species. Both eastern wood-pewee and wood thrush were observed using the forested habitats on the Site Study Area. As the woodland associated with these observations is large and forest cover in the planning area is relatively low (13.3%; SNC, 2016), the forested area on the Site and in the Site-vicinity Study Area has been considered SWH for these bird species.

Two additional SOCC were determined to be potentially present in the Site-vicinity Study Area only, but not on the Site Study Area: grasshopper sparrow (*Ammodramus savannarum*); short-eared owl (*Asio flammeus*), both of which require open habitats. As this type of habitat is widespread in the planning area, no SWH for either of these species has been identified in the Site-vicinity Study Area.

In addition, there are four specific habitat types identified as potentially providing habitat for species of conservation concern:

- Marsh bird breeding habitat
- Open country bird breeding habitat
- Shrub/early successional bird breeding habitat
- Terrestrial crayfish

There is no marsh habitat suitable for marsh breeding birds on the Site or in the Site-vicinity Study Area. No open country or shrub/early successional breeding bird habitat meeting the size criteria or containing the required species as listed in the SWHECS are present on the Site or in the Site-vicinity Study Area. No evidence of terrestrial crayfish was identified on the Site or in the Site-vicinity Study Area during the field surveys.

Animal Movement Corridors

The SWHTG (MNRF, 2000) defines animal movement corridors as elongated, naturally vegetated parts of the landscape used by animals to move from one habitat to another. This is generally in response to different seasonal habitat requirements. For example, trails used by deer to move to wintering areas or areas used by amphibians between breeding and summer habitat. To qualify as significant wildlife habitat, these corridors would be a critical link between habitats that are regularly used by wildlife.

The SWHECS indicates that movement corridors are to be identified where certain types of SWH have been identified according to the SWHECS, including:

- Amphibian movement corridors: to be identified when significant amphibian breeding habitat (wetland) is present.
- Deer movement corridors: to be identified when deer wintering habitat is present.

None of these SWH were identified on the Site or in the Site-vicinity Study Area; therefore, no animal movement corridors are identified.

The Site-vicinity Study Area is not adjacent to any major watercourse or major landscape feature that would act as a natural corridor for wildlife. The Site-vicinity Study Area is located in a local landscape characterized by a flat topography and a matrix of open and forested habitats, and so does not provide a linkage between different habitat types, or habitats providing different seasonal requirements for wildlife. For this reason, no migration corridors have been identified on the Site or in the Site-vicinity Study Area.

9.4.4.5.5 Areas of Natural and Scientific Interest

Significant ANSIs are areas identified as provincially significant by the MNRF using evaluation procedures established by the Province, as amended from time to time.

Based on the desktop assessment there are no significant ANSIs on the Site or in the Site-vicinity Study Area.

9.4.4.5.6 Terrestrial Endangered and Threatened Species

The following discussion of provincially endangered or threatened species is based on the SAR screening provided in Volume 2 Appendix F-4. Species with a low probability to occur on the Site and Site-vicinity Study Areas are included in the screening, but are not discussed further in this report. Each of the species listed below has moderate or high potential to inhabit the Site or Site-vicinity Study Areas, based on the desktop SAR screening and the results of the field surveys.

Barn Swallow

In Ontario, barn swallow (*Hirundo rustica*) breeds in areas that contain a suitable nesting structure, open areas for foraging, and a body of water. This species nests in human made structures including barns, buildings, sheds, bridges, and culverts. Preferred foraging habitat includes grassy fields, pastures, agricultural cropland, lake and river shorelines, cleared rights-of-way, and wetlands (COSEWIC, 2011). Mud nests are fastened to vertical walls or built on a ledge underneath an overhang. Suitable nests from previous years are reused (Brown and Brown, 2019).

No evidence of nesting of this species was observed at the Site Study Area, and no suitable structures for nesting are present in the Site-vicinity Study Area; however, this species may forage over the Site and Site-vicinity Study Areas. This species is considered threatened under the SARA and ESA. Under the ESA, an active nest and the area within 200 m of it is considered the regulated habitat. Alteration within this area that may negatively impact the species or the habitat would require submission of an Information Gathering Form to the MECP to determine permitting needs under the ESA.

Bobolink

In Ontario, bobolink (*Dolichonyx oryzivorus*) breeds in grasslands or graminoid dominated hayfields with tall vegetation (Gabhauer, 2007). Bobolink prefers grassland habitat with a forb component and a moderate litter layer. They have low tolerance for presence of woody vegetation and are sensitive to frequent mowing within the breeding season. They are most abundant in established, but regularly maintained, hayfields, but also breed in lightly grazed pastures, old or fallow fields, cultural meadows and newly planted hayfields. Their nest is woven from grasses and forbs. It is built on the ground, in dense vegetation, usually under the cover of one or more forbs (Renfrew et al., 2015).

No evidence of nesting of this species was observed at the Site or in the Site-vicinity Study Area; however, suitable nesting habitat is present in the southwest corner of the Site-vicinity Study Area associated with a small area of hayfield. This species is considered threatened under the SARA and ESA. Under the ESA, an active nest and the suitable habitat within 300 m of it is considered the regulated habitat. Alteration within this area that may negatively impact the species or the habitat would require submission of an Information Gathering Form to the MECP to determine permitting needs under the ESA.

Eastern Meadowlark

In Ontario, eastern meadowlark (*Sturnella magna*) breeds in pastures, hayfields, meadows and old fields. Eastern meadowlark prefers moderately tall grasslands with abundant litter cover, high grass proportion, and a forb component (Hull, 2019). They prefer well drained sites or slopes, and sites with different cover layers (Roseberry and Klimstra, 1970).

No evidence of nesting of this species was observed at the Site or in the Site-vicinity Study Area; however, suitable nesting habitat is present in the southwest corner of the Site-vicinity Study Area associated with a small area of hayfield. This species is considered threatened under the SARA and ESA. Under the ESA, an active nest and the suitable habitat within 300 m of it is considered the regulated habitat. Alteration within this area that may negatively impact the species or the habitat would require submission of an Information Gathering Form to the MECP to determine permitting needs under the ESA.

Little Brown Myotis and Eastern Small-footed Myotis

In Ontario, little brown myotis' range is extensive and covers much of the province. It will roost in both natural and man-made structures. Roosting colonies require a number of large dead trees, in specific stages of decay and that project above the canopy in relatively open areas. Caves or abandoned mines may be used as hibernacula, but high humidity and stable above freezing temperatures are required (ECCC, 2018a).

Eastern small-footed myotis is not known to roost in trees, but there is very little known about its roosting habits. The species generally roosts on the ground under rocks, in rock crevices, talus slopes and rock piles, but it occasionally inhabits buildings. Entrances of caves or abandoned mines where humidity is low, and temperatures are cool and sometimes subfreezing may be used as hibernacula (Humphrey, 2017).

Little brown myotis was recorded at stations BAT01 and BAT02, and eastern small-footed myotis was recorded at station BAT02. Based on the numbers recorded for each of these species, and the times at which they were recorded, Golder's opinion is that there is a little brown myotis roost in the vicinity of BAT02, and possibly also in the vicinity of BAT01. Also, based on the high number of big brown bat calls, several of which were social calls, it is likely that there is a big brown bat roost in the vicinity of BAT01. Although eastern small-footed myotis was recorded, the low numbers, time of detection and absence of suitable habitat on the Site Study Area indicate that this species is unlikely to be roosting on the Site Study Area.

Little brown myotis is considered endangered under the SARA and ESA. This species currently receives general protection under the ESA, meaning that both individuals and their habitats are protected from harm, harassment, damage or destruction. A recovery strategy for this species has been prepared (Humphrey and Fotherby, 2019), which will assist the Government of Ontario in developing a definition of the regulated habitats, to be protected under the ESA, for this species.

Based on Golder's field surveys, several trees suitable for providing maternity roost habitat for little brown myotis were identified in the vicinity of BAT01 and BAT02, and are shown on Figure 9-11. According to the recovery strategy (Humphrey and Fotherby, 2019), the habitat for little brown myotis is considered the ecosite that encompasses the suitable maternity roost trees (SWD2-2 on Figure 9-10), plus forests, wetlands and waterbodies within 2,400 m surrounding the ecosite (foraging habitat). Within the 2,400 m radius, hayfields, pastures, meadows, and thickets within 40 m of a forested habitat are also to be included as foraging habitat. Alteration within this area that may negatively impact the species or the habitat would require submission of an Information Gathering Form to the MECP to determine permitting needs under the ESA.

American Ginseng

In Ontario, American ginseng (*Panax quinquefolius*) is found in moist, undisturbed and relatively mature deciduous woods often dominated by sugar maple. It is commonly found on well-drained, south-facing slopes. American ginseng grows under closed canopies in well-drained soils of glacier origin that have a neutral pH (ECCC, 2018b).

Although this species has not been observed on the Site Study Area, it may be present in the Site-vicinity Study Area. This species is considered endangered under the SARA and the ESA. Under the ESA, the area within 150 m of the area occupied by this species is considered the regulated habitat. Alteration within this area that may negatively impact the species or the habitat would require submission of an Information Gathering Form to the MECP to determine permitting needs under the ESA.

Butternut

In Ontario, butternut is found along stream banks, on wooded valley slopes, and in deciduous and mixed forests. It is commonly associated with beech, maple, oak and hickory (Voss and Reznicek, 2012). Butternut prefers moist, fertile, well-drained soils, but can also be found in rocky limestone soils. This species is shade intolerant (Farrar, 1995).

Although this species has not been observed on the Site Study Area, it may be present in the Site-vicinity Study Area. This species is considered endangered under the SARA and ESA. This species currently receives general protection under the ESA, meaning that both individuals and their habitats are protected from harm, harassment, damage or destruction. A recovery strategy for this species has been prepared (Poisson and Ursic, 2013), which will assist the Government of Ontario in developing a definition of the regulated habitats, to be protected under the ESA, for this species. According to the recovery strategy, the area within 50 m of each tree should be considered the habitat. Alteration within this area that may negatively impact the species or the habitat would require submission of an Information Gathering Form to the MECP to determine permitting needs under the ESA.

9.4.4.5.7 Wildfire Risk Potential

Golder determined that the forested habitats at the Site and in the Site-vicinity Study Area represent a moderate to low fire risk according to Table 4-1 of MNRF (2017), based on the species composition and forest condition. Based on this and following the evaluation matrix provided in Appendix 4 of MNRF (2017), no further consideration to wildlife is required.

9.5 Land Use Planning

The existing Boyne Road Landfill site is located at 12620 Boyne Road (Lot 8, Concession VI) in the rural ward of Winchester in the Township of North Dundas.

This section includes a review of the land use planning policy and regulatory context, in addition to an analysis of existing land uses within the Site-vicinity and Site Study Areas. Planning policy was assessed to determine potential for future development in the area of the landfill site. Planning policy reviewed consisted of:

- MECP Guideline D-4 Land Use On or Near Landfills and Dumps (MOE, 1995a)
- MECP Guideline D-6 Compatibility between Industrial Facilities (MOE, 1995b)
- Provincial Policy Statement, 2020
- United Counties of Stormont, Dundas, and Glengarry Official Plan (2018)
- Township of Winchester Zoning By-Law No. 12-93

9.5.1 MECP D-4 Land Use On or Near Landfills and Dumps

The MECP D-4 Land Use On or Near Landfills and Dumps (MOE, 1995a) guide outlines restrictions and controls on land use in the vicinity of landfills and waste management systems in order to provide health, safety, convenience, and welfare protection to nearby residents.

There are a number of sensitive land uses that the Ministry recommends against not permitting adjacent to operational landfills, as stated in S. 5.1.1, including:

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 vehicles service facilities adjacent to highway, utility operations, scrap yards, heavy industrial uses, gravel pits, quarries, mining, or forestry activities; or

d. *cemeteries.*

Land uses compatible with landfills currently in operation, as stated in S. 5.1.2, include:

a. *utilities and above grade transportation routes except major highways;*
b. *fences;*
c. *wood harvesting and other forestry activities;*
d. *certain farming activities;*
e. *industrial uses, including incinerators permitted to operate under O.Reg. 347;*
f. *gravel pits and quarries, and other mining activities (provided the landfill water table is not affected); or*
g. *such land uses which would not be threatened by any hazard to public health or safety and would not be impaired by nuisance effects.*

The guide further states, in S. 5.2, that no land use may take place within a minimum 30 m of an active landfill and that operating landfills shall have a buffer area of no less than 30 m. The typical buffer is normally between 60 and 100 m.

Sections 5.3 and 5.4 of Guideline D-4 state substantial contaminant discharges and visual problems are normally most significant within 500 m of landfill areas. It is the recommendation of the Ministry that these 500 m be used as the study area for any proposed land uses. This study area can be expanded up to 3 km where significant impacts are anticipated. Section 5.5 specifies that where preventative measures have not been indicated to prevent or minimize adverse effects, land use proposals should not be recommended for approval.

9.5.2 MECP Guideline D-6 Compatibility between Industrial Facilities

The MECP Guideline D-6 Compatibility between Industrial Facilities guide defines category designations for industrial uses and provides recommended distances between these uses and sensitive land uses. There are three categories of designation, each with varying degrees of potential influence areas, as stated in S. 4.1.1:

- Class I Industrial – 70 m
- Class II Industrial – 300 m
- Class III Industrial – 1000 m

The guide recommends the use of these terms and minimum setback distances within land use planning policies such as official plans and zoning by-laws. Recommended minimum separation distance between industrial uses and sensitive land uses, as stated in S. 4.3, are:

- Class I – 20 m
- Class II – 70 m
- Class III – 300 m

9.5.3 Provincial Policy Statement, 2020

The Provincial Policy Statement supports growth and intensification within both urban and rural settlement areas while protecting the viability of rural areas.

The PPS defines *waste management systems* as sites and facilities designed to accommodate solid waste from one or more municipalities and may include recycling facilities, transfer stations, processing and disposal sites.

Section 1.2.1 (d) of the PPS requires co-ordination between the various tiers of government, lower, single, and/or lower tier, when dealing with provincial matters including waste management systems.

Section 1.6.10 of the PPS states that "*Waste management systems* need to be provided that are of an appropriate size and type to accommodate present and future requirements, and facilitate, encourage and promote reduction, reuse and recycling objectives" (PPS, pg. 21). It also notes that waste management facilities should be located and designed in accordance with local and provincial legislation.

Waste management systems are classified as a 'Major facility' under the PPS, meaning they require separation from sensitive land uses.

9.5.4 United Counties of Stormont, Dundas, and G*lengarry Official Plan, 2018*

The subject site is located within the Rural District designation of the United Counties of Stormont, Dundas, and Glengarry Official Plan. It also has an identified Active Landfill per Schedule A1. "The intent of this designation is to accommodate a variety of land uses that are appropriate for a rural location and a limited amount of residential development where such development will not preclude continued agricultural and non-residential uses." Permitted uses in the Rural District designation include:

- Agricultural uses, forestry and conservation, and natural resource management activities
- Residential uses on existing lots of record and on new lots created by severance as provided for by this Plan
- Animal boarding, breeding, and training facilities, including stables
- Bed and breakfast establishments
- Open space
- Cemeteries

Uses outside of these permitted uses are subject to a zoning by-law amendment and must adhere to the additional uses listed in the OP.

Sections of the OP that relate to waste management facilities include:

3.5.2.2.9. "Land use compatibility shall be considered in the design and development or redevelopment of residential areas. This includes establishing or respecting building setbacks, separation distances, and influence areas from incompatible land uses (e.g., sewage treatment facilities, waste management facilities, industrial uses, mineral extraction operations etc.). Such uses should be located to avoid existing and future residential areas."

4.3.5.2. "New waste management systems may be permitted in either Rural District or Employment District designations and shall require an amendment to this plan and require approval under the *Environmental Protection Act* before an amendment is considered. Provincial and municipal approvals will be required for the hauling and disposal of waste materials and sewage and septage."

4.3.5.3. "Closed or inactive sites, whether public or private, may be used for other purposes subject to meeting requirements of the *Environmental Protection Act* (Section 46 Order). In general, sites used to accommodate a waste management system cannot be redeveloped within a period of 25 years from the date the site was closed without approval from the Minister of the Environment and Climate Change (now the MECP) and amendment to this Plan. Closure plans for waste management systems should include progressive rehabilitation of the site. The County and Local Townships shall collaborate to ensure all closed or inactive waste management systems (and their associated sites) are appropriately identified on the Land Use Schedules of this Plan in accordance with the symbology outlined in 4.3.5.1. Where more restrictive separation distances and/or investigation requirements are determined to be necessary, these should be reflected in the land use schedule and/or zoning of the site."

4.3.5.4 "Local Municipalities shall ensure that there is sufficient capacity to accommodate waste disposal for all new development. Local Municipalities should be proactive in reducing solid waste generation to protect the environment and extend the life of existing landfill sites within the County."

4.3.5.5 "Local Municipalities will use a 500 m radius, or such other distance recommended by the Ministry of the Environment, as a guideline for triggering the assessment of the impact(s) of waste management systems on surrounding lands. Development proposals near sensitive land uses within the influence study area must include, but are not limited to, landfill generated gases, ground and surface water contamination by leachate, odour, litter, vehicular traffic, dust, noise, vectors and vermin and visual impact (see Section 3.5.1.5). Development within 500 m of an existing waste management system shall generally be discouraged unless supported by an appropriate study or studies which confirm that there will be no negative impacts on the proposed development related to current uses/activities associated with the normal operation of the waste management system. Furthermore, the study(ies) shall confirm, to the satisfaction of the County, that the proposed development will not impact future expansions of the uses/activities associated with the existing waste management system."

9.5.5 Township of Winchester Zoning By-law No. 12-93

The Boyne Road Landfill site is zoned Special Rural – Waste Disposal (SRD) under the Township of Winchester Zoning By-Law No. 12-93 (see Figure 9-12) . Note that the Township still uses the By-laws that existed at the time of amalgamation, hence the reference is still to the former municipality and not North Dundas.

The permitted uses within this zoning include:

- Agricultural uses
- Conservation use
- Forestry use
- Waste disposal site

The yard requirements for this zone are a minimum of 9 m (29.5 ft.). The separation distance between SRD uses and dwelling units must be 500 m (1640.4 ft.).

The definitions for these uses are found below.

The lands immediately surrounding the landfill site are vacant. There are residential properties to the west of the site; however, they are well removed with the closest dwelling over 600 m away. There are also agricultural properties surrounding the landfill property, with the closest barn approximately 1.5 kilometres away. Agricultural properties are defined as lands with the use of growing crops, raising livestock and animals for food, fur or fiber, aquaculture, apiaries, agro-forestry, maple syrup production, and associated on-farm buildings and structures.

The location of the Boyne Road Landfill is well removed from any other land uses, compatible or otherwise. There are provisions in the County Official Plan to support the expansion, closure, and continued use of the landfill site. Both the Official Plan and the Township Zoning By-law are in accordance with the buffer requirements set out in the MECP D-4 and D-6 Guidelines. As well, the Official Plan and Zoning By-law are in line with the Provincial Policy Statement in that they work together as upper and lower tier municipalities on matters of waste management.

From a land use planning perspective, it is considered that there are opportunities for the landfill site to expand. Surrounding land uses are vacant and potentially incompatible land uses, such as residential and agriculture, are well removed from the site.

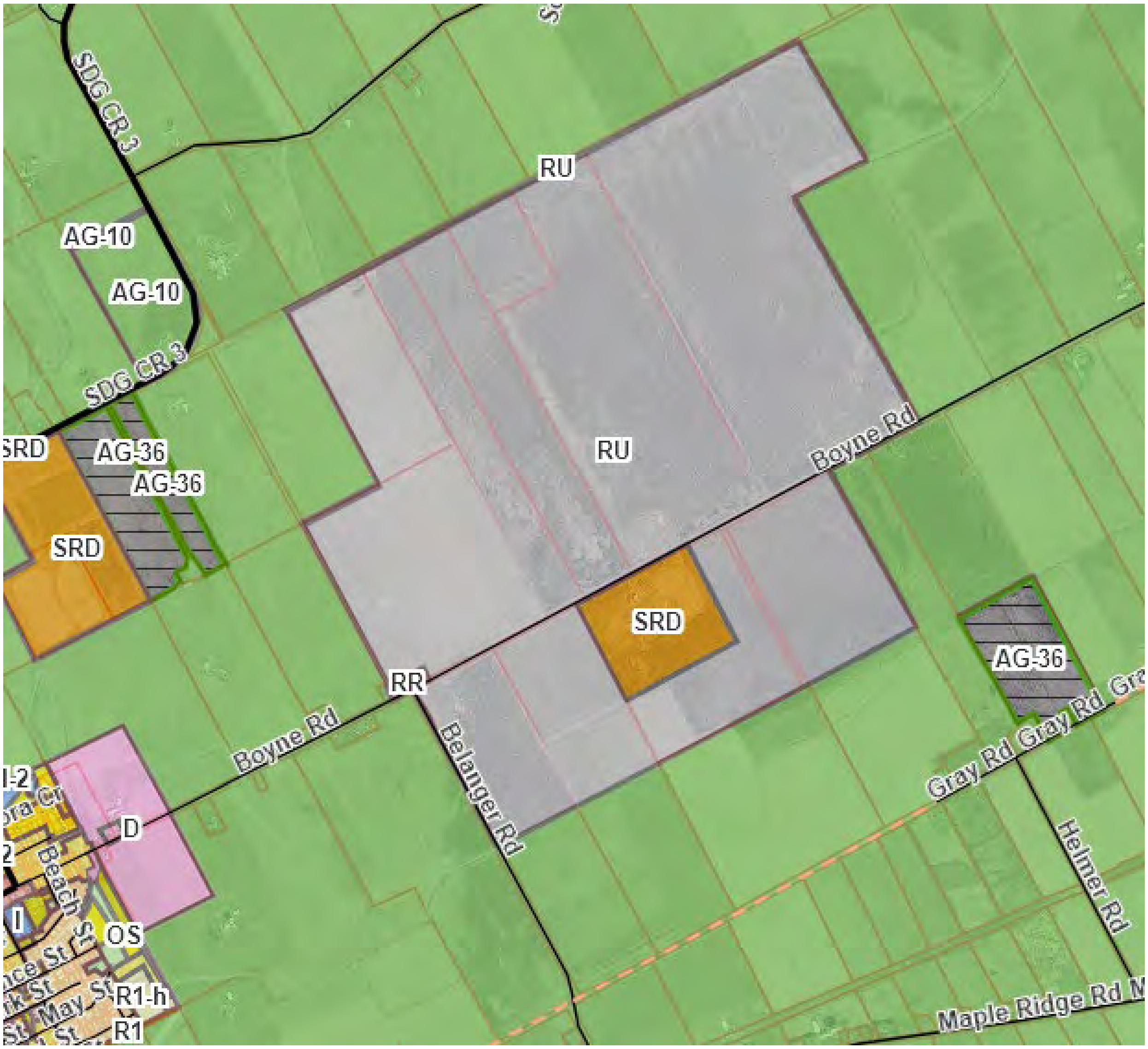


Figure 9-12: Surrounding Land Designations

A Waste Disposal site is defined in the By-law as a site licensed or approved by the Ministry of the Environment and/or its agents where garbage, refuse, domestic or industrial waste is disposed of or dumped, excluding radioactive or toxic chemical wastes, and shall include a sludge disposal area.

The expansion of the Landfill site should be guided by the “D-4 Land Use on or Near Landfills and Dumps” to ensure minimum distances are being maintained between the landfill and existing sensitive land uses, such as agriculture. This guide states that no land use may take place within 30 m of a fill area, and that there be a 500 m study area for any proposed land use within this distance of the landfill site.

Should the proposed landfill expansion be horizontal in nature and occupy lands outside of the SRD Zone, there will be a need for a rezoning. If the lateral extent of the expansion remains within the SRD Zone, there will be no requirement for a rezoning.

9.6 Agriculture

In the United Counties of Stormont, Dundas and Glengarry Official Plan, the majority of the Township of North Dundas is designated as Agricultural Resource Lands outside of the Urban Settlement Area. The County Official Plan defines Agricultural Resource Lands as lands predominated by prime agricultural lands and other large tracts of land characterized by viable farming activity.

This designation is derived from the PPS 2020, which defines Prime Agricultural Land as specialty crop areas and/or Canada Land Inventory Class 1, 2, and 3 lands, as amended from time to time, in this order of priority for protection. Groupings of Prime Agricultural Land form Prime Agricultural Areas, which are defined as areas where prime agricultural lands predominate. This includes areas of prime agricultural lands and associated Canada Class 4 through 7 lands, and additional areas where there is a local concentration of farms that exhibit characteristics of ongoing agriculture. These groupings of Agricultural Lands are shown in the Official Plan as Prime Agriculture.

Permitted uses on these lands include:

- Agricultural uses
- Agriculture-related uses and on-farm diversified uses
- Forestry use or woodlands
- Conservation uses
- Existing dwellings and dwellings on lots created by consent and legally existing uses, buildings or structures
- Public service facilities which are more appropriately located in the rural area because of their type, size or the catchment area they serve
- Mineral aggregate operation as an interim use
- Passive outdoor recreation use excluding buildings and golf courses
- Natural heritage features and areas
- Wayside pits or quarries
- Legally existing uses, buildings, or structures

The County’s Land Use Schedule designates the lands due south and to the east of the Boyne Road Landfill site as Agricultural Resource Lands. Agricultural uses are also permitted in the Rural zone designation, which includes the landfill site.

The Township of North Dundas Zoning By-law, for the subject lands that are in the former Township of Winchester, designates the areas immediately surrounding the Boyne Road Landfill site as Rural, where agricultural use is a permitted use. Lands on the perimeter of these Rural lands are designated Agricultural Zone.

The By-law defines agricultural use as the use of land, building, or structures for any of the following:

(a) The production of crops, including all related activities such as soil preparation, fertilizer and manure spreading, planting, spraying, harvesting, storage, and sale of produce.
(b) The raising, breeding, boarding, keeping, training, and grazing of all types of livestock.
(c) The production and sale of animal products such as milk, eggs, honey, wool or fur.
(d) The storage, maintenance and use of all forms of farm related machinery such as tractors, harvesters, grain dryers, and irrigation equipment.

9.6.1 Soils

The Ministry of Agriculture, Food and Rural Affairs Agricultural Maps show the Landfill Site within a Muck soil area. Muck soil, as defined in the Soil Survey of Dundas County (Ontario Agricultural College, 1952)., is soil having a 0 to 0.45 m thickness of organic layer consisting of semi-decomposed vegetative material, usually neutral to alkaline on the surface. Presently, this soil is generally not suitable for agriculture and has traditionally not been included in an Agricultural designation, as it requires a great deal of work to prepare for crops and the rate of return is low.

Other soil types in proximity to the Landfill site include:

- North Gower – a clay-based alkaline soil with poor drainage characteristics. This soil is generally used for permanent pasture and hay, although with proper drainage channels installed can be used for some crop growth.
- Allendale – a sand over clay soil with poor drainage characteristics. The soil is generally used for permanent pasture or woodlots. Some cereal grains can be grown in these soils.
- Grenville – a well-draining, undulating grey-brown organic soil. This soil is well-poised for agricultural use and most lands underlain by this soil in the area is cleared and used for agricultural purposes. General farming and dairy operations are supported on these soils.
- Wolford – a heavy textured morainic soil with good drainage characteristics. This soil is well suited for general farming operations when cleared.

There is a Muck buffer between the Boyne Road Landfill site and other types of soil.

The Agricultural Map also shows the landfill site as being underlain by Class O, or Organic soils, which are not placed in capability classes. The surrounding lands are classified as either Soil Class 2 or 3. Class 2 is defined as soils with moderate limitations that restrict the range of crops or require moderate conservation practices. Class 3 is defined as soils with moderately severe limitations that restrict the range of crops or require special conservation practices.

Both Classes 2 and 3 are to be considered for protection for agriculture through the Township/County Official Plan reviews.

9.7 Cultural Heritage Resources

9.7.1 Archaeological Resources

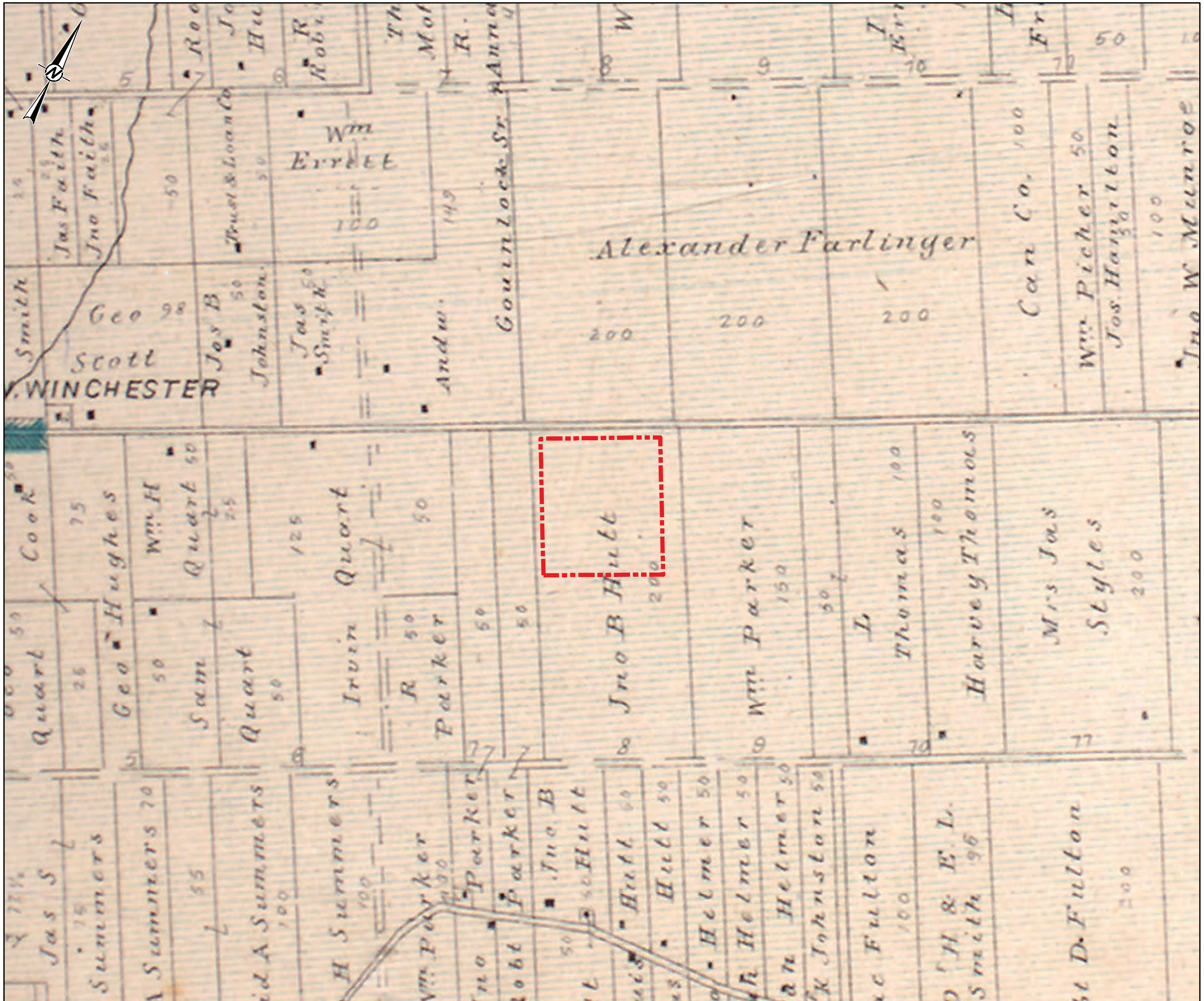
In support of this EASR, a Stage 1 archaeological assessment was carried out in the Site Study Area (Volume 2 Appendix G-2) in accordance with the Ontario Ministry of Heritage, Sport, Tourism, and Culture Industries' (MHSTCI) Standards and Guidelines for Consultant Archaeologists (2011). A Stage 1 archaeological assessment background study provides information about the project area, evaluates archaeological potential, and provides recommendations as to whether further work is required.

9.7.1.1 Site Study Area History

Land registry records for Lot 8, Concession 6 of Winchester Township indicate the lot was first granted by the Crown to Hannah Louchs in 1801 (reg. no. 557). The land was sold to John Crysler in 1808 and then to John Richardson in 1811 (reg. no. 191, 1172). In 1839, the entire lot was transferred to Peter McGill and the Trustees of Thomas B. Anderson (reg. no. 438). John Hutt purchased the entire lot in 1855 (reg. no. 438) and he appears to have owned it until 1895 when he willed the property to George (west half) and John (east half) Hutt (reg. no. 8118). The property appears to have remained in the Hutt family until the early 20th century.

An 1879 plan of Winchester Township (Figure 9-13) shows the name "Jno B Hutt" on the property. This is likely the John Hutt who is listed in the land registry records. No structures are shown on the property during this time. However, a structure is shown to the south on the adjacent lot (Lot 7, Concession 5) associated with the same name, so it is likely that John Hutt resided to the south. He may have used the southern portions of Lot 8, Concession 6, for agriculture while the northern end was left unused. A road going to the nearby village of Winchester is shown running along the north end of the Site Study Area and the settlement of Boyne is located in the approximate location of the schoolhouse between lots 12 and 13 of Concession 6.

Canada Census records for 1861 list John Hutt as a 46 year old farmer. He is listed as residing in a brick house, which is likely the house shown on Lot 7. Given the early date of this record, the fact that John Hutt has already built a brick home suggests that he was already well established on his property by this time and was successful enough to afford the construction of a brick house rather than the log or frame house most common during this period. Indeed, all the other families listed on the same page in the Census records are residing in log and frame houses, expect for John Hutt.



LEGEND

STUDY AREA

REFERENCE(S)

1. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: MTM ZONE 9

0 150 300 600

1:15,000 METRES

CLIENT

TOWNSHIP OF NORTH DUNDAS

PROJECT

INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE

1879 PLAN OF WINCHESTER TOWNSHIP

CONSULTANT

GOLDER MEMBER OF WSP

YYYY-MM-DD	2022-02-01
DESIGNED	----
PREPARED	JEM
REVIEWED	RH
APPROVED	AM

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	0	**9-13**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:

25mm

The 20th century history of the Site Study Area is shown by aerial photographs (Figure 9-16) and topographic maps (Figures 9-14 and 9-15). A topographic map from 1908 (Figure 9-14) indicates that the southern end of the Site Study Area was woodlot. No structures are shown within 300 m of the Site Study Area. Two streams are located over 300 m to the east and west. A 1933 topographic map shows little change within the Site Study Area (Figure 9-15). A 1954 air photo (Figure 9-16) shows the Site Study Area prior to its use as a landfill. The southwest corner is an agricultural field while much of the rest of the Site Study Area is woodlot or unused lands. The 1972 air photo (Figure 9-16) shows the beginnings of the landfill with much of the rest of the property remaining woodlot. The 1985 air photo (Figure 9-16) shows the impact of the expanding landfill with a larger area disturbed. The drainage ditch located in the northeast corner is now visible suggesting the ditch dates to between 1972 and 1985.

9.7.1.2 Site Study Area Environment

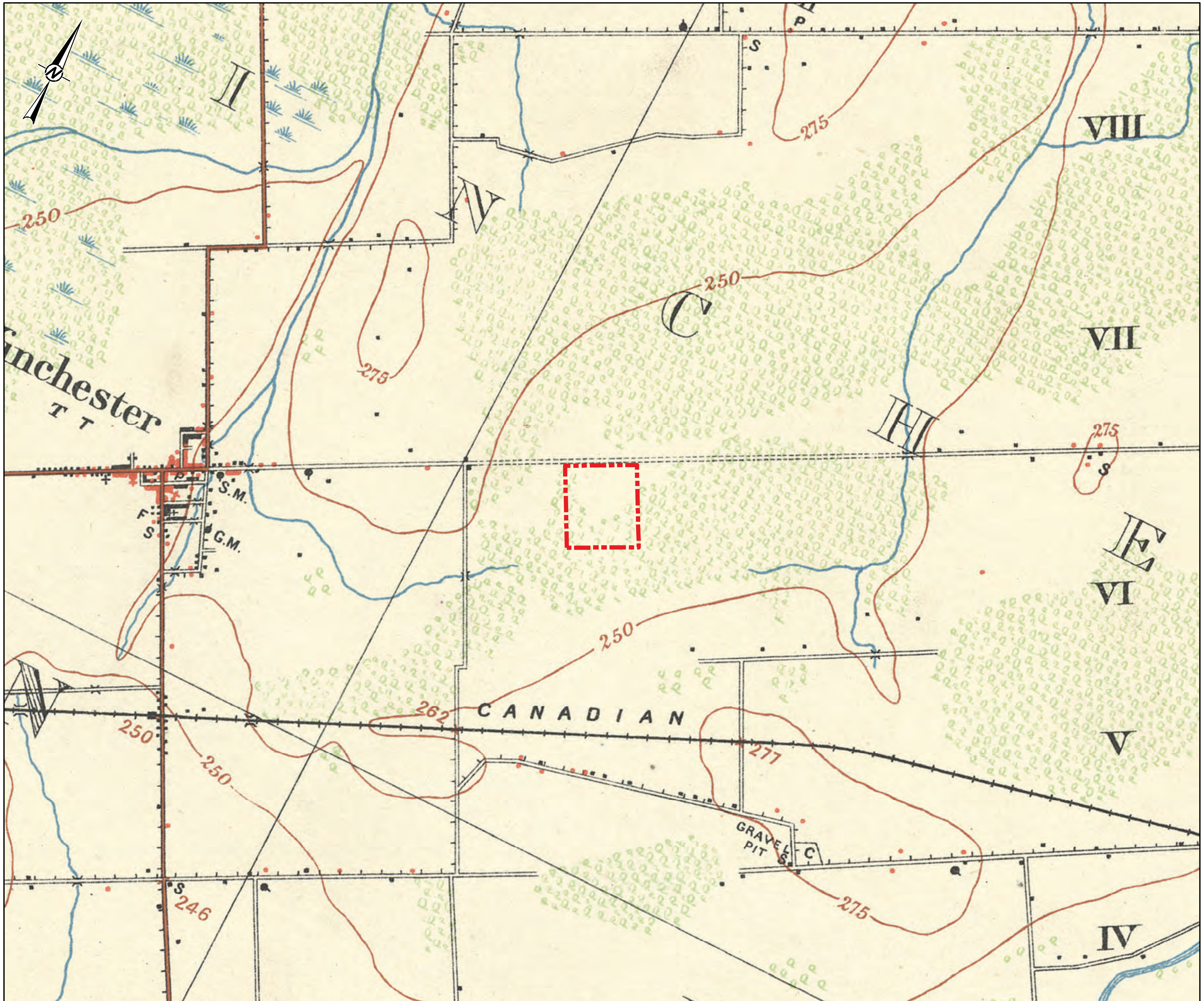
The Site Study Area is located within the Winchester Clay Plains physiographic region, a low-lying area within the South Nation River drainage basin. The original vegetation of the plains consisted primarily of red maple, elm, white and black ash which are all species characteristic of swamp-forest environments (Chapman and Putnam, 1984, p. 203). The original forests of the region were largely removed, and the swamps drained to convert the land to agriculture. The South Nation River is located approximately 4.5 km to the south.

The surficial geology is shown to consist of organic deposits over much of the Site Study Area. The southwestern corner indicates clay, silty clay and silt.

The portion of the Site Study Area located along Boyne Road is presently being used as a landfill. The southern half is primarily woodlot with the exception of the southwestern corner, which is an agricultural field.

9.7.1.3 Previous Archaeology and Known Archaeology Sites

The Ministry of Heritage, Sport, Tourism and Cultural Industries’ (MHSTCI’s) Archaeological Report Database was searched on July 8, 2021, for previous archaeological assessments completed within 50 m of the Site Study Area. Although the archaeological report database did not show any archaeological assessments within 50 m, Golder’s archaeological report database indicates CARF (1992) conducted a Stage 1 archaeological assessment for a proposed water transmission main. One of six proposed routes followed Boyne Road and appears to pass within 50 m of the present Site Study Area (Figure 9-17). CARF identified this route as having low archaeological potential for historical and Indigenous archaeological resources.



LEGEND

STUDY AREA

REFERENCE(S)

1. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: MTM ZONE 9

0 250 500 1,000

1:25,000 METRES

CLIENT

TOWNSHIP OF NORTH DUNDAS

PROJECT

INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE

1908 TOPOGRAPHIC MAP

CONSULTANT

GOLDER
MEMBER OF WSP

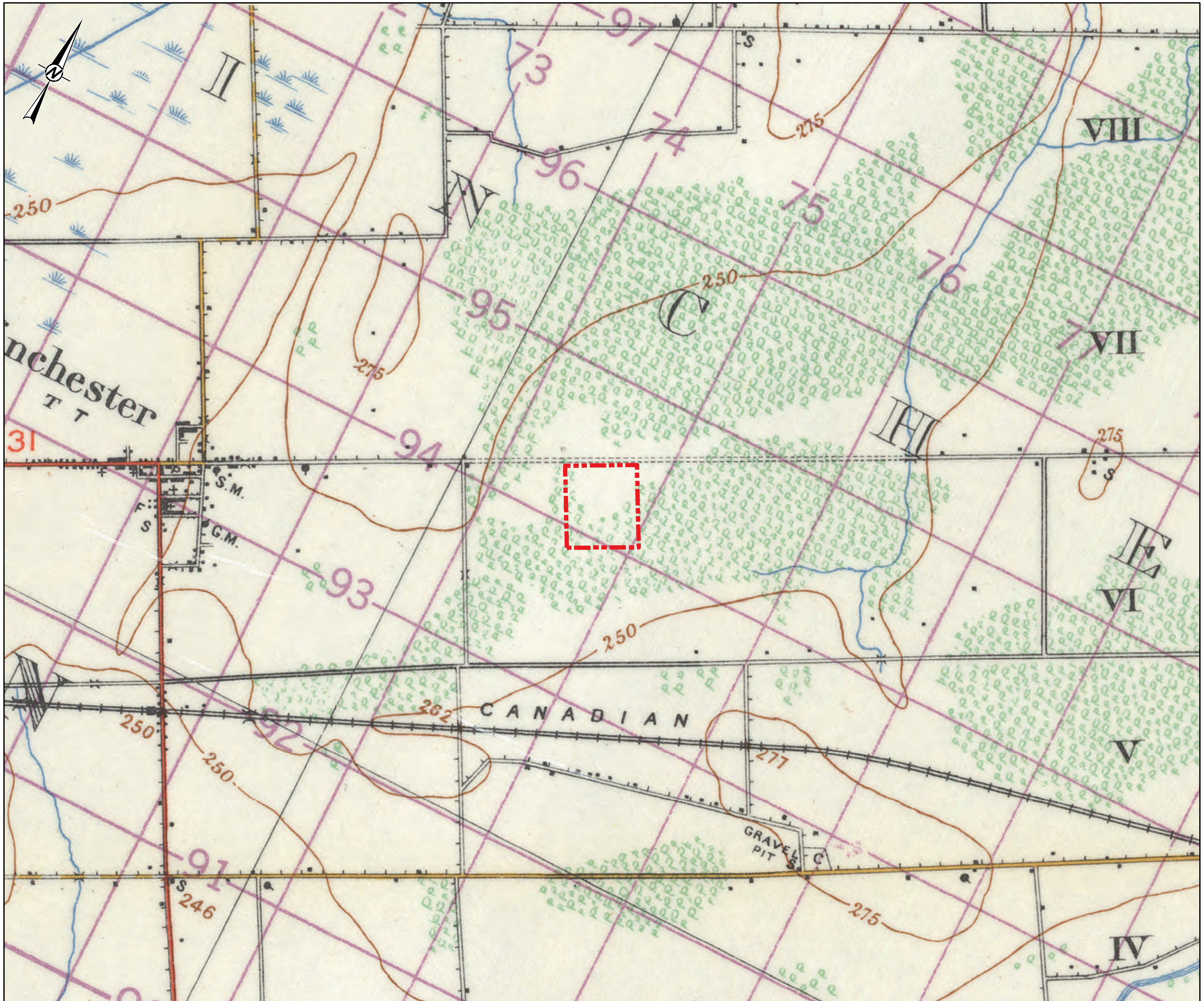
YYYY-MM-DD	2022-02-01
DESIGNED	----
PREPARED	JEM
REVIEWED	RH
APPROVED	AM

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	0	**9-14**

Path: N:\Active\Spatial_IM\Township_of_North_Dundas\BoyneRoadLandfill\99_PROJ\1648253\40_PROD\Phase_2.0_Task_2.1.8 Arch\1648253-2218-HA-9-14.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:

25mm



LEGEND

STUDY AREA

REFERENCE(S)

1. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: MTM ZONE 9

0 250 500 1,000

1:25,000 METRES

CLIENT

TOWNSHIP OF NORTH DUNDAS

PROJECT

INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE

1933 TOPOGRAPHIC MAP

CONSULTANT

GOLDER MEMBER OF WSP

YYYY-MM-DD	2022-02-01
DESIGNED	----
PREPARED	JEM
REVIEWED	RH
APPROVED	AM

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	0	**9-15**

LEGEND

STUDY AREA

REFERENCE(S)
1. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: MTM ZONE 9

0 100 200 400
1:10,000 METRES

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
AERIAL PHOTOGRAPHS

CONSULTANT

GOLDER MEMBER OF WSP

YYYY-MM-DD	2022-02-01
DESIGNED	----
PREPARED	JEM
REVIEWED	RH
APPROVED	AM

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	0	9-16

Path: N:\Active\Spatial_IM\Township_of_North_Dundas\BoyneRoadLandfill\99_PROJ\1648253\40_PROD\Phase_2.0_Task_2.1.8 Arch\1648253-2218-HA-9-16.mxd

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25mm

0

LEGEND

- WATERCOURSE
- ROADWAY
- STAGE 1 ARCHAEOLOGICAL ASSESSMENT (CARF 1992; 92-65) - APPROXIMATE LOCATION
- STUDY AREA

REFERENCE(S)

1. LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2014
2. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: MTM ZONE 9 VERTICAL DATUM: CGVD28

0 40 80 160

1:4,000 METRES

CLIENT

TOWNSHIP OF NORTH DUNDAS

PROJECT

INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE

PREVIOUS ARCHAEOLOGICAL ASSESSMENTS WITHIN 50 M

CONSULTANT

GOLDER MEMBER OF WSP

YYYY-MM-DD	2022-02-01
DESIGNED	----
PREPARED	JEM
REVIEWED	RH
APPROVED	AM

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	0	9-17

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:

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Other archaeological assessments conducted within the vicinity of the Site Study Area have been limited. CARF (1997, 2000) conducted Stage 1 and 2 archaeological assessments for a new 7 km long sewage system running from an existing sewage lagoon located northeast of the Village of Winchester to the South Nation River. A portion of the sewage system corridor followed Belanger Road located approximately 600 m to the west of the Site Study Area. More recently, a Stage 1 and 2 archaeological assessment (P027-125-2011) and Stage 2 archaeological assessment (P052-0753-2016) were conducted for the Mighty Solar Farm located over 5 km to the east.

The primary source of information regarding known archaeological sites in the MHSTCI archaeological sites database. The database was consulted on July 8, 2021, which indicated there are no registered archaeological sites located within 1 km of the Site Study Area.

9.7.1.4 Stage 1 Site Inspection

A visual inspection of the Site Study Area was conducted on July 14, 2021, under PIF P1107-0045-2021.

The northern half of the Site Study Area consists of the existing Boyne Road Landfill (Figures 9-18 to 9-20). Much of this area has been impacted by activities associated with the landfill and is surrounded by large earthen berms that separate the landfill from the surrounding land (Figure 9-21).

Figure 9-18: Entrance to the Boyne Road Landfill, view southeast. The large berm that surrounds the landfill is behind the sign on the left.

Figure 9-19: View northeast showing conditions within the landfill. The entire landfill footprint has been disturbed and contains no archaeological potential.

Figure 9-20: View southwest showing conditions within the Boyne Road Landfill.

Figure 9-21: One of the large berms that surround the landfill portion of the Site Study Area, view northeast.

On the west end of the Site Study Area there is an old gravel road that leads to the south end of the property (Figure 9-22). This road appears to have been artificially raised above the neighbouring farmland, likely using soils from a drainage ditch that runs alongside much of the road (Figure 9-23). This ditch which also runs through the center of the Site Study Area, just south of the boundary of the existing landfill, is the existing landfill perimeter ditch and does not correspond to any water sources shown on the historical plans or topographic maps and thus reflects modern drainage patterns.

Figure 9-22: An overgrown road located along the western edge of the Site Study Area, view southeast. The road is artificially raised above the neighbouring farmland. A large berm runs parallel to the left, separating the road from the landfill.

Figure 9-23: Perimeter drainage ditch running through the Site Study Area, view northeast.

The southern half of the Site Study Area is mostly woodlot (Figures 9-24 to 9-26) with the southwest corner consisting of agricultural fields (Figure 9-27). The southern portion of the Site Study Area contains several abandoned 20th century vehicles and other modern waste

(Figures 9-28 to 9-30). These modern garbage piles are likely associated with the 20th century use of the agricultural fields to the south.

Figure 9-24: Field conditions within the wood lot located at the southern end of the Site Study Area, view north.

Figure 9-25: Field conditions within the wood lot located at the southern end of the Site Study Area, view northwest.

Figure 9-26: Open meadow area located south of the present landfill boundaries, view southeast.

Figure 9-27: Agricultural field located in the southwest corner of the Site Study Area, view southeast.

Figure 9-28: 20th century garbage pile located in the southeast portion of the Site Study Area, view southeast

Figure 9-29: Abandoned trailer located near the southeast corner of the Site Study Area, view southeast.

Figure 9-30: Abandoned bus located within the southeast portion of the Site Study Area, view southeast

Another modern drain is located along the eastern edge of the Site Study Area (again part of the existing landfill perimeter ditch), which has created wet conditions within the northeast corner (Figure 9-31). Background research indicates that these conditions date to the construction of the drains sometime after 1972.

Figure 9-31: Wet field conditions caused by modern drainage in the northeast corner of the Site Study Area, view southeast.

9.7.2 Built Heritage Resources and Cultural Heritage Landscapes

The scope of this evaluation of existing conditions follows guidance outlined in the MHSTCI Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes checklist (2016). For the purposes of the evaluation, the Site-vicinity Study Area constitutes all property parcels within or crossed by the 500 m boundary around the Site Study Area as well as all adjacent properties (Figure 8-1).

9.7.2.1 Key Legislation and Policies

In Ontario, several provincial and municipal policies and legislation guide identifying, protecting, and managing cultural heritage resources.

9.7.2.1.1 Environmental Assessment Act

The *Environmental Assessment Act* (EAA) was legislated to ensure that Ontario's environment is protected, conserved, and wisely managed. Under the EAA, "environment" includes not only natural elements such as air, land, water and plant and animal life, but also the "social, economic and cultural conditions that influence the life of humans or a community", and "any building, structure, machine or other device or thing made by humans".

9.7.2.1.2 *Planning Act* and Provincial Policy Statement

The Ontario *Planning Act* (1990b) and associated Provincial Policy Statement 2020 (PPS, 2020) mandate heritage conservation in land use planning. Under the *Planning Act*, conservation of "features of significant architectural, cultural, historical, archaeological or scientific interest" are a "matter of provincial interest" and integrates this at the provincial and municipal levels through the PPS 2020. Issued under Section 3 of the *Planning Act*, PPS 2020 recognizes that cultural heritage and archaeological resources "provide important environmental, economic, and social benefits", and that "encouraging a sense of place, by promoting well-designed built form and cultural planning, and by conserving features that help define character, including built heritage resources and cultural heritage landscapes" supports long-term economic prosperity (PPS, 2020:6,22).

The importance of identifying and evaluating built heritage and cultural heritage landscapes is recognized in two policies of PPS 2020:

- Section 2.6.1 – *Significant built heritage resources* and *significant cultural heritage landscapes* shall be *conserved*.
- Section 2.6.3 – Planning authorities shall not permit *development* and *site alteration* on *adjacent lands* to *protected heritage property* except where the proposed *development* and *site alteration* has been evaluated and it has been demonstrated that the *heritage attributes* of the *protected heritage property* will be *conserved*.

Each of the italicized terms is defined in Section 6.0 of PPS 2020, with those relevant to this report provided below:

- **Adjacent lands**: for the purposes of policy 2.6.3, those lands contiguous to a *protected heritage property* or as otherwise defined in the municipal official plan.
- **Built heritage resource**: means 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. *Built heritage resources* are located on property that may be designated under Parts IV or V of the Ontario *Heritage Act* (Ontario, 1990c), or that may be included on local, provincial, federal and/or international registers.
- **Conserved**: means the identification, protection, management and use of built heritage resources, cultural heritage landscapes and archaeological resources in a manner that ensures their cultural heritage value or interest is retained. This may be achieved by the implementation of recommendations set out in a conservation plan, archaeological assessment, and/or heritage impact assessment that has been approved, accepted or adopted by the relevant planning authority and/or decision-maker. Mitigative measures and/or alternative development approaches can be included in these plans and assessments.
- **Cultural heritage landscape**: means 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. Cultural heritage landscapes may be properties that have been determined to have cultural heritage value or interest under the Ontario *Heritage Act*; or have been included in on federal and/or international registers, and/or protected through official plan, zoning by-law, or other land use planning mechanisms.
- **Development**: means the creation of a new lot, a change in land use, or the construction of buildings and structures requiring approval under the *Planning Act*.
- **Heritage attributes**: the principal features or elements that contribute to a protected heritage property's cultural heritage value or interest, and may include the property's built, constructed, or manufactured elements, as well as natural landforms, vegetation, water features, and its visual setting (e.g., significant views or vistas to or from a protected heritage property).
- **Protected heritage property**: property designated under Parts IV, V or VI of the Ontario *Heritage Act*; property subject to a heritage conservation easement under Parts II or IV of the Ontario *Heritage Act*; property identified by the Province and prescribed public bodies as provincial heritage property under the Standards and Guidelines for Conservation of Provincial Heritage Properties; property protected under federal legislation, and UNESCO World Heritage Sites.

- **Significant**: means, in regard to cultural heritage and archaeology, 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*.

The definition for *significant* includes a caveat that "while some significant resources may already be identified and inventoried by official sources, the significance of others can only be determined after evaluation." The criteria for significance established by the Province as well as the need for evaluation is outlined in the following section. Municipalities implement PPS 2020 through an official plan, which may outline further heritage policies.

9.7.2.1.3 Ontario Heritage Act and Ontario Regulation 9/06

The Ontario *Heritage Act* (OHA) enables the Province and municipalities to conserve significant individual properties and areas. For municipalities, Part IV and Part V of the OHA enables councils to "designate" individual properties (Part IV), or properties within a heritage conservation district (Part V) as being of Cultural Heritage Value or Interest (CHVI). Evaluation for CHVI under the OHA (or significance under PPS 2020) is guided by *O. Reg. 9/06*, which prescribes the "criteria for determining cultural heritage value or interest". *O. Reg.* 9/06 has three categories of absolute or non-ranked criteria, each with three sub-criteria:

1) The property has ***design value or physical value*** because it:
    i) Is a rare, unique, representative or early example of a style, type, expression, material or construction method
    ii) Displays a high degree of craftsmanship or artistic merit, or
    iii) Demonstrates a high degree of technical or scientific achievement.
2) The property has ***historic value or associative value*** because it:
    i) Has direct associations with a theme, event, belief, person, activity, organization, or institution that is significant to a community
    ii) Yields, or has the potential to yield information that contributes to an understanding of a community or culture, or
    iii) Demonstrates or reflects the work or ideas of an architect, artist, builder, designer, or theorist who is significant to a community.
3) The property has ***contextual value*** because it:
    i) Is important in defining, maintaining or supporting the character of an area
    ii) Is physically, functionally, visually or historically linked to its surroundings, or
    iii) Is a landmark.

A property needs to meet only one criterion of *O. Reg.* 9/06 to be considered for designation under Part IV of the OHA. If found to meet one or more criterion, the property's CHVI is then described with a Statement of Cultural Heritage Value or Interest that includes a brief property description, a succinct statement of the property's cultural heritage significance, and a list of its heritage attributes.

In the OHA heritage attributes are defined slightly differently to the PPS 2020 and directly linked to real property; therefore, in most cases a property's CHVI applies to the entire land parcel, not just individual buildings or structures.

Once a municipal council decides to designate a property, it is recognized through by-law and added to a ''Register'' maintained by the municipal clerk. A municipality may also ''list'' a property on the Register to indicate it as having potential cultural heritage value or interest.

9.7.2.2 Scope and Method

The scope for a cultural heritage screening assessment is outlined in the MHSTCI *Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes: A Checklist for the Non-Specialist* (2016; the MHSTCI *Checklist*). The MHSTCI Checklist provides a tool to identify from desktop sources all known or recognized cultural heritage resources in a study area, as well as commemorative plaques, cemeteries, Canadian Heritage River watersheds, properties with buildings 40 or more years old, or potential cultural heritage landscapes. Since cultural heritage is linked to real property under the *OHA*, the desktop analysis included all parcels within or crossed by the study area boundaries.

To complete the MHSTCI Checklist, Golder undertook the following tasks:

- **Task 1**: review of available desktop sources for aerial imagery, historical maps, federal, provincial, and municipal heritage registers, inventories and/or databases. These sources include:
  - Canadian Register of Historic Places (https://www.historicplaces.ca/en/pages/about-apropos.aspx)
  - Parks Canada Directory of Federal Heritage Designations (http://www.pc.gc.ca/apps/dfhd/search-recherche_eng.aspx) and Directory of Heritage Railway Stations (https://www.pc.gc.ca/en/culture/clmhc-hsmbc/pat-her/gar-sta/on)
  - Canadian Heritage Rivers System list of designated heritage river systems (https://chrs.ca/en)
  - Ontario Heritage Trust (OHT) Places of Worship Inventory (https://www.heritagetrust.on.ca/en/places-of-worship/places-of-worship-database/search), Plaque Database (http://www.heritagetrust.on.ca/en/online-plaque-guide), web mapping tool showing OHT Buildings and Easements (https://www.heritagetrust.on.ca/en/index.php/property-types/buildings), and OHT Register (https://www.heritagetrust.on.ca/en/oha/basic-search)

  - Ontario Historical County Maps Project web mapping application (http://utoronto.maps.arcgis.com/apps/webappviewer/index.html?id=8cc6be34f6b54992b27da17467492d2f)
  - Historical Topographic Map Digitization Project (Ontario Council of University Libraries, main page: https://ocul.on.ca/topomaps/collection/)
  - 20th century aerial imagery accessed from the University of Toronto Map and Data Library (https://mdl.library.utoronto.ca/collections/air-photos/1954-air-photos-southern-ontario/index)
  - Google Street View©
- **Task 2**: consult planning staff at the Township of North Dundas to inquire if local registers and/ or inventories exist as well as identify additional data sources.
- **Task 3**: identify and map all known (i.e., designated, listed, inventoried) and potential built heritage resources and cultural heritage landscapes within and adjacent to the study area, and recommend further studies based on the MHSTCI Checklist.

9.7.2.3 Existing Conditions

9.7.2.3.1 Overview of Existing Conditions

Tasks 1 to 3 identified within the Site and Site-vicinity Study Area:

- No listed or designated built heritage resources or cultural heritage landscapes
- No properties with buildings or structures 40 or more years old of potential CHVI
- No potential cultural heritage landscapes

The completed MHSTCI Checklist and supplementary documentation for this analysis are provided in Volume 2 Appendix G-1.

9.7.2.3.2 Record of Engagement

Table 9-16 lists the results of consultation with planning staff at the Township of North Dundas as well as building, easement and plaque management staff at the OHT.

Table 9-16: Results of Engagement

Contact	Information Request	Response Received
Calvin Pol Director of Planning, Building and Enforcement, Township of North Dundas	Query sent via email 22 July 2021 to inquire if the Township had any heritage registers or inventories (preliminary or draft) they would be able to share at this time and/ or if the Township was aware of any built heritage or cultural heritage landscape concerns within or adjacent to the Site-vicinity Study Area.	Response received via email 26 July 2021 providing a copy of the Counties' *Official Plan* and confirming no built heritage or cultural heritage landscapes within or near the Site-vicinity Study Area.
Kevin DeMille Natural Heritage Coordinator, Designated Contact for Trust Property and Easements Requests, Ontario Heritage Trust	Query sent via email 22 July 2021 to confirm if the OHT's *Places of Worship Inventory*, *Plaque Database*, web mapping tool of OHT Buildings and Easements, and OHA *Register* were up to date as well as inquire if the OHT had any additional cultural heritage concerns within or near the Site-vicinity Study Area.	Response received via email 28 July 2021 confirming OHT's *Places of Worship Inventory*, *Plaque Database*, web mapping tool of OHT Buildings and Easements, and OHA *Register* were up to date and that OHT was not aware of any additional cultural heritage concerns within or near the Site-vicinity Study Area.

9.8 Socio-economic

The socio-economic environment relates to the following assets in a community:

- Social assets: e.g., housing, recreational facilities, tourist attractions.
- Natural assets: e.g., parks, trails, watercourses and open spaces.
- Economic assets: e.g., businesses, industry, employment.
- Infrastructure assets: e.g., roads, waste management, utilities.
- Institutional assets: e.g., schools, hospitals, care homes, emergency services.

In addition, for landfill expansion projects, visual considerations are an important component to be considered.

The Boyne Road Landfill site is located in the Township of North Dundas and is located approximately 2 km east of the main Village of Winchester. The Village of Chesterville is located about 6.5 km southeast of the Site Study Area. Due to its closer proximity, the Village of Winchester is more likely to experience positive or negative effects related to landfill expansion and hence moving forward the Village of Winchester is discussed; however, the Village of Chesterville is not discussed.

The existing conditions noted in this section cover the immediate area surrounding the landfill site and the wider community. For the purposes of the assessment, the study area for local economy and residents and community is defined as the area within 500 m of the Site Study Area.

The socio-economic environment can be affected by expanded landfill operations in a number of different ways including potential changes to the population, effects to municipal finances, changes to employment opportunities, nuisance effects such as increased noise, odour or vermin (e.g., rats and gulls), effects to traffic and roads as well as visual impacts.

This section documents the baseline socio-economic environment in terms of the assets mentioned above as well as detailing current landfill operations and any known related issues in the community.

9.8.1 Local Economy

The Township of North Dundas is considered an “agri-food cluster” with many agriculture related businesses including Natunola, Sevita, Horst Equipment, Advanced Drainage Systems, SynAgri, Tri-County Protein, Agri-Partners as well as large farm equipment dealers selling Massey Ferguson, CASE IH, New Holland, John Deere and other brands (SDG, 2020).

The labour force participation rate in Winchester in 2015 was 59.1%, this is slightly lower than the average for Ontario (64.7%); however, the unemployment rate of 4.4% is lower than the provincial average of 7.4%. This is likely due to the older population who are retired. The average household income in Winchester in 2015 was $75,596, which is lower than the average for Ontario ($97,856). Healthcare, public administration and retail are the most common industry sectors for local residents (Statistics Canada, 2016).

Major employers in the area include the Winchester District Memorial Hospital (approximately 450 employees), and Lactalis Canada (approximately 180 employees) (SDG, 2020).

9.8.2 Residents and Community

9.8.2.1 Residences and Businesses

The landfill site is located in a mainly agricultural setting with few residences or notable features in the immediate vicinity. There are no existing residences within 500 m of the landfill boundary; the closest existing residence is on Boyne Road and is approximately 0.7 km west of the landfill. There are 6 existing residences found between 700 m and 1 km of the landfill.

The area is defined by agricultural operations and there are no businesses located within 500 m of the Site Study Area. To the east of the Site Study Area there are some farm operations and industrial operations (CNK Ag-Tech is approximately 2 km away and services farm machinery). The Village of Winchester is approximately 2 km west of the Site Study Area boundary and has a number of residences and business operations including shops, offices and restaurants.

9.8.2.2 Population

The population of the Township and the existing landfill's nearest neighbouring community, the Village of Winchester were discussed in Section 5.8 and are approximately 11,700 and 2,400, respectively. The average age in the community is 48.5 years which is older than the average age for Ontario as a whole (41); the number of residents aged 85 years or more is also higher than the provincial average (5.6% compared to 2.2%).

9.8.2.3 Institutional and Community Facilities

Winchester is a small community but is well served by institutional and community facilities. The Winchester District Memorial Hospital is a teaching hospital recently renovated and provides important care to the community and surrounding areas. The Dundas Manor Long Term Care Home is found on the same site as the hospital. In terms of schools, Winchester Public School is the only school in the village, the closest high school is North Dundas District High School. Winchester has a Fire Department located on Clarence Street. There is also a paramedic post located south of the town that is managed by Cornwall SDG Paramedic Service (City of Cornwall, 2020). The community is served by the Ontario Provincial Police who have a detachment located on Lawrence Street.

The Joel Steele Community Centre is located in downtown Winchester and includes the Winchester skating club and an outdoor swimming pool and the Winchester 100 club park which features a skate park, children's play areas and a pavilion and picnic area. The Winchester Curling Club is located opposite the community centre.

Other notable community features are:

- Winchester Public Library
- Winchester Lions' club
- Places of worship including Westminster United Pastoral Charge, Southgate Church and Bethany Chapel

The downtown area of Winchester hosts many retail outlets, restaurants, banks, a pharmacy and a post office providing important services and consumer goods for local people.

9.8.2.4 Existing Landfill Operations

The Boyne Road Landfill has been in operation since 1965 and is estimated to have approved disposal capacity to operate through 2023 and into 2024. It is the only municipal landfill site available for residents and businesses in the township. The landfill site is only authorized to accept waste from residents and businesses within the Township of North Dundas. The landfill site also has a waste recycling facility that is used for receipt of metals, plastics, cardboard and newspapers that are then sent elsewhere for processing, a tire recycling program, a household hazardous waste depot and an electrical and electronic equipment waste depot.

A survey of the full landfill footprint was completed in both December 2015 and December 2020; a comparison of the full landfill surface between 2015 and 2020 indicates an average annual fill rate of approximately 16,200 m^3 per year. In 2019, the Township reported that approximately 478 tonnes of recyclable materials were collected or dropped-off (Volume 3 Appendix J) and reported a diversion rate of 23%.

The landfill and other facilities at the site (recycling, diversion, etc.) currently employs two staff.

The Boyne Road Landfill currently costs $55,000 per year to operate, including salaries and excluding capital costs and hauling contracts.

No complaints related to the landfill site were received in past year (Golder, 2020).

9.8.3 Visual

9.8.3.1 Methodology

A technical review of publicly available biophysical, regulatory and cultural data relating to visual aesthetics within the Site-vicinity Study Area was completed to prepare a baseline description of the current visual landscape character. Landscape character evaluation uses information about the visual landscape to determine distinct patterns of physical elements that distinguish areas from one another. The description of landscape character focuses on the nature of these elements and their combination to express visual aesthetic assets, including scenic quality. The assessment methodology used in this study is based on components of the Guidelines for Landscape and Visual Impact Assessment (LI/IEMA, 2013) and the USDI Visual Resource Management System (USDI, 1986), as well as professional judgment and experience from conducting previous visual impact assessments.

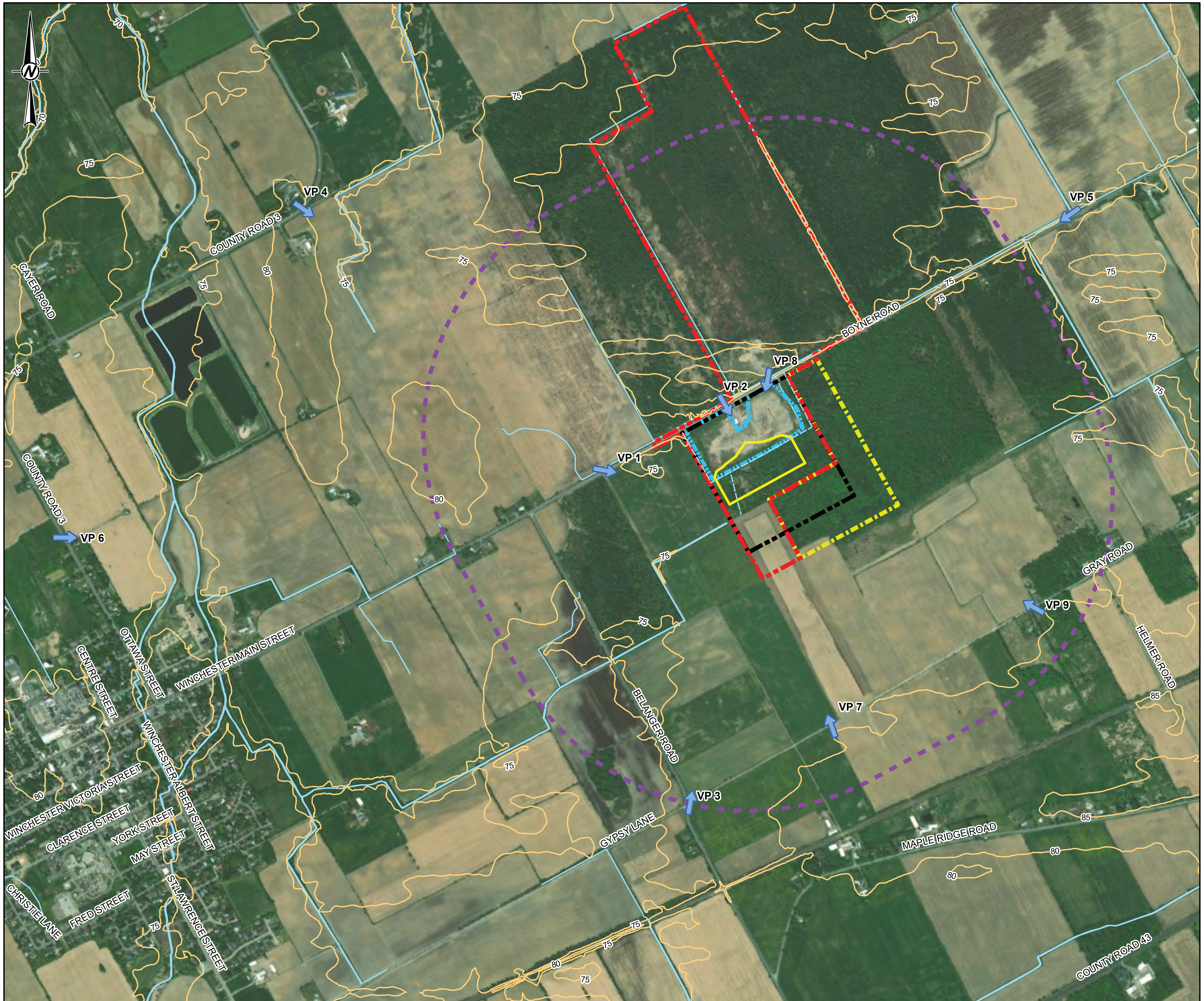
The baseline study used several data sources, including ecoregion, landcover, land use and topographic data available from the MNRF, as well as Bing and ESRI Imagery. Regulatory information (e.g., the Zoning By-Law) was obtained from the Township of North Dundas and the SDG. Spatial data was used in a geographic information system (GIS) to conduct a viewshed analysis to determine potential representative public receptor locations for viewing the undertaking within 1 km[1] of the Site Study Area.

[1] 1 km represents a foreground viewing distance that provides for a discernible level of visual detail to be perceived (USDI, BLM 1986).

The following existing conditions are also based on the baseline study and on photographic field reconnaissance undertaken on November 23, 2018, November 6, 2019, and April 7, 2020 from selected potential public receptor viewpoint locations (Figure 9-32). Field photographs were taken in the late fall or early spring during leaf-off conditions to demonstrate maximum visibility of the proposed undertaking or worst-case scenario conditions.

9.8.3.2 Existing Conditions

The landscape character within the Wider Study Area can be defined as semi-rural with agricultural features being predominant, as depicted in Figure 9-33. The landform is generally a uniform and open configuration interspersed with natural features that include trees, shrubs, wetlands and watercourses. The Township is located in Ecoregion 6E (Lake Simcoe – Rideau) where the majority of the landcover is cropland, pasture or abandoned fields with a small percentage of water (Crins et al. 2009). The Township is located in the Upper St. Lawrence section of the Great Lakes – St. Lawrence Forest Region, which contains a wide variety of both coniferous and deciduous species (Rowe 1972) that are interspersed throughout agricultural fields as wood lots, hedge rows or vegetation corridors. Built structures include roads, communication towers, power lines and poles, fences, and buildings.



LEGEND

- VIEWPOINT LOCATION AND DIRECTION
- TOPOGRAPHIC CONTOUR, metres
- INTERMITTENT WATERCOURSE
- WATERCOURSE
- PROPOSED LIMIT OF WASTE FOR THE LANDFILL EXPANSION AREA
- EXISTING LANDFILL FILL AREA
- SITE STUDY AREA
- TOWNSHIP OWNED PROPERTY
- APPROXIMATE PROPERTY BOUNDARY OF LANDFILL SITE
- 1 km VISUAL STUDY AREA

NOTE(S)
1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)
1. LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2014
2. SERVICE LAYER CREDITS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY
3. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: MTM ZONE 9 VERTICAL DATUM: CGVD28

0 150 300 600
1:15,000 METRES

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
VISUAL STUDY AREA AND KEY VIEWPOINT LOCATIONS

CONSULTANT

GOLDER
MEMBER OF WSP

YYYY-MM-DD	2022-02-01
DESIGNED	PJM
PREPARED	JEM
REVIEWED	PAS
APPROVED	---

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.1.11	A	9-32

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:

Ecoregion 6E is underlain by limestone bedrock (Chapman et al., 1984) and interspersed with drumlin fields and moraines. The local surface form is classified as level and the soils are primarily mineral-based and dominated by greyish brown coloured Melanic Brunisols (Soils Landscape of Canada v3.2).

Figure 9-33: Taken November 6, 2019 from County Road 3 (Viewing South East from Viewpoint 4 on Figure 9-32)

The Village of Winchester is located approximately 2 kilometres west of the Site Study Area. Some residences along the eastern boundary of the town may be able to view the existing landfill. Farms and residences along Maple Ridge Road have a view towards the existing landfill site from the south, although that view may be screened by the forested land in the south corner of the landfill property.

The landscape within the Site-vicinity Study Area consists of relatively flat terrain. The overall topographic relief across the Site-vicinity Study Area indicated by topographic mapping (Figure 9-32) shows that the ground surface ranges in elevation from approximately 75 masl in the northwest to 80 masl in parts of the southeast. The existing landfill rises to a maximum height of approximately 12 m above the surrounding terrain and is partially visible behind a row of trees from vantage points to the northwest, west and southwest. Views of the existing landfill from the east and southeast are obscured by the forested land adjacent to the eastern and southeastern side of the Site Study Area. The Land north of Boyne Road is predominantly forested and offers visual screening from further to the north.

The existing landfill is most visible to motorists and pedestrians that are travelling east along Boyne Road, as depicted in Figure 9-34 from viewpoint 1. The landfill can be seen across the field and is partially visible through a row of trees along the western property boundary. The landfill is also partially visible through trees and buildings when passing the main entrance on Boyne Road and from the snowmobile trail that runs along the north side of Boyne Road. The existing landfill is not at all visible from viewpoint 9 and is partially visible from viewpoints 3 and 7 (refer to Figure 9-32) along Gray Road located about 1 km south of the existing disposal area.

Figure 9-34: Taken April 7, 2020 from Boyne Road (Viewing East from Viewpoint 1 on Figure 9-32)

There are currently no objectives or guidelines present in current land use planning policy or regulation in the SDG Official Plan related to visual quality or visual aesthetics.

9.9 Transportation

Potential transportation components include both roadway traffic and aircraft. The Boyne Road Landfill is located 36 km from the Ottawa International Airport and 24 km from the Rideau Valley Air Park (aerodrome); in view of these separation distances, consideration of and potential effects on aircraft are not relevant to the proposed expansion of the Boyne Road Landfill site. The transportation component therefore includes only roadway traffic.

9.9.1 Traffic

The Boyne Road Landfill site is located along the south side of Boyne Road approximately 2 km east of the Village of Winchester. The roadway system is illustrated on Figure 9-35, which is provided below.

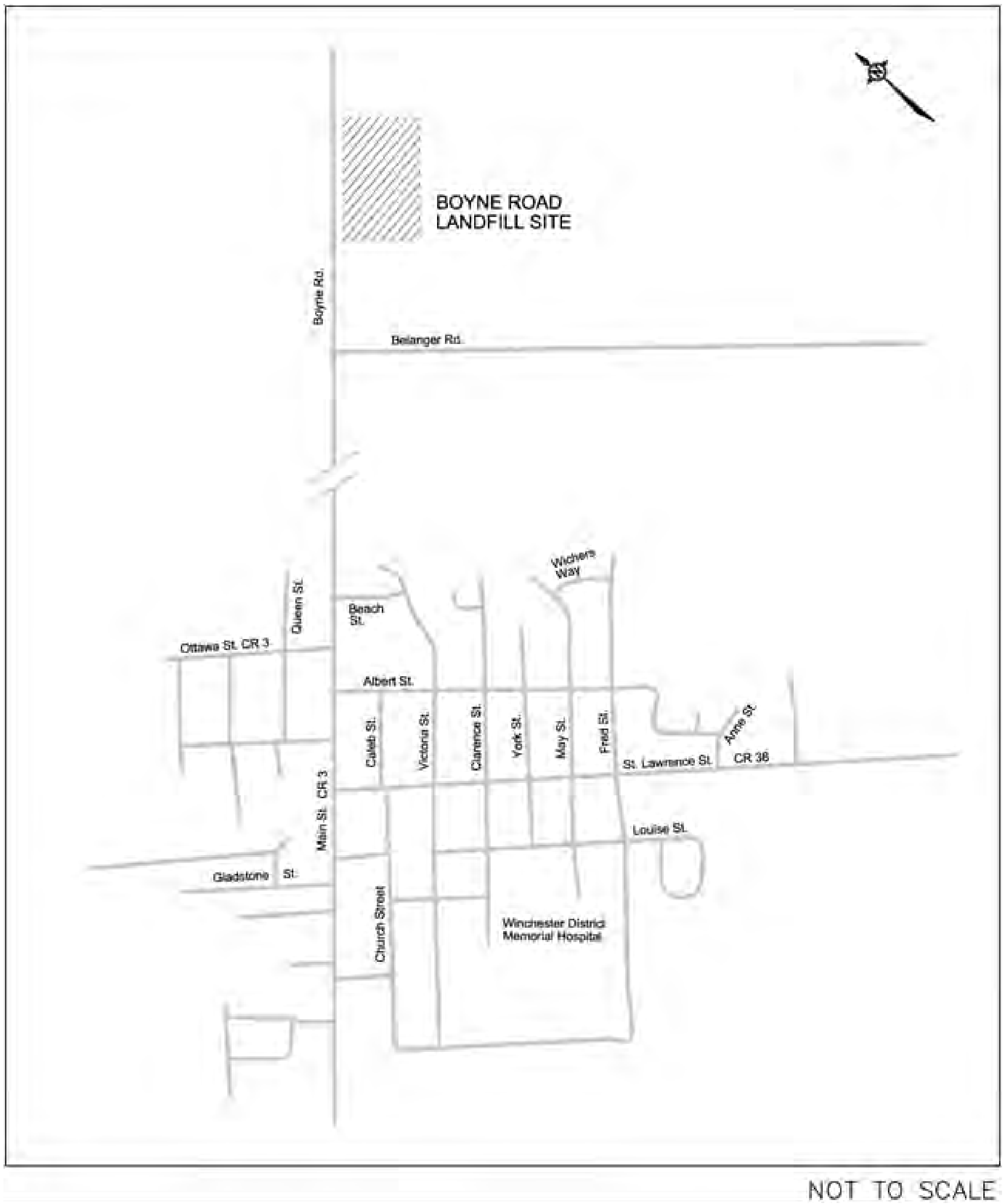


Figure 9-35: Roadway System near Boyne Road Landfill Site

From a traffic perspective, the roads and intersections relevant to the landfill site are described below.

Roadways

Boyne Road (Main Street) – The landfill site is located along Boyne Road. Boyne Road is an east-west arterial road under the jurisdiction of the Township of North Dundas. The road travels between the Village limit of Winchester to the west and County Road 7 (CR 7) to the east, a length of approximately 8.6 km. Boyne Road is a rural road with a 7.2 m paved surface and gravel shoulders. The speed limit is posted at 80 km/h.

Main Street – Main Street travels through the Village of Winchester connecting to the west limit of Boyne Road. Main Street (CR 3) is under the jurisdiction of the SDG from CR 31 to the west, connecting to and travelling north along Ottawa Street east of the village core. Main Street has an urban cross section, which changes to a rural cross section as it extends towards the village limit. The street has a sidewalk on the north side of the road which terminates at Ottawa Street, and a sidewalk on the south side which extends to the urban limit of the road. The speed limit along Main Street is posted at 50 km/h.

St. Lawrence Street – St. Lawrence Street (CR 38) is a north-south arterial road under the jurisdiction of the SDG. The street is located 2.8 km west of the Boyne Road Landfill site. St. Lawrence Street has an urban cross section with sidewalks on both sides of the roadway and extends south through the village from Main Street. The posted speed limit is 50 km/h.

County Road 7 – CR 7 is a north-south rural road under the jurisdiction of the SDG. The road is located 6.6 km east of the Boyne Road Landfill site. CR 7 has a paved surface with gravel shoulders with a posted speed limit of 80 km/h.

Intersections

Access/Boyne Intersection – The site access and Boyne Road is a “T” intersection with the access to the landfill representing the northbound approach to the intersection. The site access is a private approach with an implied stop. Boyne Road would form the eastbound and westbound approaches to the intersection. There are no exclusive turn lanes at any of the approaches to the intersection. The intersection will be analyzed as a two-way stop-controlled intersection. The intersection has the following lane configuration:

Northbound Access	One shared left/right turn lane (Implied stop)
Eastbound Boyne Road	One shared through/right lane
Westbound Boyne Road	One shared left/through lane

An aerial photograph of the site access/Boyne Road intersection obtained from Google Mapping is shown below as Figure 9-36.

Figure 9-36: Aerial Photograph of Boyne Road/Landfill Site Access Intersection

St. Lawrence/Main Intersection – The intersection of St. Lawrence Street and Main Street within the Village of Winchester is a “T” intersection controlled by all-way stop signs. The intersection is located 2.8 km west of the landfill access onto Boyne Road. An aerial photograph of the St. Lawrence/Main intersection obtained from Google Mapping is shown below (Figure 9-37). All approaches are a single lane with no exclusive turn lanes. The intersection has the following lane configuration along with an aerial photograph of the intersection.

Northbound St. Lawrence St.	One shared left/right turn lane (stop sign)
Eastbound Main Street	One shared through/right lane (stop sign)
Westbound Main Street	One shared left/through lane (stop sign)

Figure 9-37: Aerial Photograph of St. Lawrence/Main Intersection

CR 7/Boyne Intersection – The intersection of CR 7 and Boyne Road is located 6.6 km east of the landfill access. The intersection is a two-way stop-controlled intersection with stop signs placed at the eastbound Boyne Road and westbound Connaught Road approaches. There are no exclusive turn lanes at any of the approaches to the intersection, which has the following lane configuration:

Northbound CR 7	One shared left/through/right lane
Southbound CR 7	One shared left/through/right lane
Eastbound Boyne Road	One shared left/through/right lane (stop sign)
Westbound Connaught Rd.	One shared left/through/right lane (stop sign)

An aerial photograph of the CR 7/Boyne intersection obtained from Google Mapping is shown below (Figure 9-38).

Figure 9-38: Aerial Photograph of CR-7/Boyne Intersection

Peak Hour Traffic

The peak hour traffic was determined from counts taken by the project team at the Access/Boyne intersection on September 9, 2021, and at the St. Lawrence/Main and CR 7/Boyne intersections on September 14, 2021. Figure 9-39 shows the 2021 peak hour traffic counts with a count summary table presented in Volume 2 Appendix H as Exhibit 1 for the Access/Boyne intersection, Exhibit 2 the St. Lawrence/Main intersection, and Exhibit 3 the CR 7/Boyne intersection.

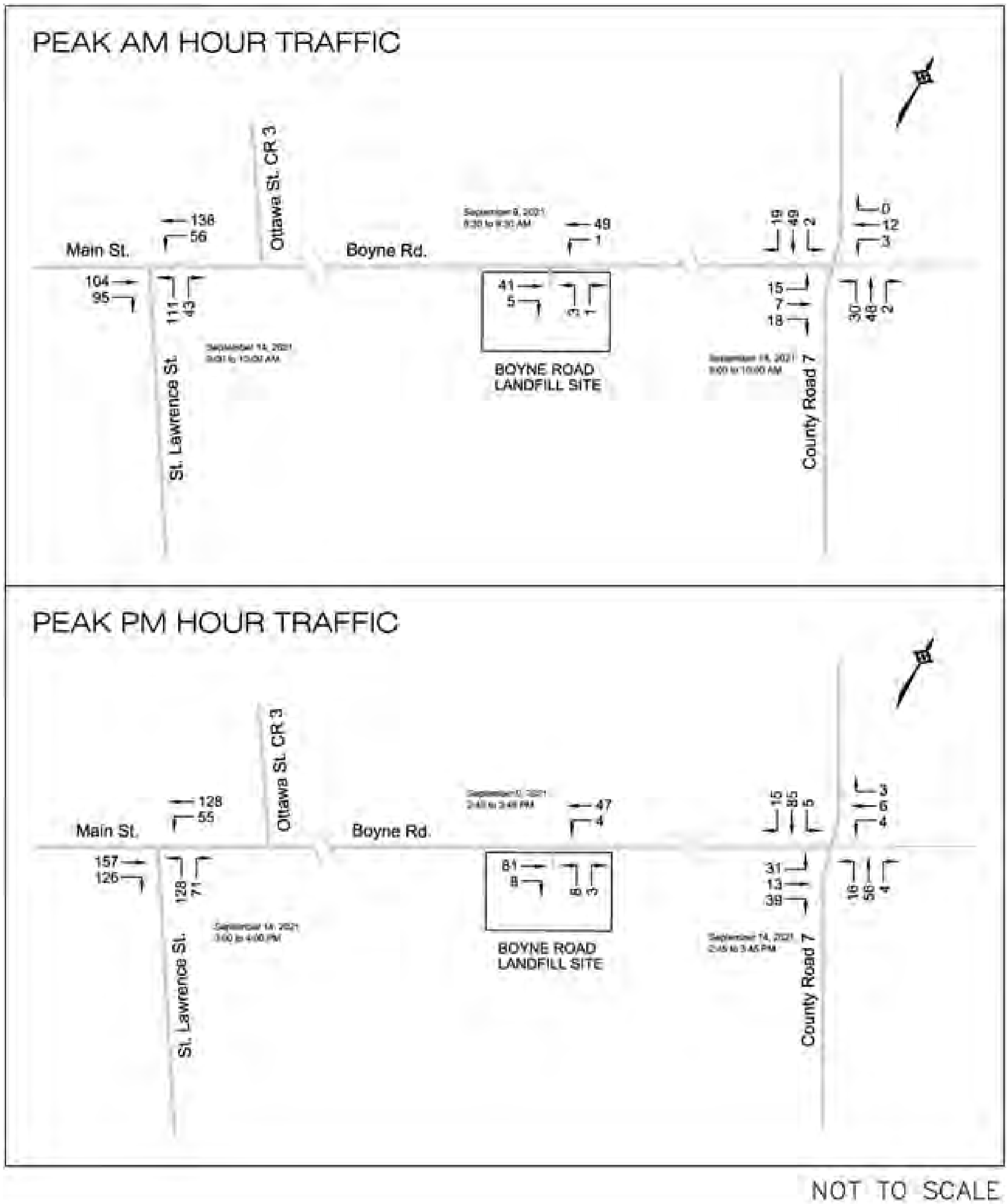


Figure 9-39: 2021 Peak AM AND PM Hour Traffic Counts

Routes for Recycling and Collection

The Boyne Road Landfill facility accepts waste and recyclables from the communities of Winchester, Chesterville, Morewood, Inkerman and South Mountain, plus the rural area within the Township of North Dundas. The truck routes to the major communities have already been established and are the shortest and most convenient routes along County roads. The major route not designated as a County road is Boyne Road where the landfill facility is located. Boyne Road stretches from the Village of Winchester to County Road 7. Figure 9-40, shows the collection route for both waste and recyclables.

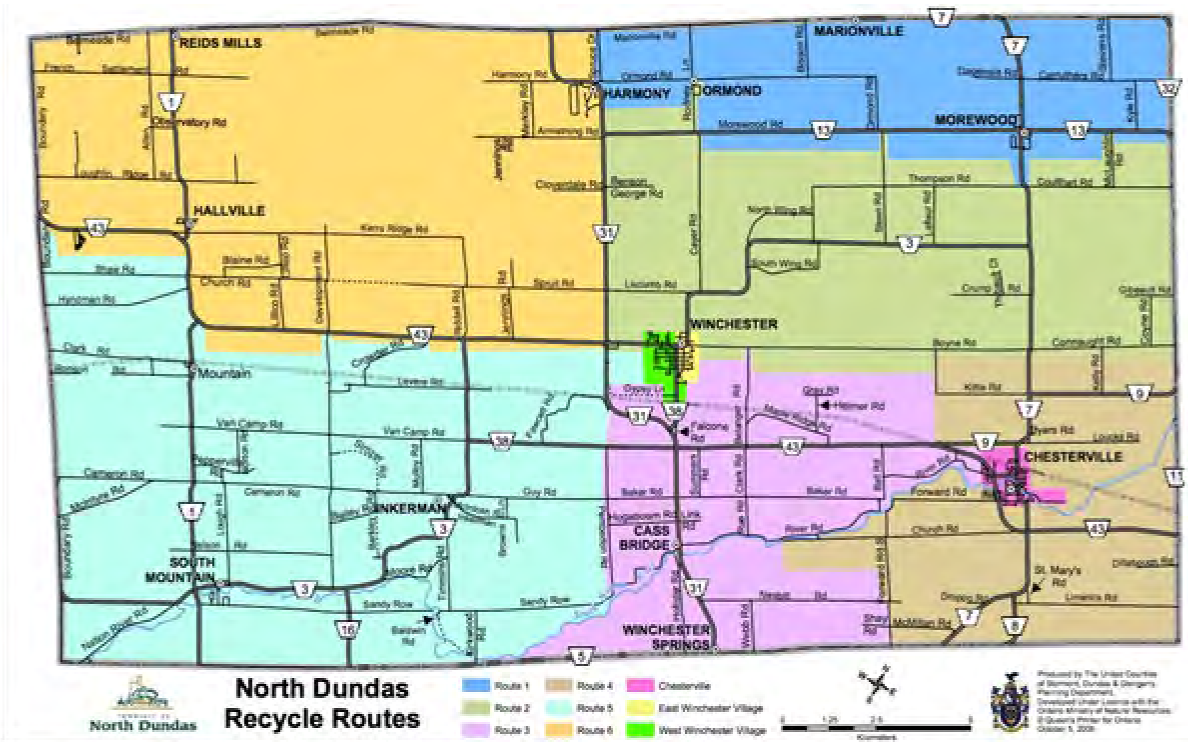


Figure 9-40: Waste Collection Route Map

As described above, the traffic counts taken at the St. Lawrence/Main and CR 7/Boyne intersections were conducted on Tuesday, September 14, 2021. Tuesday is the day for the collection of waste and recyclables by municipal trucks for Routes 1 and 2, which includes the communities of Morewood, Inkerman and South Mountain. Traffic counts at the site access were taken on Thursday, September 9, 2021, and would include municipal trucks collecting waste and recyclables in the Chesterville and East Winchester areas.

Some of the waste and recycling material is dropped off by contractors by truck or trailer, which would travel from the construction site to the landfill facility. These routes would vary depending on the location of the construction site. Alternate truck routes would not be as efficient and may have greater impact on the surrounding area compared to the established routes.

9.10 Design and Operations

The Design and Operations component comprises the design and operation of the Boyne Road Landfill site. The operations at the site are approved under ECA No. A482101. As described in Section 1.3, the landfill site has been operational since 1965 and is the only operational waste disposal site in the Township, receiving all the residential and some of the IC&I waste from the entire Township. In addition to the landfill, the material recycling facility, the HHW and WEEE transfer station are located in the north central portion of the site on the south side of Boyne Road. All recyclables (metal, plastic, paper, cardboard) collected within the Township are taken here then transferred to a recycling facility located outside of the Township.

The Boyne Road Landfill currently has an approved disposal area of 8.1 ha within an overall landfill property (consisting of the original disposal area and the addition of a number of parcels of adjoining land between 1992 and 2018) of approximately 97.1 ha. The Township has also acquired an additional 16.2 ha of property immediately to the east and southeast of the landfill property. In addition to the landfill property, the Township has acquired groundwater easements on adjacent properties (referred to as Contaminant Attenuation Zone). These areas are shown on Figure 1-2.

The landfill currently has an approved waste disposal capacity of 643,050 m^3. Over the past ten years, the annual fill rate ranges from approximately 10,400 to 18,900 m^3 per year (with one higher fill rate in 2017), with an average annual fill rate of approximately 16,200 m^3 per year.

The landfill operates from 8 a.m. to 4 p.m., Monday through Friday plus one hour before, i.e., 7 a.m. to 8 a.m., for site preparation and one hour after, i.e., 4 p.m. to 5 p.m. to complete placement of daily cover. The site also operates Saturday from 8 a.m. to 12 p.m. May through November and only one Saturday a month from 8 a.m. to 12 p.m. November through May. The site is closed on Sunday.

The approved landfill footprint is C-shaped (around the diversion facilities). The disposal area design has for the most part 4 horizontal: 1 vertical (4H:1V) sideslopes and a top deck area with a 5% slope to provide drainage. The sequence of landfilling follows an approved phasing plan. The final contour design has two peak areas at a height of approximately 12.5 m above the adjacent ground level. Runoff from the disposal area is controlled by a perimeter ditch on the west, south and east sides that discharges to the off-site municipal drain network.

The existing landfill site is a natural attenuation landfill, without an engineered bottom liner and leachate collection system. Compliance of the landfill with the applicable requirements for protection of off-site groundwater quality relies on natural processes in the subsurface. An annual monitoring program, consisting of groundwater and surface water monitoring, is part of the current landfill site operations. The results of the 2020 monitoring program (Golder, 2021) indicate that with respect to protection of off-site groundwater quality, the landfill is operating in compliance with the MECP Reasonable Use Guideline (MECP, 1994). Surface water quality in the often-stagnant water within the drainage ditch along the north side of Boyne Road that receives surface water runoff from the landfill site is interpreted to experience discontinuous marginal impacts by landfill leachate but is generally in compliance with provincial surface water management policies and relevant CWQG.

In addition, the site has not received complaints about nuisance effects off-site, i.e., dust, odour, noise).

10.0 Description of and Rationale for the ‘Alternative Methods’ of Landfill Expansion

This section describes the ‘Alternative Methods’ for expansion of the Boyne Road Landfill site. ‘Alternative Methods’ are the different ways that the proposed expansion of the Boyne Road Landfill could be implemented to gain an additional 25 years of disposal capacity. As described in the approved ToR Supporting Document #1 Waste Management Alternatives Evaluation (Golder, 2015), two conceptual design options were considered in that preliminary assessment for the location of a landfill expansion. The first was on the existing landfill site property on the south side of Boyne Road; a landfill footprint expansion at this location would be adjacent to the south side of the existing disposal area. The second was to establish a new landfill footprint within a portion of the large property on the north side of Boyne Road that is used for snow disposal and is part of the landfill buffer zone.

The subsurface conditions and groundwater flow system associated with the existing landfill had been investigated and were relatively well understood, whereas investigation work had not been done at the time and would have had to be initiated to understand the potential for developing a landfill on the property north of Boyne Road.

The subsurface information available on the north side of Boyne Road suggests that this area may be underlain by compressible peat soils, which would present a challenge and add costs to construction of a landfill to satisfy the *O.Reg.* 232/98 Landfill Standards requirements. Lastly, the Raisin-South Nation Source Water Protection Plan identifies a portion of the Township-owned property north of Boyne Road as within an area of the predicted groundwater capture zone of the Chesterville municipal wells and subject to the Source Protection policies.

For these reasons, it was proposed in the preliminary assessment of waste management alternatives that the landfill expansion be considered only on the existing landfill property on the south side of Boyne Road. This rationale is still valid for the evaluation of the ‘Alternative Methods’ as part of this Environmental Assessment.

Due to the physical constraints associated with the configuration of the existing waste footprint and its location on the existing landfill site property, the ‘Alternative Methods’ are limited to vertical expansion above the existing waste footprint and/or lateral expansion to the south within the landfill property and the Site Study Area (see Figure 8-1).

As described in Section 7.0 of this EASR, the updated projected residual waste from the existing service area from the end of 2020 to the end of the 25-year planning period has been confirmed. The corresponding airspace is 450,000 m^3beyond 2020, slightly more than described in the ToR. The design of the ‘Alternative Methods’ of expansion will therefore consider 450,000 m^3 of additional airspace beyond 2020, which corresponds to 417,700 m^3 for waste and daily cover beyond 2023.

In the development of the landfill expansion alternatives, site-specific factors were considered, consisting of: 1) site design requirements as set out in *O.Reg.* 232/98 Landfill Standards; 2) existing perimeter ditching; 3) conceptual mitigation measures for the landfill expansion; 4) anticipated stormwater management system requirements; and 5) potential visual impact from off-site. These are discussed further in Section 10.1.

10.1 Design of Expansion Alternatives

The following factors were considered in designing the expansion alternatives:

- The geometry of the landfill expansion is to follow the requirements of *O.Reg*. 232/98, i.e. landfill sideslopes of 4 Horizontal : 1 Vertical (4H:1V, 25 %) or flatter and landfill top area slopes not flatter than 20H:1V (5 %). It is noted that existing landfill conditions have some steeper portions on the south sideslopes at approximately 50 %. However, for all 'Alternative Methods', these sections would be covered by a vertical expansion. The final design would therefore follow the *O.Reg.* 232/98 requirements for minimum and maximum slopes.

- The existing landfill footprint of 8.1 hectares is not large enough to accommodate the required landfill airspace of 417,700 m^3 for waste and daily cover above the existing footprint while complying with the *O.Reg*. 232/98 requirements for minimum and maximum slopes. Therefore, all 'Alternative Methods' will require some amount of horizontal expansion of the waste footprint.

- The existing landfill has a narrow buffer along the east and west sides of the existing waste footprint between the existing approved limit of waste and the landfill site property boundary. For the expansion alternatives, the existing buffer width on the east and west side of the waste footprint will be increased for the horizontal expansion portion with a minimum buffer of 30 m. Since the Township owns land to the east and southeast that is not yet part of the landfill property, the minimum buffer width of 100 m recommended in *O.Reg.* 232/98 can be achieved for all 'Alternative Methods' to the east and southeast, if required (to accommodate perimeter landfill-related infrastructure, i.e., perimeter road, stormwater management system components, contingency measures, etc.).

- The existing Boyne Road Landfill operates as a natural attenuation site, where leachate generated by the landfill is allowed to enter into the groundwater below the disposal area and the leachate-impacted groundwater then moves in the direction of groundwater flow. The MECP Reasonable Use Guideline (RUG) B-7 (MOE, 1994) and *O.Reg.* 232/98 Landfill Standards define the allowable effects of leachate on off-site groundwater quality. At the Boyne Road Landfill, RUG compliance is achieved by having a large enough landfill site property and CAZ groundwater easements on adjacent lands that the leachate effects on groundwater quality are reduced to the allowable concentrations before the impacted groundwater reaches the boundaries of these properties. Nearby groundwater discharge to surface water in municipal drains can be mitigated if required. Due to high capital and operating costs associated with an engineered leachate collection and treatment system; constraints on the available capacity of Winchester and Chesterville communal sewage treatment systems in the Township, particularly in the winter months to accept landfill leachate; and in the absence of a receiving watercourse for treated effluent from an on-site leachate treatment facility that has year round flow, the only economically viable approach for the Township is to continue operating an expanded Boyne Road Landfill as a natural attenuation site, recognizing that it may be necessary for the Township to acquire additional property and/or CAZ easement agreements and monitor municipal drains.

- As described in Section 9.2, the subsurface conditions generally consist of surficial topsoil/peat overlying a silty sand/sandy silt glacial till and then limestone bedrock at depths ranging from about 1.5 to 9 mbgs. The groundwater table is quite flat, and groundwater flow from the landfill area is to both the north/northwest and south/southwest at a slow rate estimated at about 4 m/yr. The seasonally high groundwater table in the Site Study Area (see Figure 8-1) is essentially at ground surface. The MECP Landfill Standards require a minimum separation of 1 m between the high groundwater table and the base of the waste. Therefore, the different ‘Alternative Methods’ need to include the construction of an approximately 1 m thick pad of imported permeable fill material (for example, sandy material) above the ground surface (stripped of its thin layer of topsoil) to provide a base for waste disposal. The use of permeable fill will also allow the leachate to infiltrate into the groundwater system while minimizing the potential for both the development of a leachate mound within the waste and lateral leachate seeps at the perimeter of the expanded disposal area footprint.

- It is noted that the current landfill property is located within an area of the Chesterville WHPA currently identified as vulnerable. The Chesterville Water Supply is obtained from a high-capacity overburden well located some 3 km southeast from the Boyne Road Landfill. This portion of the WHPA has been assigned a vulnerability score of 4. Landfills licensed for municipal and IC&I waste are only considered a significant threat in the Chesterville WHPA for scores of 8 or higher. As such, the area south of the current waste footprint considered for the different ‘Alternative Methods’ is not listed as a significant drinking water threat in the Raisin-South Nation Source Water Protection (SWP) Plan (SNC, 2016a), or considered as such under the application of the SWP policies. The issue of source water protection will be assessed for the preferred expansion alternative as related to potential groundwater impacts (see Section 13.2).

- To reduce the contaminating lifespan of the landfill, it is anticipated that a permeable final cover design approach will be used for the preferred ‘Alternative Method’. This final cover would consist of 600 mm of soil and 150 mm of topsoil or other material suitable to support vegetation, as set out in *O.Reg.* 232/98.

- Stormwater runoff from the expanded landfill will be managed by a stormwater management system. Drainage off the north part of the existing landfill site is currently directed towards Boyne Road while the remainder of the landfill site drains to the constructed perimeter ditch around the west, south and east sides of the disposal area. The perimeter ditch outlets directly (without any quality or quantity control) via an existing culvert at the northeast corner of the landfill property to the roadside ditch on the north side of Boyne Road. During the continuing operations phase of the expanded landfill and post-closure, it is proposed that stormwater runoff from the landfill will continue to be collected by grass-lined ditches, but will be directed to a stormwater management facility (pond or wetland) located at the northeast corner of the landfill. The depth of the pond or wetland excavation will be limited to the existing grades in the area, to limit the possibility of interception of groundwater potentially impacted by leachate. The stormwater run-off from the pond or wetland will discharge via the existing culvert into the roadside ditch on the north side of Boyne Road into Volks Municipal Drain. This municipal drainage ditch flows east and discharges into Black Creek, approximately 1.5 km east of the landfill. The stormwater management system will be designed to handle the design storms as per *O.Reg*. 232/98 and to remove total suspended solids (TSS) as per the MECP Guidelines; sizing will consider potential effects of climate change. Consideration will be given to a raised perimeter conveyance ditch around the expanded landfill footprint (leading to the pond or wetland) to limit the potential for impact from leachate-impacted groundwater discharge into the ditch, and so that collected runoff is from the landfill cover only and does not intercept stormwater runoff from adjacent areas.

- It is proposed to install a culvert in the roadside ditch along the north side of Boyne Road (Volks Municipal Drain) opposite the landfill site frontage. This measure would isolate and convey surface water past the landfill site from upstream (west) to downstream (east) and prevent leachate-impacted groundwater from seeping into the surface water in the ditch. With the culvert installed and provided with periodic seepage collars to prevent water movement along the granular bedding and backfill, the groundwater would continue northward as groundwater flow into the landfill buffer zone located north of Boyne Road and the approved CAZ easement, and site compliance would be evaluated by the groundwater RUG rather than effects on ditch surface water quality. This culvert replacement of the existing open ditch is illustrated on Figures 10-1, 10-3 and 10-5.

- With the capacity being pursued for the landfill expansion of 417,700 m^3 to accommodate landfilling operations until the end of the planning period in 2048, the estimated total site capacity for waste and daily cover is 1,060,750 m^3. As per *O.Reg.* 232/98, there is no requirement for a landfill site of this capacity to include a landfill gas collection and control system and it is not proposed to be included in the preferred 'Alternative Method'. Considering the high water table that is almost at ground surface in the Site Study Area, no significant off-site migration of landfill gas is expected and the majority of landfill gas generated at the site is expected to vent through the landfill cover soils. Methane detectors are in place at on-site buildings and are expected to be maintained throughout the operating period. In addition, there are no existing structures in the Site-vicinity Study Area (refer to Figure 8-1).

- Waste diversion activities related to recycling, WEEE and HHW are expected to continue operating at their current location near the site entrance, in the north central part of the site.

10.2 'Alternative Methods' for Landfill Expansion

Based on the above factors, three 'Alternative Methods' for expansion of the Boyne Road Landfill were developed. These alternatives are referred to as:

- Alternative 1 – Combined Horizontal and Vertical Expansion with Larger East and West Buffers
- Alternative 2 – Combined Horizontal and Vertical Expansion with Larger South Buffer
- Alternative 3 – Primarily Horizontal Expansion

The names for the expansion alternatives generally describe the configuration of the expansion and the way in which the expansion achieves the majority of additional airspace.

The subsections below describe each of the landfill expansion alternatives, and each provides the required 417,700 m^3 of airspace for waste and daily cover. Unless stated otherwise, the elevations referred to are with regards to the top of waste and do not include the final cover (which as described previously is expected to be 0.75 m thick). Site plans and cross sections for each of Alternatives 1, 2 and 3 are shown on Figures 10-1 through 10-6. Table 10-1 provides a comparative summary of the 'Alternative Methods' of landfill expansion, as well as information on the currently approved landfill.

10.2.1 Alternative 1 – Combined Horizontal and Vertical Expansion with Larger East and West Buffers

An additional waste disposal capacity of approximately 417,700 m^3 could be achieved by a combination of raising the elevation over the current disposal area and tying this into the capacity achievable above the expanded footprint to the south, with the geometry satisfying the slope angle requirements of *O.Reg.* 232/98. The height of Alternative 1 is about 15 m above typical ground level on the southern part of the property.

For this 'Alternative Method', the horizontal expansion to the south provides a 100 m buffer to the east (in accordance with the buffer requirements of *O.Reg.* 232/98), 50 m to the west (a substantial increase from the current west buffer), approximately 44 m to the southeast end of the property and approximately 300 m to the southwestern end of the property. Refer to Figures 10-1 and 10-2.

As indicated earlier, the Landfill Standards also require a minimum separation of 1 m between the high groundwater table and the base of the waste. The high groundwater table in the area south of the existing disposal area is essentially at ground surface. Therefore, the design includes the construction of an approximately 1 m thick pad of imported permeable fill material (for example, sandy material) above the ground surface to provide a base for waste disposal. The lateral expansion footprint of this constructed base for this Alternative is approximately 3.9 ha.

10.2.2 Alternative 2 – Combined Horizontal and Vertical Expansion with Larger South Buffer

For this ‘Alternative Method’, an additional waste disposal capacity of slightly more than approximately 417,700 m^3 could be achieved by a combination of raising the elevation over the current disposal area and tying this into the capacity achievable above the expanded footprint to the south, with the geometry satisfying the slope angle requirements of O.Reg. 232/98. The buffer to the south was increased compared to Alternative 1 at the expense of the east buffer for the horizontal expansion. The horizontal expansion to the south still provides a 71 m buffer to the east, 34 m to the west, approximately 52 m to the southeast end of the property and approximately 309 m to the southwestern end of the property. Refer to Figures 10-3 and 10-4.

The lateral expansion footprint of the constructed base for this Alternative is approximately 4.5 ha. An approximately 1 m thick pad of imported permeable fill material above the ground surface will be required to provide a base for waste disposal.

The height of Alternative 2 is about 15 m above typical ground level on the southern part of the property.

10.2.3 Alternative 3 – Primarily Horizontal Expansion

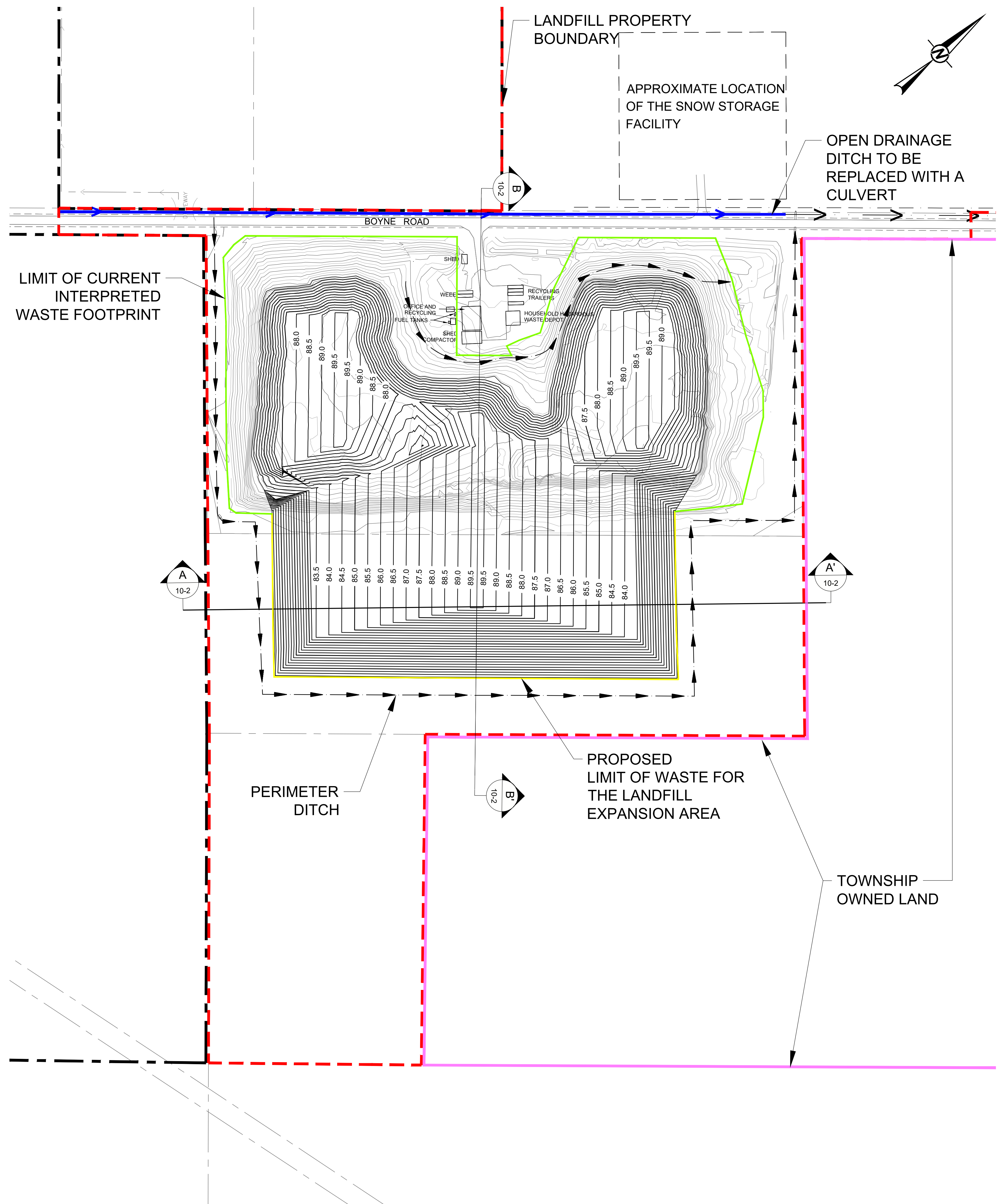
For this ‘Alternative Method’, the vertical expansion above the approved top of waste contours is limited to the southern half of the current footprint, tying it with the horizontal expansion to the south and its more elevated crest (the maximum height) is reached approximately 220 m south of Boyne Road (compared to less than 70 m for Alternatives 1 and 2). The geometry satisfies the slope angle requirements of O.Reg. 232/98. The horizontal expansion to the south provides a 100 m buffer to the east (in accordance with the buffer requirements of *O.Reg.* 232/98), 30 m to the west, approximately 57 m to the southeast end of the property and approximately 314 m to the southwestern end of the property. Refer to Figures 10-5 and 10-6.

The lateral expansion footprint of the constructed base for this Alternative is approximately 3.8 ha. An approximately 1 m thick pad of imported permeable fill material above the ground surface will be required to provide a base for waste disposal.

The height of Alternative 3 is about 15 m above typical ground level on the southern part of the property.

10.2.4 Alternative 4 – Do-Nothing

In EAs, the Do-Nothing alternative is considered as a benchmark against which the potential environmental impacts and the advantages and disadvantages of the alternatives being considered can be measured and compared. For the Township of North Dundas, the Do-Nothing alternative would be to close the Boyne Road Landfill when it reaches its approved capacity and not pursue any other solution for waste management for the Township. It is noted that one of the Township’s basic requirements as a municipality is to provide municipal services and infrastructure for its ratepayers. As such, the Do-Nothing alternative is not an ‘Alternative Method’ that could be considered to resolve the long-term waste management problem; rather, as stated above, it provides a basis of comparison as part of the EA process.



LEGEND

85.0	GROUND SURFACE CONTOURS (MASL), BASED ON RESULTS OF THE SURVEYS CONDUCTED IN 2008, 2010, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019 AND 2020
89.5	PROPOSED EXPANSION TOP OF WASTE ELEVATION CONTOURS (MASL)
	APPROXIMATE PROPERTY BOUNDARY OF LANDFILL SITE
	APPROXIMATE BOUNDARY OF EXISTING CONTAMINANT ATTENUATION ZONE EASEMENT LANDS
	APPROXIMATE LOCATION OF PROPOSED PERIMETER DITCH
	EXISTING ROADSIDE DITCH TO BE REPLACED WITH A CULVERT (APPROXIMATE LOCATION)
	ADDITIONAL LAND OWNED BY TOWNSHIP

NOT FOR CONSTRUCTION

DRAFT

REFERENCE(S)

1. BASE PLAN SUPPLIED IN ELECTRONIC FORMAT BY STANTEC CONSULTING LTD.
2. 2008 AND 2010 SURVEYS COMPLETED BY STANTEC CONSULTING LTD.
3. MAY 2012, JULY 2013, NOVEMBER 2014, DECEMBER 2015, NOVEMBER 2016, DECEMBER 2017, DECEMBER 2018 AND NOVEMBER 2019, APRIL 2020 AND DECEMBER 2020 SURVEYS COMPLETED BY GOLDER ASSOCIATES LTD.
4. COORDINATES SYSTEM: MTM ZONE 9 NAD83 DATUM CGVD28

0 50 100

1:3,000 METRES

CLIENT

TOWNSHIP OF NORTH DUNDAS

CONSULTANT

GOLDER MEMBER OF WSP

YYYY-MM-DD	2021-03-08
DESIGNED	YJM
PREPARED	ABD
REVIEWED	YJM
APPROVED	PAS

PROJECT

INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE

ALTERNATIVE 1 - COMBINED HORIZONTAL AND VERTICAL EXPANSION WITH LARGER EAST AND WEST BUFFERS SITE PLAN

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	A	10-1

25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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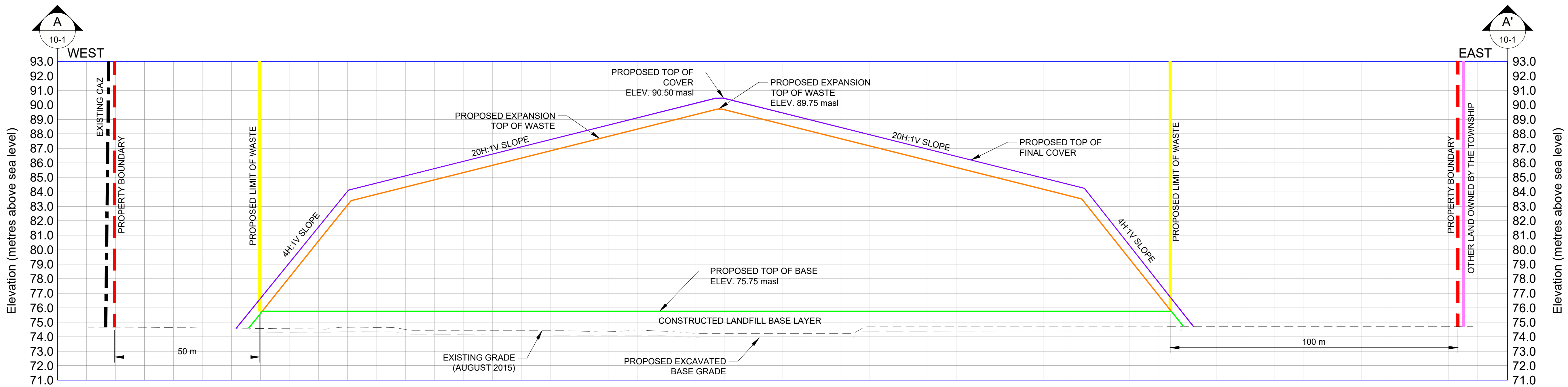

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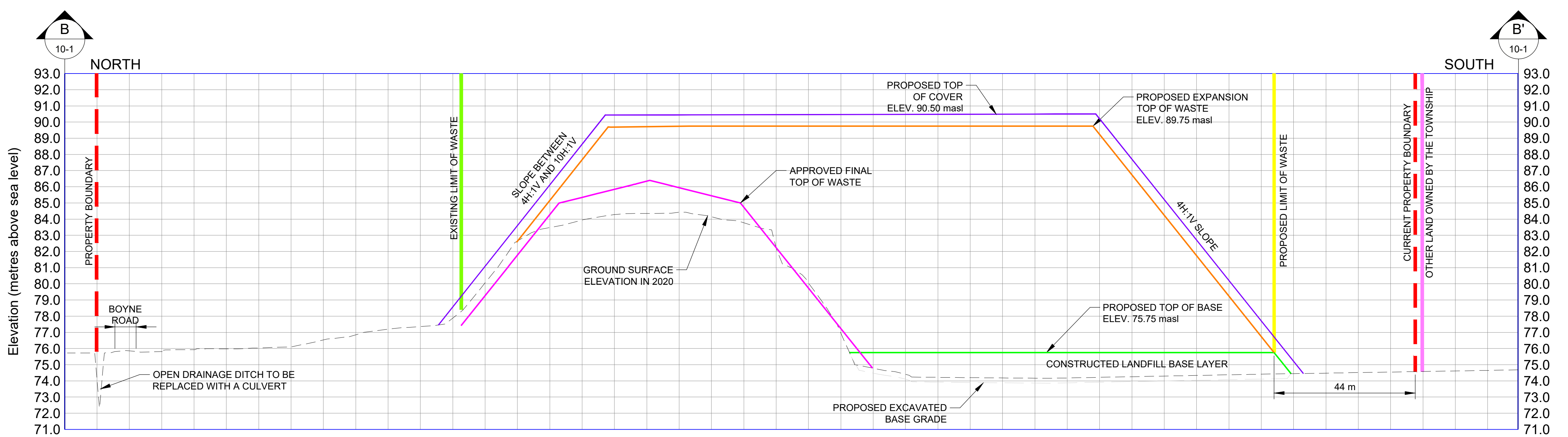
VERT. SCALE: 1:300 m 10-1



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VERT. SCALE: 1:300 m 10-1

0 25 50
1:1,500 HORIZONTAL SCALE METRES

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1:300 VERTICAL SCALE METRES

NOT FOR CONSTRUCTION

DRAFT

CLIENT
TOWNSHIP OF NORTH DUNDAS

CONSULTANT
GOLDER MEMBER OF WSP

YYYY-MM-DD	2021-03-08
DESIGNED	YJM
PREPARED	ABD
REVIEWED	YJM
APPROVED	PAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
ALTERNATIVE 1 - COMBINED HORIZONTAL AND VERTICAL EXPANSION WITH LARGER EAST AND WEST BUFFERS CROSS-SECTIONS

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	A	10-2

25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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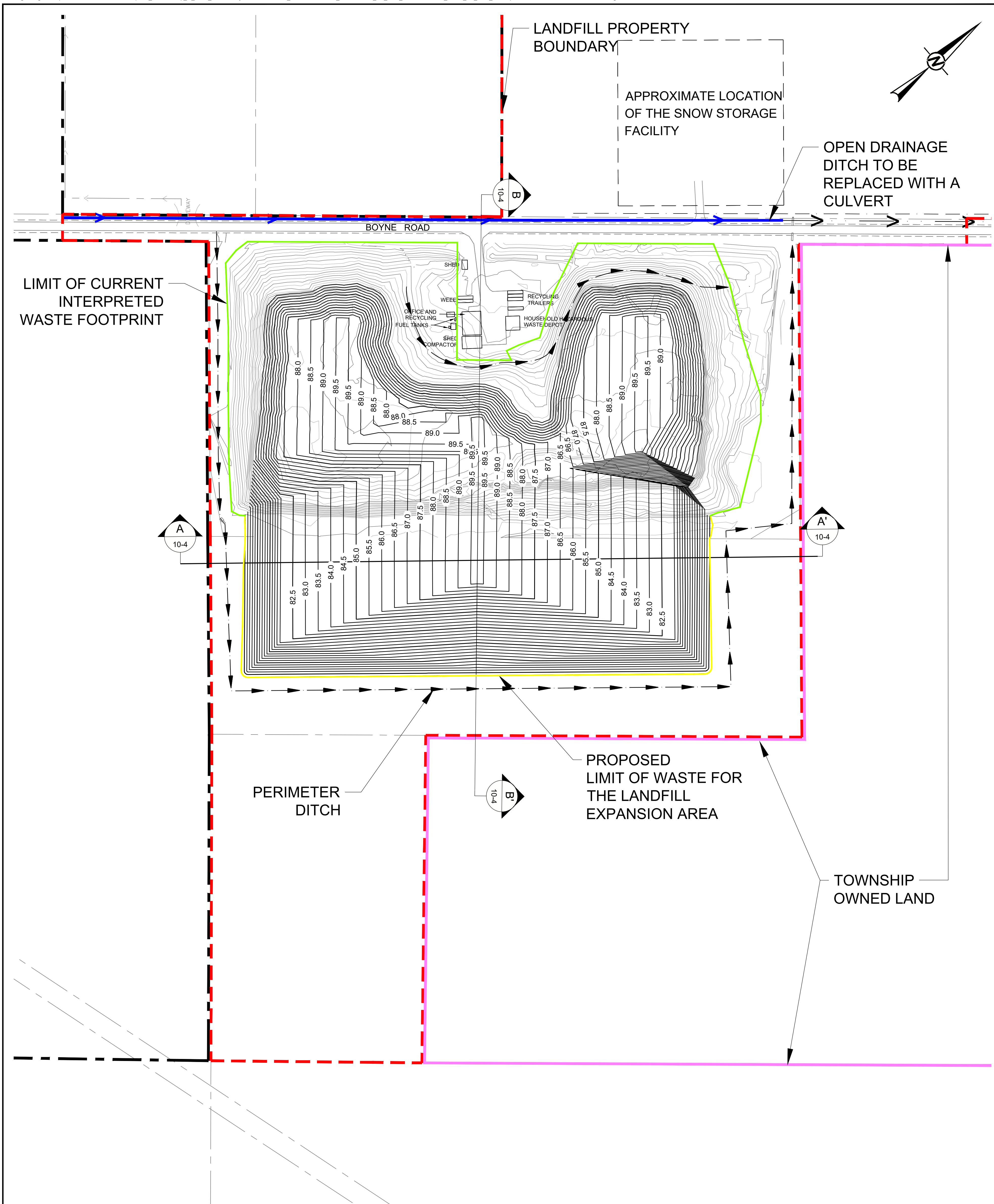

LEGEND

- 85.0 — GROUND SURFACE CONTOURS (MASL), BASED ON RESULTS OF THE SURVEYS CONDUCTED IN 2008, 2010, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019 AND 2020
- 89.5 — PROPOSED EXPANSION TOP OF WASTE ELEVATION CONTOURS (MASL)
- APPROXIMATE PROPERTY BOUNDARY OF LANDFILL SITE
- APPROXIMATE BOUNDARY OF EXISTING CONTAMINANT ATTENUATION ZONE EASEMENT LANDS
- APPROXIMATE LOCATION OF PROPOSED PERIMETER DITCH
- EXISTING ROADSIDE DITCH TO BE REPLACED WITH A CULVERT (APPROXIMATE LOCATION)
- ADDITIONAL LAND OWNED BY TOWNSHIP

REFERENCE(S)

1. BASE PLAN SUPPLIED IN ELECTRONIC FORMAT BY STANTEC CONSULTING LTD.
2. 2008 AND 2010 SURVEYS COMPLETED BY STANTEC CONSULTING LTD.
3. MAY 2012, JULY 2013, NOVEMBER 2014, DECEMBER 2015, NOVEMBER 2016, DECEMBER 2017, DECEMBER 2018 AND NOVEMBER 2019, APRIL 2020 AND DECEMBER 2020 SURVEYS COMPLETED BY GOLDER ASSOCIATES LTD.
4. COORDINATES SYSTEM: MTM ZONE 9 NAD83 DATUM CGVD28

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1:3,000 METRES

NOT FOR CONSTRUCTION

DRAFT

CLIENT	TOWNSHIP OF NORTH DUNDAS	PROJECT	INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN
CONSULTANT	GOLDER MEMBER OF WSP	TITLE	**ALTERNATIVE 2 - COMBINED HORIZONTAL AND VERTICAL EXPANSION WITH LARGER SOUTH BUFFER SITE PLAN**
YYYY-MM-DD	2021-01-25	PROJECT NO.	1648253
DESIGNED	ABD	PHASE/TASK	2.0/2.2.0
PREPARED	ABD	REV.	A
REVIEWED	YJM	FIGURE	10-3
APPROVED	PAS		

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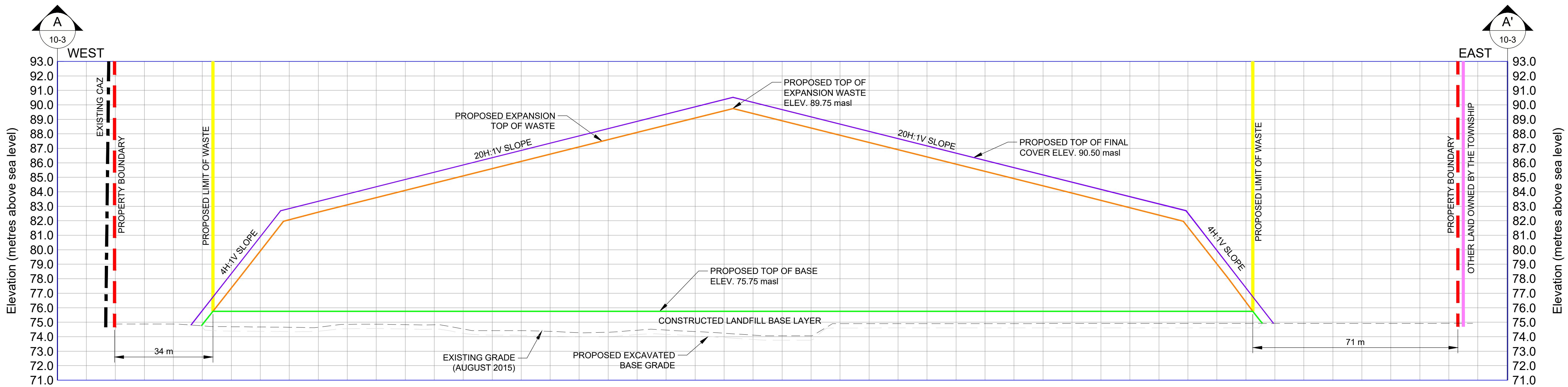

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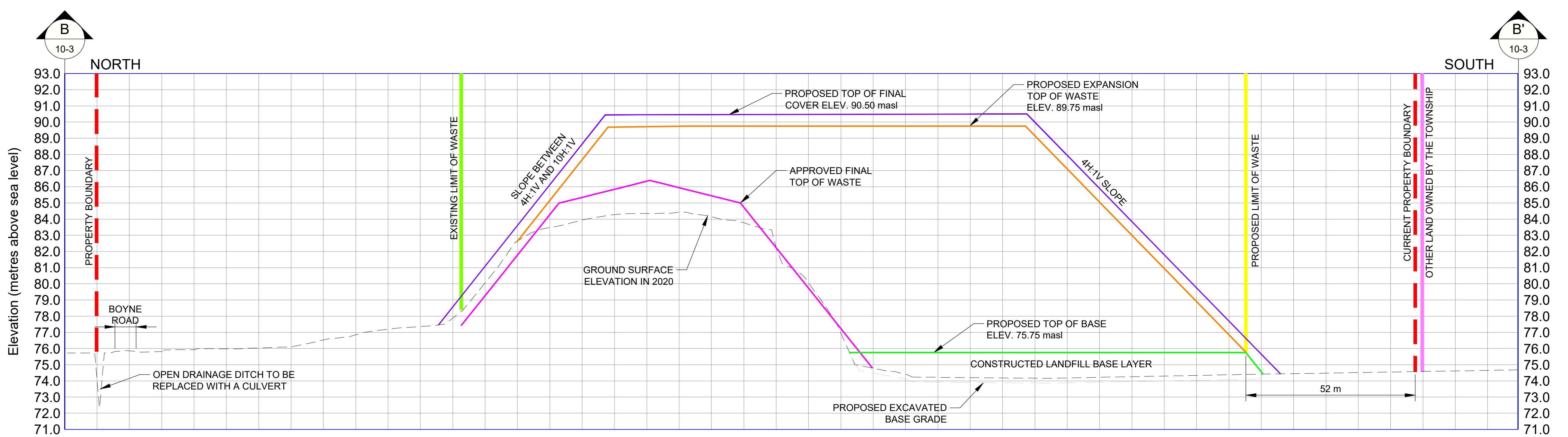
VERT. SCALE: 1:300 m 10-3



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VERT. SCALE: 1:300 m 10-3

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1:1,500 HORIZONTAL SCALE METRES

0 5 10
1:300 VERTICAL SCALE METRES

CLIENT
TOWNSHIP OF NORTH DUNDAS

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-01-25
DESIGNED	ABD
PREPARED	ABD
REVIEWED	YJM
APPROVED	PAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
ALTERNATIVE 2 - COMBINED HORIZONTAL AND VERTICAL EXPANSION WITH LARGER SOUTH BUFFER CROSS-SECTIONS

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	A	10-4

25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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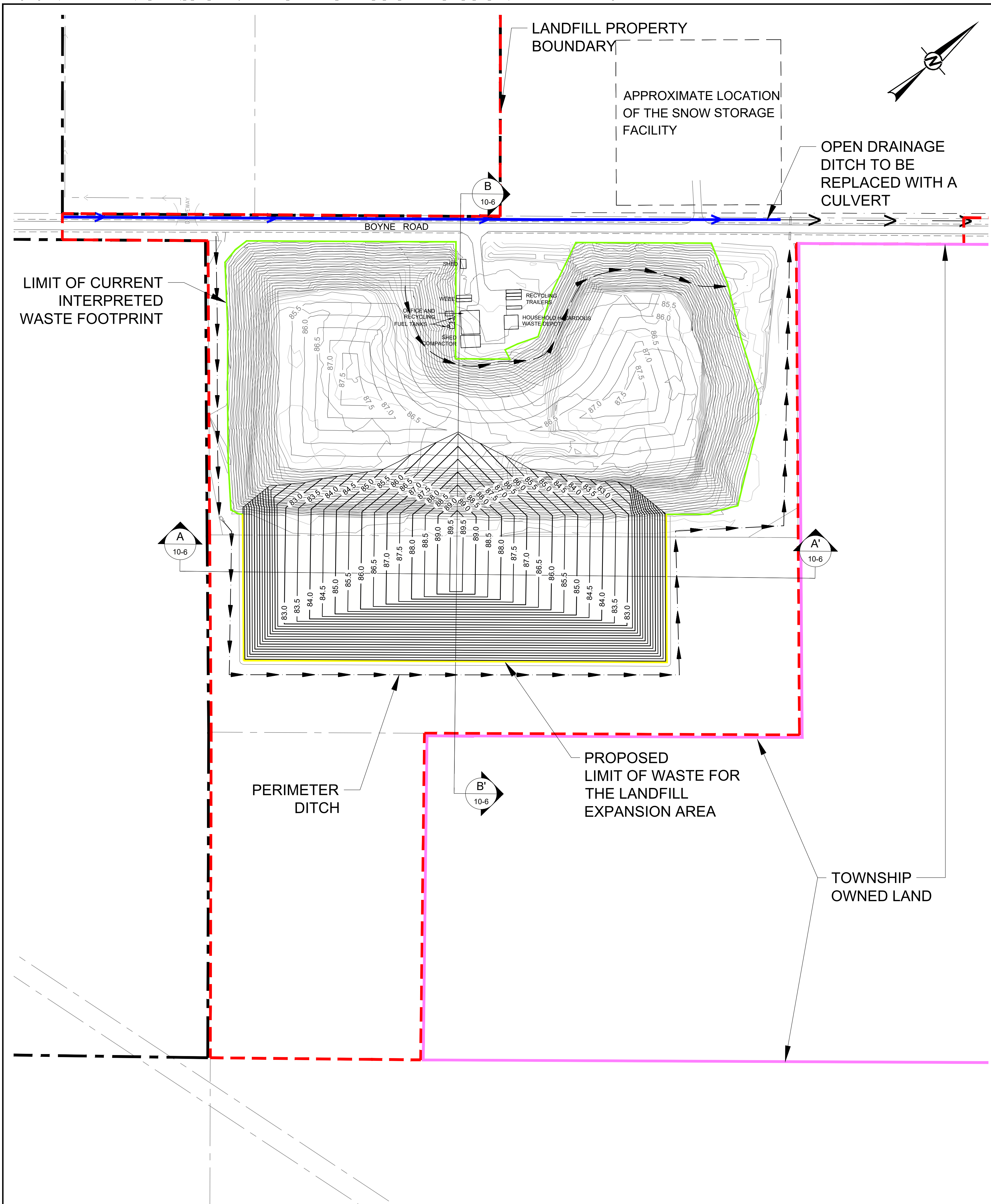

LEGEND

85.0	GROUND SURFACE CONTOURS (MASL), BASED ON RESULTS OF THE SURVEYS CONDUCTED IN 2008, 2010, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019 AND 2020
89.5	PROPOSED EXPANSION TOP OF WASTE ELEVATION CONTOURS (MASL)
	APPROXIMATE PROPERTY BOUNDARY OF LANDFILL SITE
	APPROXIMATE BOUNDARY OF EXISTING CONTAMINANT ATTENUATION ZONE EASEMENT LANDS
	APPROXIMATE LOCATION OF PROPOSED PERIMETER DITCH
	EXISTING ROADSIDE DITCH TO BE REPLACED WITH A CULVERT (APPROXIMATE LOCATION)
	ADDITIONAL LAND OWNED BY TOWNSHIP

NOT FOR CONSTRUCTION

DRAFT

REFERENCE(S)

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4. COORDINATES SYSTEM: MTM ZONE 9 NAD83 DATUM CGVD28

0 50 100
1:3,000 METRES

CLIENT
TOWNSHIP OF NORTH DUNDAS

CONSULTANT
GOLDER
MEMBER OF WSP

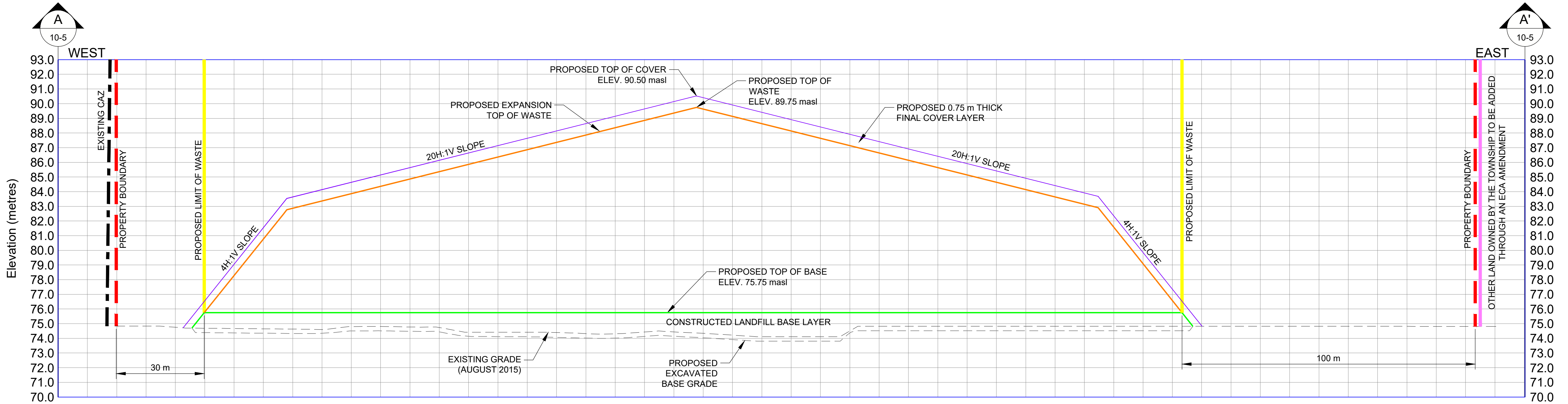
YYYY-MM-DD	2021-03-19
DESIGNED	YJM
PREPARED	ABD
REVIEWED	YJM
APPROVED	PAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
ALTERNATIVE 3 - PRIMARILY HORIZONTAL EXPANSION SITE PLAN

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	A	10-5

25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B



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VERT. SCALE 1:300 m
A-A' SECTION
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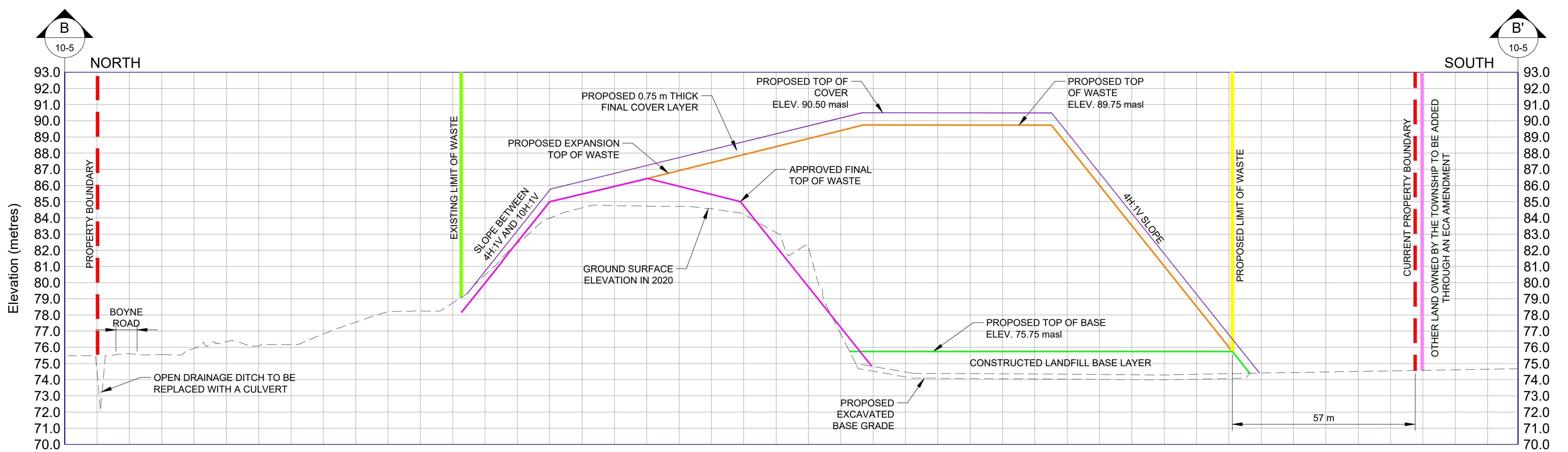

HORIZ. SCALE 1:1,500 m
VERT. SCALE 1:300 m
B-B' SECTION
10-5

NOT FOR CONSTRUCTION

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0 25 50
1:1,500 HORIZONTAL SCALE METRES

0 5 10
1:300 VERTICAL SCALE METRES

CLIENT
TOWNSHIP OF NORTH DUNDAS

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-03-19
DESIGNED	YJM
PREPARED	ABD
REVIEWED	YJM
APPROVED	PAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

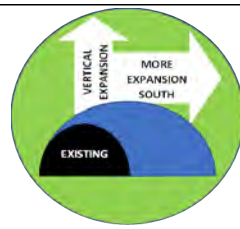
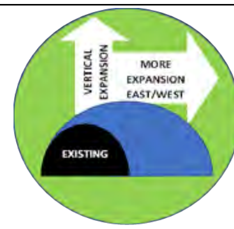
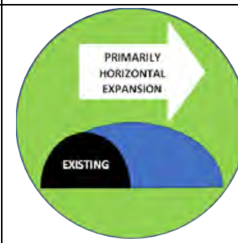
TITLE
ALTERNATIVE 3 - PRIMARILY HORIZONTAL EXPANSION CROSS-SECTIONS

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	A	10-6

10.2.5 Summary of Alternative Methods

A summary of the 3 Alternative Methods is presented in Table 10-1 below.

Table 10-1: Summary of Boyne Road Landfill Expansion Alternative Methods Excluding Do-Nothing

Design Concept	Existing Landfill	Alternative 1	Alternative 2	Alternative 3
Description		 Combined Horizontal and Vertical Expansion with Larger East and West Buffers	 Combined Horizontal and Vertical Expansion with Larger South Buffer	 Primarily Horizontal Expansion
Site/Property Area (ha)	97.1	97.1	97.1	97.1
Existing CAZ (ha)	71.25	71.25	71.25	71.25
Total Waste Footprint Area (ha)	8.1	12.0	12.6	11.9
Peak Waste Elevation (masl)	87.75	89.75	89.75	89.75
Height of Peak above Average Ground Elevation (m)	12.5	15	15	15
Horizontal Expansion Area Bottom of Waste Elevation (masl)	-	75.75	75.75	75.75
Volume of Excavation (m^3)	-	12,650	14,150	12,100
Total Additional Airspace beyond 2023 (m^3)	-	417,700	426,000	417,700

10.3 Geotechnical Considerations for Expansion Alternatives

The area of the current Boyne Road landfill and the proposed expansion area on its south side are underlain by a variable but relatively thin layer of silty clay and glacial till overlying limestone bedrock. From a geotechnical perspective, these are competent subgrade materials that do not pose geotechnical constraints in terms of design of the expansion geometry, i.e., side slope stability at typical landfill side slope inclinations of 4H:1V, landfill height or compression under the weight of the landfilled material. It is also noted that there is no landfill infrastructure beneath the existing landfill or proposed vertical and horizontal expansion that could be adversely affected by compression of subgrade soils under the weight of the waste. Geotechnical confirmatory stability analysis will be carried out for the preferred expansion alternative.

11.0 Comparison and Evaluation of Landfill Expansion Alternatives

11.1 Methodology

In this section, the predicted potential effects for each 'Alternative Method' are described, and the 'Alternative Methods' compared.

As described in Section 10.0 of this EASR, three 'Alternative Methods' for expansion of the Boyne Road Landfill were developed. These alternatives are referred to as:

- Alternative 1 – Combined Horizontal and Vertical Expansion with Larger East and West Buffers (Figure 10-1)
- Alternative 2 – Combined Horizontal and Vertical Expansion with Larger South Buffer (Figure 10-3)
- Alternative 3 – Primarily Horizontal Expansion (Figure 10-5)

During the EA a total of 10 components (e.g., atmosphere, surface water, biology, etc.) and 17 sub-components (e.g., air quality, noise, surface water quality, etc.) have been identified, which have been confirmed to be appropriate during this EA during consultation and considered in the assessment. For further clarification, the components represent a high-level aspect of the environment, each of the sub-components represents a specific aspect of the environment, and the indicators represent a potential effect of the undertaking. A detailed description of the components, sub-components and indicators used for this assessment are provided in Table 8-1 of Section 8.0 of this EASR.

Section 11.2 of this EASR discusses the predicted or expected potential effects for each 'Alternative Method' in the context of each component and sub-component using the indicators. The indicators that represent a potential effect of the undertaking were further described by identifying factors that might differentiate between the 'Alternative Methods'. Subsequently, each expansion alternative was comparatively evaluated using either qualitative, quantitative or a combination of each method; as well, an assessment of advantages and disadvantages was completed.

The next step in the EA process was to compile the individual component and sub-component comparative evaluations of 'Alternative Methods' and select the overall preferred method of landfill expansion (refer to Section 11.4 of this EASR).

11.2 Assessment of Net Environmental Effects for 'Alternative Methods' and Component Comparison of 'Alternative Methods'

The assessment of net environmental effects for the 'Alternatives Methods' is provided below for each component and sub-component. It is noted that this assessment did not identify any additional mitigation measures as required, but indicated if additional mitigation measures beyond those included in the proposed expansion design or normal operating practices at the landfill site are expected to be required to achieve site compliance with provincial standards.

Additionally, during this assessment all the ‘Alternative Methods’ were found to be fundamentally approvable under the EPA and hence no changes were proposed to the ‘Alternative Methods’.

During various consultation activities conducted during this EA, stakeholders did not identify any additional ‘Alternative Methods’ for consideration.

Following assessment of net environmental effects of the ‘Alternative Methods’ based on the components and sub-components, the component level comparison of the ‘Alternative Methods’ was completed.

11.2.1 Atmosphere

11.2.1.1 Air Quality

The indicators to be considered for air quality are:

- Expected concentrations of air quality indicator compounds (selected regulated air contaminants to represent this type of project), including dust, at the property area boundary.
- Expected site-related odour at off-site sensitive receptors.
- Expected GHG emissions.

The factors considered to differentiate between the ‘Alternative Methods’ for landfill expansion from the perspective of air quality were selected because they are most likely to have the potential to result in an adverse effect. The evaluation of each alternative considered the following factors and were assessed qualitatively:

- Identify the differences in potential air and odour concentrations from emission sources based on their distance and direction to nearest receptors, the property boundary, and site characteristics such as height of the expanded landfill that will influence dispersion.
- Identify differences in the alternatives that will impact GHG generation, such as the landfill configuration.

These factors were then evaluated qualitatively, ranked and the advantages and disadvantages further described.

This Alternative Methods assessment has been carried out as described in Section 8.2. The methodology used to describe the factors that may cause an adverse impact on air quality are described in the following sections.

11.2.1.1.1 Qualitative Assessment Methodology

A qualitative assessment of the ‘Alternative Methods’ was completed to evaluate potential impacts on air quality based on the proximity of the expanded waste footprint area to the landfill property boundary and the closest sensitive receptors. This has been assessed by considering the following:

- reviewing the predominant wind direction
- identification of the closest sensitive receptors
- reviewing the landfill design characteristics of each expansion alternative
- reviewing the greenhouse gas emissions

It should be noted that the air quality and odour emissions from each of the ‘Alternative Methods’ is not expected to vary between them and has not been compared in this assessment. This is due to equal waste landfilling rates among the three expansion alternatives, which represents the largest driver of these emissions.

11.2.1.1.2 Review of Predominant Wind Direction

A pre-processed five-year meteorological data set was provided by the MECP for the Boyne Road Landfill and approved for use through a Request for Approval Under s. 13 (1) of Local Air Quality Regulation for Use of Site-Specific Meteorological Data.

A wind rose was created using the five-year MECP pre-processed site specific meteorological hourly data to identify the frequency of winds blowing from each direction.

As shown in Figure 11-1 below, the predominant wind direction is from the west-southwest to the east.

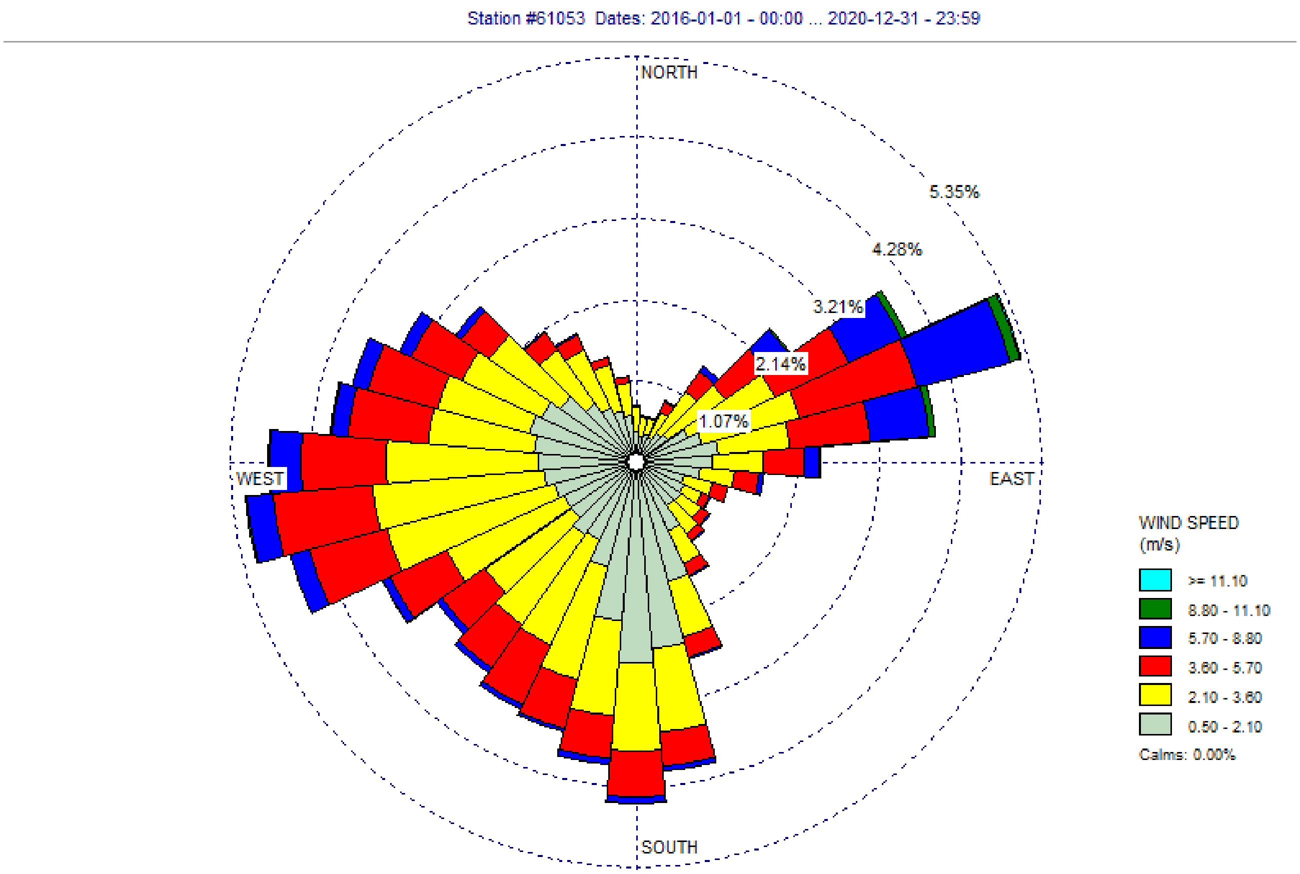


Figure 11-1: Wind Rose for the Site Specific MECP Meteorological Data Set for Boyne Road Landfill

11.2.1.1.3 Identification of Closest Sensitive Receptors

The distance between emissions sources and neighbouring sensitive receptors will be used to evaluate each alternative. Sensitive receptors were identified as residences. The sensitive receptors that will be assessed in terms of potential effects related to air quality and noise are shown on Figure 9-1.

The closest sensitive receptors in each wind direction are identified in Table 11-1.

Review of Characteristics for Each Landfill Expansion Alternative Method

The key characteristics of each expansion alternative are presented in Table 11-1. Landfill footprint, landfill height and distance from the landfill boundary to receptors are factors in the dispersion of emissions from the landfill and their potential impacts at the property boundary and at sensitive receptors.

Table 11-1: Summary of Boyne Road Landfill Expansion Alternative Methods

Design Concept	Existing Landfill	Alternative 1	Alternative 2	Alternative 3
Description	-	Combined Horizontal and Vertical Expansion with Larger East and West Buffers	Combined Horizontal and Vertical Expansion with Larger South Buffer	Primarily Horizontal Expansion
Site/Property Area (ha)	89.03	89.03	89.03	89.03
Total Waste Footprint Area (ha)	8.1	12.0	12.6	11.9
Expansion Waste Footprint Area (ha)	—	3.9	4.5	3.8
Peak Waste Elevation (masl)	87.75	89.75	89.75	89.75
Height of Peak above Average Ground Elevation (m)	12.5	15	15	15
Total Additional Airspace (m^3)**	-	417,700	426,000	417,700
Minimum Distance from Expansion Waste Extents to Property Boundary (m)	-	44	34	30
Distance from landfill to nearest Sensitive Receptor (m) *	North: ~1800 East: ~900 South: ~1100 **West: ~ 700**	North: ~1800 East: ~900 South: ~1100 **West: ~ 700**	North: ~1800 East: ~900 South: ~1100 **West: ~ 700**	North: ~1800 East: ~900 South: ~1100 **West: ~ 700**

Notes: *Closest receptor in each direction in bolded font
** Airspace for waste and daily cover beyond 2023

11.2.1.1.4 Greenhouse Gas Emissions Assessment

There are several factors that can be considered when qualitatively evaluating potential GHG emissions from a project. The following are examples of the main activities that may generate GHG emissions from a landfill expansion, but are not an exhaustive list:

- Waste volumes per alternative
- Vehicles operating and their length of travel
- Whether or not LFG is collected and flared or consumed as fuel in a power generation
- Surface area of the landfill cap and configuration that can lead to greater fugitive LFG (i.e., assumption is that a larger cap area will lead to greater fugitive LFG emissions)

For the Boyne Road Landfill, it has been assumed that the largest source of GHG emissions will be fugitive LFG from the landfilled waste. Since the annual waste volumes are not expected to vary between the ‘Alternative Methods’, the GHG emissions are likely to be similar for the three ‘Alternative Methods’. Additionally, due to the size of the landfill, other GHG emitting activities are not expected to have a large impact relative to the fugitive LFGs for any of the three ‘Alternative Methods’.

11.2.1.1.5 Air Assessment Results

Receptors and off-property impacts

The shortest distance between the expanded waste placement (considering both the expansion footprint area and vertical expansion area components) and the property boundary is very similar, ranging from approximately 30 to 40 m to west. As the closest separation distance for all three alternatives is very similar, it is not expected that there would be a significant difference in each alternative when considering the potential air quality impacts at the property boundary.

The shortest distance between the expanded waste footprint area and a sensitive receptor is approximately 700 m for all of the three ‘Alternative Methods’ This sensitive receptor is a residence located west along Boyne Road, which is not in the predominant wind direction. The nearest sensitive receptor that is downwind of the predominant wind direction is approximately 900 m.

As a result, there is no apparent preference between the alternatives.

Height of vertical expansion and landfill footprint

With atmospheric dispersion modelling, lower emission release heights are typically expected to result in less dispersion and consequently higher concentrations of air quality indicator compounds and dust at and beyond the property area boundary and odour at sensitive receptors, in comparison to higher emission release heights.

Comparatively, the surface area of the landfill cap for each alternative will impact dilution of emissions (i.e., larger surface area will have greater initial dilution in comparison to a smaller surface area with similar mass emission rates).

All three ‘Alternative Methods’ are very similar from a footprint and vertical expansion perspective, so it is unlikely that there would be any preference between them from a dispersion and potential impacts at receptors perspective.

Alternative 3 has a marginally smaller expansion waste footprint and could be considered as the least preferred, but the difference is expected to be marginal.

Greenhouse gas – fugitive LFG considerations

For the purposes of evaluating the potential greenhouse gas emissions from the ‘Alternative Methods’, it was assumed that the alternative with the largest surface area within the waste footprint area for placement of expansion waste will contribute to the largest GHGs, and would be the least preferred alternative. As shown in Table 11-1, since the footprints of each alternative do not differ significantly, the three expansion alternatives are considered to be equally preferred from a GHG emissions perspective.

The comparative evaluation of ‘Alternative Methods’ using these factors is presented in Table 11-2.

Based on the above, there is no clear preferred alternative from an air quality perspective as the factors that impact air quality dispersion do not differ significantly among expansion alternatives.

Table 11-2: Air Quality Evaluation of 'Alternative Methods'

Indicator	Differentiating Factors	Alternative 1	Alternative 2	Alternative 3
Predicted concentrations of air quality indicators at the property boundary.	The footprint area and height of the landfill, as well as the distance from the expansion waste placement to the nearest property boundary, for each of the ‘Alternative Methods’.	Equally Preferred	Equally Preferred	Equally Preferred
Expected site-related odour at off-site sensitive receptors.	Distance from landfill expansion area to closest sensitive off-site receptor.	Equally Preferred	Equally Preferred	Equally Preferred
Expected GHG emissions.	Surface Area for placement of waste in the expansion	Equally Preferred	Equally Preferred	Equally Preferred
Preferred Alternative for Air Quality		**Equally Preferred**	**Equally Preferred**	**Equally Preferred**

In view of the above ranking, there are no unique advantages or disadvantages when comparing the three alternatives for the Boyne Road Landfill expansion from an air quality perspective. This is because from the perspective of the air quality sub-component the landfill expansion 'Alternative Methods' are quite similar, and hence no distinct advantages or disadvantages can be discerned.

Under Do-Nothing conditions, the landfill would close and air quality indicators, odour and GHG would reduce over time from current conditions as the site would not be operational. The site will still have the potential for air quality, odour and GHG impacts, just at lower levels.

A disadvantage of unorganized waste disposal in the Township associated with a Do-Nothing alternative is the risk to propagate air quality, odour and GHG in other locations; whereas an advantage of the Do-Nothing alternative over any landfill expansion 'Alternative Method' is that the air quality indicators, odour and GHG potential impacts would not increase at the existing landfill as a result of expansion A disadvantage of any landfill expansion 'Alternative Method' is the landfill would see continued air quality indicators, odour and GHG from the operational site at levels greater than Do-Nothing, but in compliance with regulatory limits. An advantage of any landfill expansion alternative method is any air quality indicator, odour or GHG impact is contained at the site of the existing landfill and not spread throughout the Township by inappropriate waste disposal.

Noise

The indicator for Noise is:

- Noise Levels at neighbouring noise sensitive existing receptors or vacant lots (with appropriate zoning that may accommodate the future construction of sensitive noise receptors).

A qualitative assessment of the three 'Alternative Methods' was completed to evaluate the potential impacts on noise levels. Note the Site-vicinity Study Area defined for noise includes the Haul Route along Boyne Road. For the purposes of this comparison of 'Alternative Methods', the Haul Route was not further assessed since it is the same for any alternative.

The factors considered to differentiate between the 'Alternative Methods' for the landfill expansion, from the perspective of noise, were selected because they have the greatest potential to result in an adverse effect. These consist of the potential acoustic exposure and the proximity of the landfilling activities to the POR(s), the potential change in noise levels in relation to the existing landfill activities, and compliance of the alternatives in relation to applicable noise limits.

The comparative evaluation of the 'Alternative Methods' using the identified factors is presented in Table 11-3.

Table 11-3: Noise Evaluation of the 'Alternative Methods'

Indicator	Differentiating Factors	Alternative 1	Alternative 2	Alternative 3
Noise Levels and Change in Noise Levels at PORs	Increase of maximum height of the landfill above grade elevation	15 m	15 m	15 m
	Shortest potential distance of landfill activities to any Existing POR	~ 700 m	~ 700 m	~ 700 m
	Direction of the nearest Existing POR from the landfill	West	West	West
	Shortest potential distance of landfill activities to any Vacant POR	~ 500 m	~ 500 m	~ 500 m
	Direction of the nearest Vacant POR from the landfill	East	East/West	East/West
	Compliance with Noise Level Limits	Can be designed and operated to comply	Can be designed and operated to comply	Can be designed and operated to comply
Preferred Alternative for Noise [1]		**Equally Preferred**	**Equally Preferred**	**Equally Preferred**

Notes: [1] As further discussed below, it is expected each 'Alternative Method' could be designed and operated in a manner to comply with MECP noise limits.

Although these 'Alternative Methods' could result in a potential increase in the maximum noise levels at a POR, based on previous experience with similar sites across Ontario, it is expected each 'Alternative Method' could be operated, with administrative and/or physical noise controls (if required) in a manner to allow the Boyne Road Landfill to operate in compliance with MECP noise limits.

Based on the above, there is no clear preferred alternative from an environmental noise perspective as the factors that impact noise do not differ significantly among the expansion alternatives. In view of the above ranking, there are no unique advantages or disadvantages when comparing the three alternatives for the proposed landfill expansion from an environmental noise perspective. This is because from the perspective of the noise sub-component the 'Alternative Methods' of landfill expansion are quite similar and hence no distinct advantages or disadvantages can be discerned.

The closure of the existing landfill under the Do-Nothing scenario would see noise from the site activities reduce to zero. There would still be noise in the area due to other activities, as well as the recycling activities. A disadvantage of any landfill expansion 'Alternative Method' versus Do-Nothing is continued noise, noting that it is anticipated the site can be designed and operated to meet the MECP noise limits. For noise there are likely no advantages to any landfill expansion ‘Alternative Method’ versus Do-Nothing. An advantage of the Do-Nothing scenario is there would likely be no additional noise in the Township associated with unorganized waste management. There are no disadvantages to Do-Nothing from the noise perspective.

11.2.2 Geology and Hydrogeology

The indicator for groundwater quality is:

- Expected effect on groundwater quality at the landfill site property boundary and/or compliance boundaries.

The factors considered to differentiate between ‘Alternative Methods’ for landfill expansion, from the perspective of the groundwater quality indicator, were selected because they are most likely to potentially result in an adverse effect. These factors are:

- The position of the landfill expansion footprint in the groundwater flow system and relative to the compliance boundaries
- Waste footprint area configuration for placement of expansion waste relative to groundwater flow direction
- Maximum thickness of waste

The factors were selected for the reasons described below.

<u>The position of the landfill expansion footprint in the groundwater flow system and relative to the compliance boundaries</u> – Groundwater compliance is assessed relative to the Reasonable Use Guideline at the boundaries of the landfill site property or CAZ(s). For natural attenuation landfills, it is desirable to place the waste footprint on the landfill site as far upgradient in the groundwater flow system as possible, to maximize the potential for attenuation of leachate impacts in groundwater prior to it reaching the compliance boundaries.

<u>Waste footprint area configuration relative to groundwater flow direction</u> – It is known that the direction of groundwater flow beyond the immediate vicinity of the waste disposal area is generally to both the north and south in both the overburden and bedrock. To minimize potential magnitude of leachate effects on groundwater, it is preferable to orient the long dimension of the waste footprint area perpendicular to the direction of groundwater flow.

<u>Maximum thickness of waste</u> – the greater the total thickness of waste, the greater the potential leachate source strength and the longer the contaminating lifespan of the landfill (which is defined as the length of time for the contaminant concentrations in the leachate to decline over time to the allowable Reasonable Use Guideline concentration in the groundwater). For the proposed natural attenuation landfill expansion, a higher leachate source strength will potentially result in an increased magnitude of effects on groundwater quality in the leachate plume in the overburden.

The comparative evaluation of ‘Alternative Methods’ using these factors is presented in Table 11-4.

Table 11-4: Groundwater Quality Evaluation of 'Alternative Methods'

Indicator	Differentiating Factors	Alternative 1	Alternative 2	Alternative 3
Expected effect on groundwater quality at the landfill site property boundary and/or compliance boundaries.	The position of the landfill expansion footprint in the groundwater flow system and relative to the compliance boundaries.	All expansion alternatives are positioned essentially the same in the groundwater flow system and relative to the compliance boundaries. Equally Preferred	All expansion alternatives are positioned essentially the same in the groundwater flow system and relative to the compliance boundaries. Equally Preferred	All expansion alternatives are positioned essentially the same in the groundwater flow system and relative to the compliance boundaries. Equally Preferred
	Waste footprint area configuration relative to groundwater flow direction	All expansion alternatives have the same configuration and essentially the same dimensions relative to the groundwater flow direction. Equally Preferred	All expansion alternatives have the same configuration and essentially the same dimensions relative to the groundwater flow direction. Equally Preferred	All expansion alternatives have the same configuration and essentially the same dimensions relative to the groundwater flow direction. Equally Preferred
	Maximum thickness of waste	14 m Equally Preferred	14 m Equally Preferred	14 m Equally Preferred
Preferred Alternative for Groundwater Quality		**Equally Preferred**	**Equally Preferred**	**Equally Preferred**

In view of the above ranking, there are no unique advantages or disadvantages when comparing the three alternatives for the Boyne Road Landfill expansion from a groundwater perspective. This is because from the perspective of the geology and hydrogeology component the landfill expansion ‘Alternative Methods’ are quite similar and hence no distinct advantages or disadvantages can be discerned.

The existing landfill, if closed in a Do-Nothing scenario, would continue to have impacts to groundwater quality at the property boundary for 100s of years, at concentrations below regulatory limits. A disadvantage of any landfill expansion ‘Alternative Method’ is the increase of the potential impacts to groundwater quality at the property boundary beyond the Do-Nothing scenario, but with concentrations below regulatory limits. An advantage to any landfill expansion ‘Alternative Method’ is groundwater impacts are all in one known and monitored location. A disadvantage of the Do-Nothing scenario is it could generate groundwater impacts at other potentially unmonitored locations in the Township. An advantage of the Do-Nothing scenario is that any groundwater impacts at the existing landfill, or elsewhere, are likely to be at levels below what would be expected at an expanded landfill.

11.2.3 Surface Water

The Surface Water environment component comprises two sub-components:

- Surface water quality
- Surface water quantity

Contaminants associated with the landfill expansion and associated operations could seep or runoff into surface water and potentially adversely affect water quality and aquatic life. Operations associated with the landfill expansion could alter runoff and peak flows. The surface water assessment for each of the environmental sub-components is summarized in the following sections.

11.2.3.1 Surface Water Quality

The indicator to be considered for surface water quality is:

- Expected effect on surface water quality in the drainage ditch along Boyne Road (Volks Drain) and within the Site-vicinity Study Area.

The factors considered to differentiate between 'Alternative Methods' for landfill expansion, from the perspective of the surface water quality indicator, were selected because they are most likely to result in an adverse effect. These factors are:

- Expected changes in waste footprint and therefore the total drainage area directly connected to the roadside ditch
- Sediment loading on proposed stormwater mitigation

The factors were selected for the reasons described below.

Expected Changes in total drainage area to stormwater management (SWM) mitigation facility – An increase or decrease in the proposed waste footprint area and total landfill site development area discharging to the roadside ditch and the Volks Drain will impact the sizing of treatment volumes in the facility required as mitigation measures. The existing landfill drainage area and the approximate drainage area corresponding to each of the expansion alternatives is shown on Figures 9-9 and 11-2 through 11-4.

Sediment loading on stormwater mitigation – The expected sediment loading to proposed mitigation measures will impact the required treatment volumes within the facility such that the stormwater treatment objectives are met. Each of the alternative proposed landfill expansion designs were compared to the existing landfill design to compare the changes in expected sediment loading to the SWM mitigation, which will be designed as follows:

- Enhanced (80%) long-term TSS removal is the assumed quality design criteria for the stormwater mitigation to provide the “highest level” of quality control of stormwater
- Water quality storage requirements will be determined based on Table 3.2 of the Ontario Stormwater Management Planning and Design Manual (MECP, 2003)

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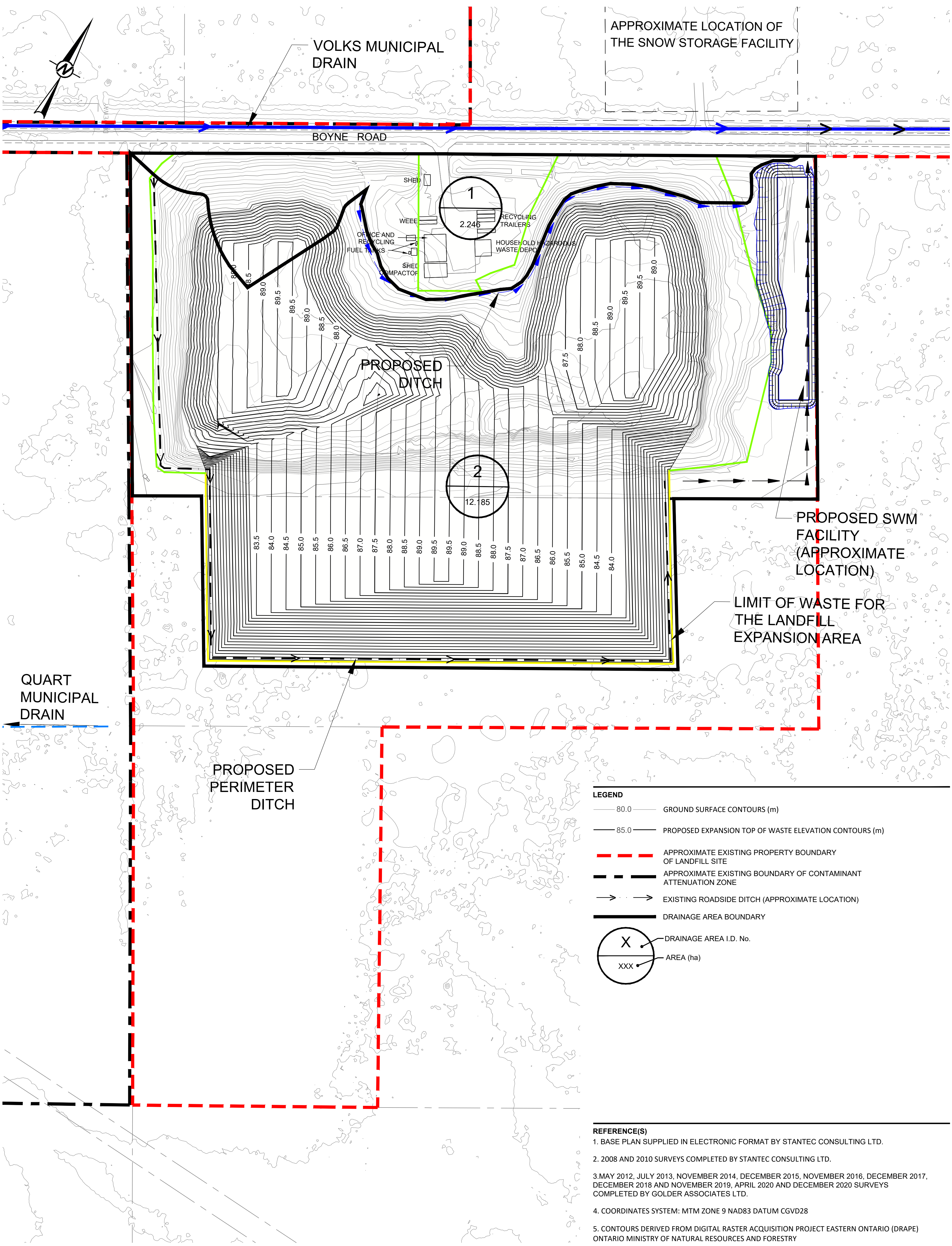

LEGEND

- 80.0 — GROUND SURFACE CONTOURS (m)
- 85.0 — PROPOSED EXPANSION TOP OF WASTE ELEVATION CONTOURS (m)
- APPROXIMATE EXISTING PROPERTY BOUNDARY OF LANDFILL SITE
- APPROXIMATE EXISTING BOUNDARY OF CONTAMINANT ATTENUATION ZONE
- EXISTING ROADSIDE DITCH (APPROXIMATE LOCATION)
- DRAINAGE AREA BOUNDARY
- X — DRAINAGE AREA I.D. No.
- XXX — AREA (ha)

REFERENCE(S)

1. BASE PLAN SUPPLIED IN ELECTRONIC FORMAT BY STANTEC CONSULTING LTD.
2. 2008 AND 2010 SURVEYS COMPLETED BY STANTEC CONSULTING LTD.
3. MAY 2012, JULY 2013, NOVEMBER 2014, DECEMBER 2015, NOVEMBER 2016, DECEMBER 2017, DECEMBER 2018 AND NOVEMBER 2019, APRIL 2020 AND DECEMBER 2020 SURVEYS COMPLETED BY GOLDER ASSOCIATES LTD.
4. COORDINATES SYSTEM: MTM ZONE 9 NAD83 DATUM CGVD28
5. CONTOURS DERIVED FROM DIGITAL RASTER ACQUISITION PROJECT EASTERN ONTARIO (DRAPE) ONTARIO MINISTRY OF NATURAL RESOURCES AND FORESTRY

NOT FOR CONSTRUCTION

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1:2,500 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
A	2021-10-29	ISSUED FOR REVIEW	----	ZS	----	----

CLIENT
TOWNSHIP OF NORTH DUNDAS

CONSULTANT
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PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
ALTERNATIVE 1: POST-CLOSURE DRAINAGE AREA PLAN

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	A	11-2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
25 mm

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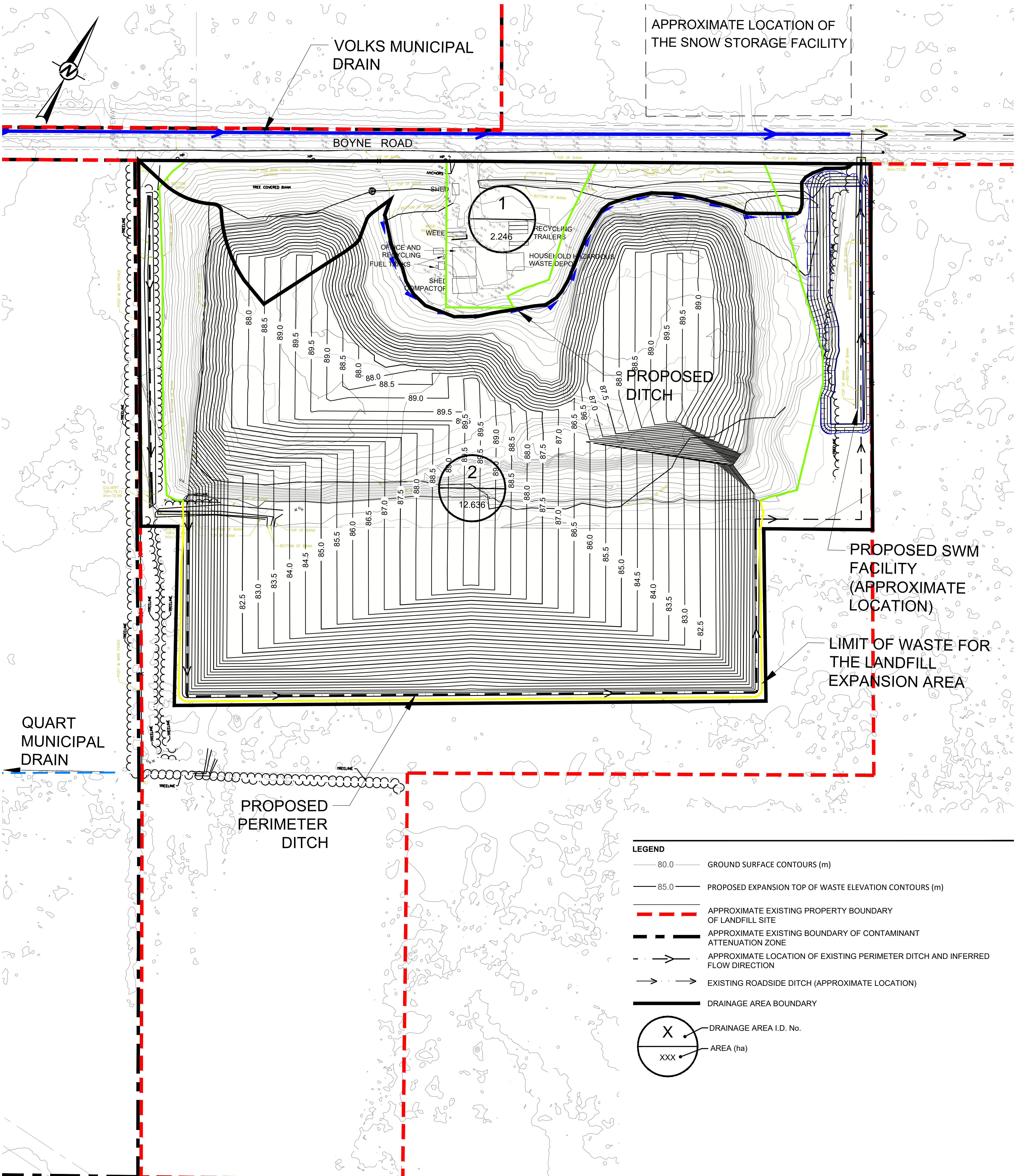

LEGEND

- 80.0 — GROUND SURFACE CONTOURS (m)
- 85.0 — PROPOSED EXPANSION TOP OF WASTE ELEVATION CONTOURS (m)
- APPROXIMATE EXISTING PROPERTY BOUNDARY OF LANDFILL SITE
- APPROXIMATE EXISTING BOUNDARY OF CONTAMINANT ATTENUATION ZONE
- APPROXIMATE LOCATION OF EXISTING PERIMETER DITCH AND INFERRED FLOW DIRECTION
- EXISTING ROADSIDE DITCH (APPROXIMATE LOCATION)
- DRAINAGE AREA BOUNDARY
- X — DRAINAGE AREA I.D. No.
- XXX — AREA (ha)

REFERENCE(S)

1. BASE PLAN SUPPLIED IN ELECTRONIC FORMAT BY STANTEC CONSULTING LTD.
2. 2008 AND 2010 SURVEYS COMPLETED BY STANTEC CONSULTING LTD.
3. MAY 2012, JULY 2013, AND NOVEMBER 2014 SURVEYS COMPLETED BY GOLDER ASSOCIATES LTD.
4. COORDINATES SYSTEM: MTM ZONE 9 NAD83
5. CONTOURS DERIVED FROM DIGITAL RASTER ACQUISITION PROJECT EASTERN ONTARIO (DRAPE) ONTARIO MINISTRY OF NATURAL RESOURCES AND FORESTRY

NOT FOR CONSTRUCTION

DRAFT

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REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
A	2021-10-13	ISSUED FOR REVIEW	----	ZS	----	----

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

CONSULTANT
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TITLE
ALTERNATIVE 2: POST-CLOSURE DRAINAGE AREA PLAN

PROJECT NO.	PHASE/TASK	REV.	of	FIGURE
1648253	2.0/2.2.0	A		11-3

25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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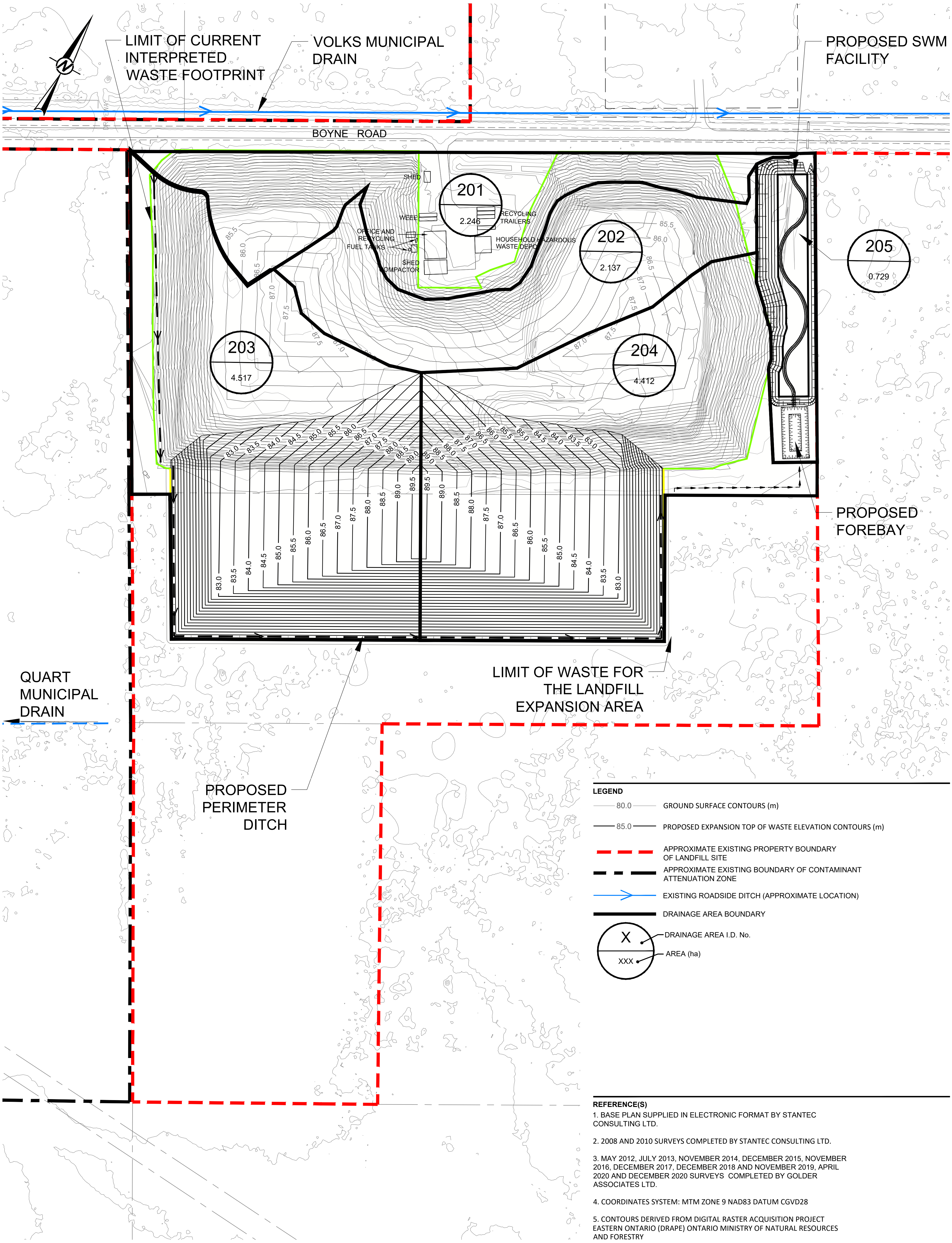

LEGEND

- 80.0 — GROUND SURFACE CONTOURS (m)
- 85.0 — PROPOSED EXPANSION TOP OF WASTE ELEVATION CONTOURS (m)
- APPROXIMATE EXISTING PROPERTY BOUNDARY OF LANDFILL SITE
- APPROXIMATE EXISTING BOUNDARY OF CONTAMINANT ATTENUATION ZONE
- EXISTING ROADSIDE DITCH (APPROXIMATE LOCATION)
- DRAINAGE AREA BOUNDARY
- X — DRAINAGE AREA I.D. No.
- XXX — AREA (ha)

REFERENCE(S)

1. BASE PLAN SUPPLIED IN ELECTRONIC FORMAT BY STANTEC CONSULTING LTD.
2. 2008 AND 2010 SURVEYS COMPLETED BY STANTEC CONSULTING LTD.
3. MAY 2012, JULY 2013, NOVEMBER 2014, DECEMBER 2015, NOVEMBER 2016, DECEMBER 2017, DECEMBER 2018 AND NOVEMBER 2019, APRIL 2020 AND DECEMBER 2020 SURVEYS COMPLETED BY GOLDER ASSOCIATES LTD.
4. COORDINATES SYSTEM: MTM ZONE 9 NAD83 DATUM CGVD28
5. CONTOURS DERIVED FROM DIGITAL RASTER ACQUISITION PROJECT EASTERN ONTARIO (DRAPE) ONTARIO MINISTRY OF NATURAL RESOURCES AND FORESTRY

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DRAFT

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REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
A	2022-01-11	ISSUED FOR CLIENT REVIEW	MHK	ZS/ABD	MHK	DVK

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

CONSULTANT
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TITLE
PREFERRED ALTERNATIVE POST-CLOSURE DRAINAGE AREA PLAN

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	A	11-4

25 mm
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

The comparative evaluation of 'Alternative Methods' using these factors is presented in Table 11-5.

Since there is currently no quality or quantity control system for stormwater management currently in place except for the existing perimeter ditch that collects and conveys runoff to the Boyne Road ditch, it has been assumed that a wetland type stormwater facility will be constructed near the outlet of the existing perimeter ditch. This wetland will be sized based on the MECP criteria noted above. A ditch is also proposed on the north face of the existing landfill to help capture the majority of the existing mound area that currently drains directly to the roadside ditch and is not first collected by the perimeter ditch. Since the proposed expansion alternatives all include expansion to the south and not the north, this additional ditch is assumed to be applicable for each alternative such that the north extents of the drainage area to be directed to the proposed wetland is consistent among alternatives.

Similarly, the existing perimeter ditch is proposed to be reconfigured and extended as necessary around the perimeter of each expansion alternative. As described in Section 10.1, the proposed location of this ditch is near the toe of the landfill sideslope but elevated in relation to adjacent grades around the expansion such that collected runoff is from the landfill cover only and does not intercept adjacent stormwater or leachate impacted groundwater.

Based on the evaluation, it is considered all three expansion alternatives are equally preferred from a surface water quality perspective.

Table 11-5: Surface Water Quality Evaluation of 'Alternative Methods'

Indicator	**Differentiating Factors**	**Alternative 1**	**Alternative 2**	**Alternative 3**
Expected effect on surface water quality in the receiving water-course	Waste footprint area and expected total drainage area	Increase in footprint of landfill (~2.6 ha) Equally Preferred	Increase in footprint of landfill (~3.0 ha) Equally Preferred	Increase in footprint of landfill (~2.4 ha) Equally Preferred
	Sediment loading on wetland	Increase in footprint and no reworking existing landfill side slopes Equally Preferred	Increase in footprint and no reworking of existing landfill side slopes Equally Preferred	Increase in footprint and no reworking existing landfill side slopes Equally Preferred
Preferred Alternative for Surface Water Quality		Equally Preferred	Equally Preferred	Equally Preferred

Note: ~ means approximately

As a result, there are no unique advantages or disadvantages when comparing the three alternatives for the Boyne Road Landfill expansion from a surface water quality perspective. This is because from the perspective of the surface water quality sub-component the landfill expansion ‘Alternative Methods’ are quite similar and hence no distinct advantages or disadvantages can be discerned.

The closure of the existing landfill will still allow for potential leachate-impacted groundwater to discharge to the municipal drain along Boyne Road. With the proposed expansion of the landfill for any ‘Alternative Method’, the possibility of impacts to the SWMS and other water bodies is very limited as a result of operational practices. Therefore, an advantage of any landfill expansion ‘Alternative Method’ is that it will decrease the potential impacts to surface water quality compared to Do-Nothing. In addition, any landfill expansion will include construction of a stormwater management wetland pond that will also improve surface water quality and is an advantage. There are no disadvantages to any landfill expansion ‘Alternative Method’ compared to the Do-Nothing scenario. Conversely there are no advantages to the Do-Nothing scenario, but two disadvantages related to surface water quality. Firstly, leachate-impacted groundwater will continue to discharge to the municipal drain along the north side of Boyne Road and, secondly, stormwater from the covered areas of the landfill will continue to proceed directly to nearby ditching without sediment control afforded by a stormwater management pond.

11.2.3.2 Surface Water Quantity

The indicators to be considered for surface water quantity are:

- Expected change in runoff and peak flows in drainage features
- Expected degree of change to off-site effects on surface water quantity within the Site Study Area and off-site within the Site-vicinity Study Area

11.2.3.2.1 Surface Water Quantity – On-site

For the on-site effects, the factors considered to differentiate between ‘Alternative Methods’ for landfill expansion, from the perspective of the surface water quantity indicators, were selected because they are most likely to result in an adverse effect. These factors are:

- Maximum slope angle
- Estimated total stormwater catchment/landfill footprint

The factors were selected for the reasons described below

<u>Maximum slope angle</u>: Increased slope angle will have an overall effect on the peak flow entering the proposed perimeter ditch and SWM wetland facility.

Estimated total stormwater catchment: The total stormwater catchment area will impact the total runoff expected from the landfill. It will be captured and attenuated for flow control. The proposed wetland will not only be designed to provide quality treatment, but it will also be designed to attenuate peak flow rates to existing or pre-development conditions for design storm events from 1:2 year through 1:100 year return periods, as required by *O.Reg.* 232/98 Landfill Standards.

11.2.3.2.2 Surface Water Quantity – Off-site

The off-site effects (the factors considered to differentiate between 'Alternative Methods' for landfill expansion) from the perspective of the surface water quantity indicators, were selected because they are most likely to result in an adverse effect. These factors are:

- Off-site volume
- Peak flow at Site Study Area boundary

The factors were selected for the reasons described below.

Off-site volume: SWM controls within the Site Study Area are proposed to control the peak flow of stormwater runoff. However, the overall volume of discharge from the landfill area will increase as a result of any new development (expansion) as infiltration to the subsurface is not available on the site (pre- and post-development ground conditions are not favourable to stormwater infiltration). A comparison of the likely overall increase in volume of stormwater runoff from each of the proposed expansion alternatives was undertaken to compare the potential effect of each on the surrounding area and downstream catchment.

Peak flow at Site Study Area boundary: As the slopes are increased within a catchment area, this change will cause an earlier and higher peak flow of stormwater runoff. The proposed SWM wetland at the landfill will provide peak flow attenuation to meet pre development peak flows.

11.2.3.2.3 Comparative Evaluation

The comparative evaluation of 'Alternative Methods' using these factors is presented in Table 11-6.

Based on the evaluation, it is considered that Alternatives 1 and 3 are the most preferred options from a surface water quantity perspective.

Table 11-6: Surface Water Quantity Evaluation of 'Alternative Methods'

Indicator	Differentiating Factors	Alternative 1	Alternative 2	Alternative 3
Expected change in peak flows within on-site drainage features	Maximum slope angle	~25% (4H:1V) Decrease in time of concentration, increase in peak runoff from waste footprint area Equally Preferred	~25% (4H:1V) Decrease in time of concentration, increase in peak runoff from waste footprint area Equally Preferred	~25% (4H:1V) Decrease in time of concentration, increase in peak runoff from waste footprint area Equally Preferred
	Estimated total landfill stormwater catchment area (ha)	Small increase. Most Preferred	Largest increase. Less Preferred	Small increase. Most Preferred
	Ranking	Most Preferred	Less Preferred	Most Preferred
Expected degree of off-site effects on surface water quantity within the Site Study Area and off-site within the Site-vicinity Study Area	Off-site volume	Increase in total volume of runoff leaving the Site Study Area. Decrease in infiltration. Most Preferred	Larger increase in total volume of runoff leaving the Site Study Area. Decrease in infiltration. Less Preferred	Increase in total volume of runoff leaving the Site Study Area. Decrease in infiltration. Most Preferred
	Peak flows at Site Study Area boundary	Peak flow rates off-site will be mitigated. Duration of off-site release will be extended from current conditions. Equally Preferred	Peak flow rates off-site will be mitigated. Duration of off-site release will be extended from current conditions. Equally Preferred	Peak flow rates off-site will be mitigated. Duration of off-site release will be extended from current conditions. Equally Preferred
	Ranking	Most Preferred	Less Preferred	Most Preferred
Preferred Alternative for Surface Water Quantity		**Most Preferred**	**Less Preferred**	**Most Preferred**

In addition to the comparative evaluation using the indicators and factors of differentiation, an assessment based on advantages and disadvantages identified by the comparative evaluation was also possible and completed (refer to Table 11-7).

Table 11-7: Evaluation of Advantages and Disadvantages for Surface Water Quantity

Surface Water Quantity	Advantages	Disadvantages
Alternative 1	Small footprint increase and therefore less reduction in site infiltration and small increase in off-site discharge volume.	none
Alternative 2	None	Larger footprint increase and therefore greater reduction in site infiltration and greater increase in off-site volume.
Alternative 3	Small footprint increase and therefore less reduction in site infiltration and small increase in off-site discharge volume.	none
Do-Nothing	-	-

Table 11-7 clearly shows that Alternatives 1 and 3 are more advantageous than Alternative 2.

Surface water quantity peak flows are based on landfill final design parameters (e.g., slope steepness, length, etc.). Under the Do-Nothing scenario a pre-existing peak flow is anticipated for the closed landfill. The regulatory requirements for landfill expansion require the matching of peak flow by using stormwater management tools (e.g., ponds, orifices, etc.). As such, the peak flow in Do-Nothing and landfill expansion scenarios are quite similar. The only difference is the peak flow may be sustained for a longer duration with the landfill expansion in some drainage areas, and for a shorter duration in other areas, compared to the Do-Nothing scenario.

It is not possible to say whether the change in the peak flow is sustained for a shorter or longer duration is a distinct advantage or disadvantage of any landfill expansion ‘Alternative Method’, and it is possible it could be both depending on the differences in the receiving ditches. Therefore, no distinct advantages or disadvantages are identified for either the Do-Nothing scenario or any landfill expansion ‘Alternative Method’ as it pertains to surface water quality.

11.2.4 Biology

The biology component comprises two sub-components:

- Aquatic ecosystems
- Terrestrial ecosystems

The comparison of the expansion alternatives for each of the biology sub-components is provided in the following sections.

11.2.4.1 Aquatic Ecosystems

The indicators for aquatic ecosystems are:

- Expected change in surface water quality and/or quantity within the Site Study Area and Site-vicinity Study Area
- Expected impact on aquatic habitat and biota, including rare, threatened or endangered species within the Site Study Area and Site-vicinity Study Area

The factors considered to differentiate between ‘Alternative Methods’ for landfill expansion, from the perspective of the aquatic ecosystems indicators, were selected because they are most likely to result in an adverse effect. The factors considered were:

- Change in the waste footprint area of the landfill
- Change in discharge rate from site
- Change in discharge volume from site
- Change in water quality to receiving watercourse
- Change in drainage area to receiving watercourse
- Impact to aquatic SAR or sensitive species
- Loss of potential fish habitat

The comparative evaluation of ‘Alternative Methods’ using these factors is presented in Table 11-8. Impacts to aquatic habitat and biota were determined using the constraints identified and the proposed waste footprints for each of the three alternatives. Figure 11-5 to Figure 11-7 display both the constraints mapping and the location of the three alternatives.

All aquatic habitat that falls within the proposed waste footprint for each alternative was included in the area totals provided in Table 11-8. Additionally, 30 m around each of the Alternatives, including the proposed perimeter ditch, was considered as an impact area to account for possible temporary impacts of construction activities related to the landfill expansion or the location of landfill infrastructure. Impacts related to changes in surface water quality and quantity derived from the factors and impacts presented in the comparison of alternatives tables for surface water, Section 11.2.3, were also considered.

Table 11-8: Aquatic Ecosystem Evaluation of 'Alternative Methods'

Indicator	Differentiating Factors	Alternative 1	Alternative 2	Alternative 3
Expected change in surface water quality and/or quantity within the Site Study Area and Site-vicinity Study Area	Change in the waste footprint area of the landfill	12 ha Less Preferred	12.6 ha Least Preferred	11.9 ha Most Preferred
	Change in discharge rate from site	Peak flow increase in on-site ditches from current condition. Stormwater management pond (SWMP) will be implemented to reduce peak flows off site. Duration of off-site release of event-based flows will be extended from current conditions. Most Preferred	Largest peak flow increase in on-site ditches from current condition. SWMP will be implemented to reduce peak flows off-site. Duration of off-site release of event-based flows will be extended from current conditions. Least Preferred	Larger increase in peak flow in on-site ditches from current condition. SWMP will be implemented to reduce peak flows off site. Duration of off-site release of event-based flows will be extended from current conditions. Less Preferred
	Change in discharge volume from site	Increase in total volume of runoff leaving the site. Decrease in site infiltration. Most Preferred	Largest increase in total volume of runoff leaving the site. Decrease in site infiltration. Least Preferred	Larger increase in total volume of runoff leaving the site. Decrease in site infiltration. Less Preferred
	Change in water quality to receiving watercourse	SWMP will be implemented to achieve 80% TSS removal. Equally Preferred	SWMP will be implemented to achieve 80% TSS removal. Equally Preferred	SWMP will be implemented to achieve 80% TSS removal. Equally Preferred
	Change in drainage area to receiving watercourse	Remains same. Equally Preferred	Remains same. Equally Preferred	Remains same. Equally Preferred
	Ranking	Most Preferred	Least Preferred	Less Preferred

Indicator	Differentiating Factors	Alternative 1	Alternative 2	Alternative 3
Expected impact on aquatic habitat and biota, including rare, threatened or endangered species within the Site Study Area and Site-vicinity Study Area	Impact to aquatic SAR or sensitive species	No habitat for aquatic SAR or sensitive species was observed within the Site or Site-vicinity Study Areas Equally preferred	No habitat for aquatic SAR or sensitive species was observed within the Site or Site-vicinity Study Areas Equally preferred	No habitat for aquatic SAR or sensitive species was observed within the Site or Site-vicinity Study Areas Equally preferred
	Loss of potential fish habitat*	1,649 m ($10,146 \text{ m}^2$) ** Least Preferred	1,645 m ($10,125 \text{ m}^2$) ** Less Preferred	1,633 m ($10,068 \text{ m}^2$) ** Most Preferred
	Ranking	Least Preferred	Less Preferred	Most Preferred
Preferred Alternative for Aquatic Ecosystems		**Less Preferred**	**Least Preferred**	**Most Preferred**

Notes:

* Based on the average observed bankfull widths of watercourses on the Site and in the Site-vicinity Study Areas.

** The proposed perimeter ditch will have a longer total length than the existing perimeter ditch, resulting in more fish habitat on-site post-construction.

LEGEND

- SUITABLE MATERNITY ROOST TREES FOR LITTLE BROWN MYOTIS
- FISH HABITAT - PERMANENT
- FISH HABITAT - INTERMITTENT
- ROADWAY
- PROPOSED PERMIETER DITCH
- OPEN DRAINAGE DITCH TO BE REPLACED WITH A CULVERT
- UNEVALUATED WETLAND
- EVALUATED NON-PSW WETLAND
- SIGNIFICANT WILDLIFE HABITAT - INTERIOR FOREST
- SIGNIFICANT WILDLIFE HABITAT - WOOD THRUSH AND EASTERN WOOD-PEWEE
- SIGNIFICANT WOODLAND
- LIMIT OF CURRENT INTERPRETED WASTE FOOTPRINT
- PROPOSED LIMIT OF WASTE FOR THE LANDFILL EXPANSION AREA
- SITE STUDY AREA
- 120 m STUDY AREA

REFERENCE(S)

1. LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2014
2. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: MTM ZONE 9 VERTICAL DATUM: CGVD28

DRAFT

0 40 80 160

1:4,000 METRES

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
BIOLOGY COMPARISON OF ALTERNATIVE METHODS: ALTERNATIVE 1

CONSULTANT

GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-09-29
DESIGNED	----
PREPARED	JEM
REVIEWED	----
APPROVED	----

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	A	11-5

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:

25mm

LEGEND

- SUITABLE MATERNITY ROOST TREES FOR LITTLE BROWN MYOTIS
- FISH HABITAT - PERMANENT
- FISH HABITAT - INTERMITTENT
- ROADWAY
- PROPOSED PERMIETER DITCH
- OPEN DRAINAGE DITCH TO BE REPLACED WITH A CULVERT
- UNEVALUATED WETLAND
- EVALUATED NON-PSW WETLAND
- SIGNIFICANT WILDLIFE HABITAT - WOOD THRUSH AND EASTERN WOOD-PEWEE
- SIGNIFICANT WOODLAND
- LIMIT OF CURRENT INTERPRETED WASTE FOOTPRINT
- PROPOSED LIMIT OF WASTE FOR THE LANDFILL EXPANSION AREA
- SITE STUDY AREA
- 120 m STUDY AREA

REFERENCE(S)

1. LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2014
2. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: MTM ZONE 9 VERTICAL DATUM: CGVD28

DRAFT

0 40 80 160

1:4,000 METRES

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
BIOLOGY COMPARISON OF ALTERNATIVE METHODS: ALTERNATIVE 2

CONSULTANT

GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-09-29
DESIGNED	----
PREPARED	JEM
REVIEWED	----
APPROVED	----

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	A	11-6

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
25mm

LEGEND

- SUITABLE MATERNITY ROOST TREES FOR LITTLE BROWN MYOTIS
- FISH HABITAT - PERMANENT
- FISH HABITAT - INTERMITTENT
- ROADWAY
- PROPOSED PERMIETER DITCH
- OPEN DRAINAGE DITCH TO BE REPLACED WITH A CULVERT
- UNEVALUATED WETLAND
- EVALUATED NON-PSW WETLAND
- SIGNIFICANT WILDLIFE HABITAT - INTERIOR FOREST
- SIGNIFICANT WILDLIFE HABITAT - WOOD THRUSH AND EASTERN WOOD-PEWEE
- SIGNIFICANT WOODLAND
- LIMIT OF CURRENT INTERPRETED WASTE FOOTPRINT
- PROPOSED LIMIT OF WASTE FOR THE LANDFILL EXPANSION AREA
- SITE STUDY AREA
- 120 m STUDY AREA

REFERENCE(S)

1. LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2014
2. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: MTM ZONE 9 VERTICAL DATUM: CGVD28

DRAFT

0 40 80 160

1:4,000 METRES

CLIENT

TOWNSHIP OF NORTH DUNDAS

PROJECT

INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE

BIOLOGY COMPARISON OF ALTERNATIVE METHODS: ALTERNATIVE 3

CONSULTANT

GOLDER MEMBER OF WSP

YYYY-MM-DD	2021-09-29
DESIGNED	----
PREPARED	JEM
REVIEWED	----
APPROVED	----

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	A	11-7

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 25mm

In addition to the comparative evaluation using the indicators and factors of differentiation, an assessment based on advantages and disadvantages identified by the comparative evaluation is shown in Table 11-9. Only those advantages or disadvantages that are unique to each alternative have been presented in Figures 11-5 to 11-7 (e.g., potential impacts to SAR or sensitive species are not listed as they are the same across the alternatives).

Table 11-9: Evaluation of Advantages and Disadvantages for Aquatic Ecosystems

Aquatic Ecosystems	Advantages	Disadvantages
Alternative 1	Least increase in duration of off-site release of event-based flows entering Volks Municipal Drain. Improved aquatic habitat.	Greatest area of fish habitat removal.
Alternative 2	Improved aquatic habitat.	Longest duration of off-site release of event-based flows entering Volks Municipal Drain.
Alternative 3	Least area of fish habitat removal. Improved aquatic habitat.	Longer duration of off-site release of event-based flows entering Volks Municipal Drain.
Do-Nothing	No change in duration of off-site release of event-based flows entering Volks Municipal Drain. No fish habitat removal.	Aquatic habitat continues to be compromised by existing landfill. Potential for disturbance of other and unknown habitat throughout the Township.

After reviewing the impacts of the three alternatives, it was determined that Alternative 3 was the most preferred option from an aquatic ecosystem perspective while Alternative 1 was a less preferred option and Alternative 2 was the least preferred option.

Alternative 3 was chosen as the most preferred option as its advantages include the least potential impact with respect to fish habitat loss, and less increase in duration of off-site release of event-based flows entering the Volks Municipal Drain.

Although a disadvantage of Alternative 1 is that it has the greatest potential impact with respect to fish habitat loss, it has the least increase in duration of off-site release of event-based flows entering Volks Municipal Drain. For this reason, it was chosen as the less preferred option. Alternative 2 was chosen as the least preferred option as it accounts for the greatest increase in duration of off-site release of event-based flows entering the Volks Municipal Drain and has a similar potential impact with respect to fish habitat loss as Alternative 1.

Under any landfill expansion 'Alternative Method' there may be a longer or shorter duration of peak flow that could impact aquatic habit (although there are no rare, threatened or endangered species). The works associated with any landfill expansion 'Alternative Method' are expected to result in a loss of aquatic habitat, which may require compensation.

Conversely, any landfill expansion 'Alternative Method' will also result in improvement to some components of the aquatic habitat.

Under the Do-Nothing scenario a disadvantage is that aquatic habitat will continue to be compromised by the existing landfill. Another disadvantage is that potential unorganized dumping could occur in the Township as a result of the Do-Nothing scenario, causing harm to aquatic habitat elsewhere. An advantage of the Do-Nothing scenario is that there is no change in duration of peak flow discharge and hence no change in aquatic habitat. There will be no loss of aquatic habitat with the Do-Nothing scenario and that is an advantage. Any landfill expansion 'Alternative Method' includes some improvements to aquatic habitat in the Volks Municipal Drain and that is an advantage to landfill expansion. However, the construction of the improvements as well as the landfill expansion itself will result in a loss of aquatic habitat which is a disadvantage. The change in duration of peak flows off-site as a result of landfill expansion is considered more of a disadvantage, with the magnitude of the differences being a result of the different landfill expansion 'Alternative Methods'.

11.2.4.2 Terrestrial Ecosystems

The indicator for terrestrial ecosystems is:

- Expected impact on terrestrial vegetation communities, wildlife habitat, and wildlife, including rare, threatened or endangered species within the Site or Site-vicinity Study Areas

The factors considered to differentiate between 'Alternative Methods' for landfill expansion, from the perspective of the terrestrial ecosystems indicator, were selected because they are most likely to result in an adverse effect. These consist of:

- Change in the site development area of the landfill
- Change in the waste footprint area of the landfill
- Impact to SAR
- Impact to SWH
- Removal of natural vegetation including wetlands and significant woodlands
- Potential for off-site impacts to wildlife habitat (e.g., noise)

The comparative evaluation of 'Alternative Methods' using these factors is presented in Table 11-10. Impacts were determined using the constraints identified and the proposed footprints for each of the three expansion alternatives. Figure 11-5 to Figure 11-7 display both the constraints mapping and the location of the three expansion alternatives.

All vegetation communities, habitat and natural features that fall within the proposed Waste Footprint Area for each alternative were included in the area totals provided in Table 11-10. Additionally, 30 m around each of the Alternatives, including the proposed perimeter ditch, was considered as an impact area to account for possible temporary impacts of construction activities related to the landfill expansion or the location of landfill infrastructure. This area is referred to as the site development area.

Table 11-10: Terrestrial Ecosystems Evaluation of 'Alternative Methods'

Indicator	Differentiating Factors	Alternative 1	Alternative 2	Alternative 3
Expected impact on terrestrial vegetation communities, wildlife habitat, and wildlife, including rare, threatened or endangered species within the Site or Site-vicinity Study Areas	Change in the site development area of the landfill	18.44 ha Less Preferred	18.74 ha Least Preferred	17.83 ha Most Preferred
	Change in the waste footprint area of the landfill	12 ha Less Preferred	12.6 ha Least Preferred	11.9 ha Most Preferred
	Impact to SAR Habitat – Little Brown Myotis	Removal of 3 potential roost trees and 6.3 ha of contiguous ecosite habitat (plus additional foraging habitat) Less Preferred	Removal of 3 potential roost trees and 6.6 ha of contiguous ecosite habitat (plus additional foraging habitat) Least Preferred	Removal of 3 potential roost tree and 5.7 ha of contiguous ecosite habitat (plus additional foraging habitat) Most Preferred
	Impact to SWH – Interior Forest Habitat	1.46 ha Less Preferred	1.48 ha Least Preferred	1.39 ha Most Preferred
	Impact to SWH – Habitat for Wood Thrush and Eastern Wood-pewee	7.3 ha Less Preferred	7.6 ha Least Preferred	6.7 ha Most Preferred

Indicator	Differentiating Factors	Alternative 1	Alternative 2	Alternative 3
	Impact to Unevaluated Wetlands and Evaluated Non-PSW Wetlands	8.1 ha Less Preferred	8.4 ha Least Preferred	7.5 ha Most Preferred
	Impact to Significant Woodlands	7.3 ha Less Preferred	7.6 ha Least Preferred	6.7 ha Most Preferred
	Potential for off-site impacts to wildlife habitat (e.g., noise)	Impact to off-site wildlife habitat will be mitigated through the implementation of 30 m buffer areas around the proposed limits of waste. Equally Preferred	Impact to off-site wildlife habitat will be mitigated through the implementation of 30 m buffer areas around the proposed limits of waste. Equally Preferred	Impact to off-site wildlife habitat will be mitigated through the implementation of 30 m buffer areas around the proposed limits of waste. Equally Preferred
Preferred Alternative for Terrestrial Ecosystems		**Less Preferred**	**Least Preferred**	**Most Preferred**

In addition to the comparative evaluation using the indicators and factors of differentiation, an assessment based on advantages and disadvantages identified by the comparative evaluation is shown in Table 11-11.

Table 11-11: Evaluation of Advantages and Disadvantages for Terrestrial Ecosystems

Terrestrial Ecosystems	Advantages	Disadvantages
Alternative 1	Moderate disturbance footprint and a configuration that allows for preservation of portions of each significant natural feature identified within the Site Study Area.	Loss of some portion of each of the significant natural features identified in the Site Study Area.
Alternative 2	None	Loss of some portion of each of the significant natural features identified in the Site Study Area, including total loss of Significant Wildlife Habitat - Interior Forest Habitat. Greatest impact on SAR habitat (little brown myotis)
Alternative 3	Smallest disturbance footprint and a configuration that allows for the greatest preservation of each significant natural feature identified within the Site and Site-vicinity Study Areas, including the best protection for SAR (little brown bat) habitat.	Loss of some portion of each of the significant natural features identified in the Site Study Area.
Do-Nothing	Preservation of all identified habitat at the existing landfill.	Potential for disturbance of other and unknown habitat throughout the Township.

After reviewing the impacts of the three alternatives it was determined that Alternative 3 was the most preferred option from a terrestrial ecosystem perspective while Alternative 1 was the less preferred option and Alternative 2 was the least preferred option.

While all three Alternatives have a similar potential impact with respect to the terrestrial ecosystem, Alternative 3 retained some portion of each of the significant terrestrial natural features identified within the Site Study Area and had the least potential impact on SAR habitat (little brown myotis), which is an advantage. It is anticipated that Alternative 3 will not have an impact to any of the surrounding significant terrestrial natural features.

Alternative 1 also protects a portion of each of the significant terrestrial natural features identified within the Site Study Area to a similar extent as Alternative 3; however, it has a greater potential impact on SAR habitat (little brown myotis). It is anticipated that Alternative 1 will not have an impact to any of the surrounding significant terrestrial natural features.

Again, although all three Alternatives have a similar potential impact on significant terrestrial natural features, Alternative 2 was the only Alternative that removed one of the features in its entirety (Significant Wildlife Habitat – Interior Forest) from the Site Study Area, and also had the greatest potential impact on SAR habitat (little brown myotis). For these reasons, it was chosen as the least preferred option. It is anticipated that Alternative 2 will not have an impact to any of the surrounding significant terrestrial natural heritage features.

The closure of the landfill under the Do-Nothing scenario is not likely to affect habitat for SAR bats (little brown myotis). Any landfill expansion 'Alternative Method' will directly negatively impact the habitat of little brown myotis through the construction process. Compensation for habitat loss will be developed in consultation with the MECP for little brown myotis. Therefore, an advantage of the Do-Nothing scenario is that the SAR bats habitat is protected. A disadvantage of the Do-Nothing scenario is that unorganized waste disposal could occur throughout the Township and potentially cause damage to other or unknown terrestrial ecosystems. A disadvantage of any landfill expansion 'Alternative Method' is the loss of that SAR bat habitat.

11.2.5 Land Use

The indicator for land use, which includes both current land use and planned future land use, is:

- Expected incompatibility with existing or known future land use.

The factors considered to differentiate between 'Alternative Methods' for landfill expansion, from the perspective of the land use, were selected because they are most likely to potentially result in an adverse effect. These factors are:

- Compatibility with municipal land use policy framework
- Proximity to sensitive land use (and type), and potential impact on sensitive land uses

Compatibility with municipal land use policy framework: This factor examines the compatibility of the landfill expansion with County Official Plan designations (2018) and the Township of Winchester Zoning By-law 12-93 designations within the Site-vicinity Study Area. It was selected as the proposed landfill expansion may not be consistent with certain land use permissions, resulting in the need for approvals under the Planning Act (e.g., Official Plan amendment and/or Zoning By-law amendment).

As described in Section 9.5, the existing Boyne Road Landfill site is located within the Rural District designation of the SDG Official Plan. The landfill itself is represented by an Active Landfill identification per Schedule A1 of the Official Plan. At the Boyne Road Landfill site, an area on the south side of Boyne Road that includes both the existing disposal area and much of the area proposed for expansion, is zoned Special Rural – Waste Disposal (SRD) under the Township of Winchester Zoning By-Law No. 12-93. Allowable forms of development within the SRD designation includes waste disposal.

Under all three alternative landfill expansion scenarios, the area proposed for waste disposal is located within the SRD zoning. As such, a Zoning By-law Amendment would not be required to implement the proposed expansion, since the waste disposal area will be enlarged within the current limits of the designated SRD zone. As such, one expansion alternative does not provide a benefit over another from a zoning perspective.

Based on the evaluation, it is expected that none of the landfill expansion alternatives provides a significant advantage, relative to the other, resulting in the equal ranking of each alternative from the perspective of compatibility with municipal land use policy framework.

Proximity to sensitive land use (and type), and potential impact on sensitive land uses: This factor was selected as waste disposal facilities can potentially affect the use and enjoyment of sensitive uses in the Site-vicinity Study Area. This factor is evaluated through an assessment of potential nuisances that are identified under the provincial land use Guideline D-4 (Land Use On or Near Landfills and Dumps) and Guideline D-6 (Compatibility between Industrial Facilities). Adverse effects on sensitive uses can potentially include noise and vibration; visual impact; odours and air emissions; litter, dust and other particulates; and other contaminants.

As described in Section 9.5, the location of the Boyne Road Landfill is well removed from any other land uses (the separation distance to the nearest sensitive receptor is 700 m). In addition, the County Official Plan establishes a 500 m holding zone (the distance within which adverse effects from landfills are generally expected to potentially extend) around the Boyne Road Landfill and requires, for municipal planning approvals purposes the proponent of a proposed development within this zone to demonstrate that the proposed development will not be subject to unacceptable adverse effects (as listed above) from ongoing operation of the landfill. As such, the municipal approvals process contains provision to control development within 500 m of both the existing and expanded landfill. As such, one expansion alternative does not provide a benefit over another in terms of proximity to and potential impact on sensitive land uses.

Based on the evaluation, it is expected that none of the landfill expansion alternatives provides a significant advantage, relative to the other, resulting in the equal ranking of each alternative from the perspective of proximity to and potential impact on sensitive land uses.

The comparative evaluation of ‘Alternative Methods’ using these factors is presented in Table 11-12.

Table 11-12: Current and Planned Future Land Use Evaluation of 'Alternative Methods'

Indicator	Differentiating Factors	Alternative 1	Alternative 2	Alternative 3
Expected incompatibility with existing or known future land use	Compatibility with municipal land use policy framework	Equally Preferred	Equally Preferred	Equally Preferred
	Proximity to sensitive land use (and type) and potential impacts on sensitive land uses	Equally Preferred	Equally Preferred	Equally Preferred
Preferred Alternative for Current and Planned Future Land Uses		**Equally Preferred**	**Equally Preferred**	**Equally Preferred**

As a result of the above comparison from a land use perspective, which concluded that the expansion alternatives are equally preferred, there are no unique advantages or disadvantages when comparing the three alternatives for the Boyne Road Landfill expansion. There are no advantages or disadvantages to describe because from the perspective of the land component the landfill expansion ‘Alternative Methods’ are quite similar.

The landfill expansion is consistent with the Provincial Policy Statement and conforms with the Official Plan. However, unorganized waste disposal potentially associated with a Do-Nothing scenario could be inconsistent with the Provincial Policy Statement. Therefore, when considering any landfill expansion ‘Alternative Method’, there are no disadvantages. However, a disadvantage of Do-Nothing is the potential for inconsistencies with land use planning policy associated with unorganized dumping.

11.2.6 Agriculture

The indicator for agriculture, which includes both current land use and planned future land use, is:

- Potential effects on existing agriculture.

The factors considered to differentiate between ‘Alternative Methods’ for landfill expansion, from the perspective of agriculture, were selected because they are most likely to potentially result in an adverse effect. These factors were selected to assess potential effects of the proposed landfill expansion alternatives on the existing and potential agricultural use of on-site and off-site lands.

These factors are:

- Degree of investment and agricultural infrastructure (e.g., tile drainage and fencing)
- Soil capability
- Potential impacts on agricultural land within the Site Study Area
- Potential impacts on agricultural land within the Site-vicinity Study Area
- Potential Impact on agricultural system (e.g., fragmentation)

The comparative evaluation of 'Alternative Methods' using these factors is presented in Table 11-13.

Table 11-13: Agriculture Evaluation of 'Alternative Methods'

Indicator	Differentiating Factors	Alternative 1	Alternative 2	Alternative 3
Potential effects on existing agriculture	Degree of investment / infrastructure	There has been no agricultural investment in the area of the proposed landfill expansion and its components. Equally Preferred	There has been no agricultural investment in the area of the proposed landfill expansion and its components. Equally Preferred	There has been no agricultural investment in the area of the proposed landfill expansion and its components. Equally Preferred
	Soil Capability (Canada Land Inventory rating)	The horizontal expansion area is underlain by Muck (organic) soils. Equally Preferred	The horizontal expansion area is underlain by Muck (organic) soils. Equally Preferred	The horizontal expansion area is underlain by Muck (organic) soils. Equally Preferred
	Potential impacts on agricultural land within the Site Study Area	A small area of cropland will be removed by the proposed expansion in the southeast corner. Equally Preferred	A small area of cropland will be removed by the proposed expansion in the southeast corner. Equally Preferred	A small area of cropland will be removed by the proposed expansion in the southeast corner. Equally Preferred

Indicator	Differentiating Factors	Alternative 1	Alternative 2	Alternative 3
	Potential impacts on agricultural land within the Site-vicinity Study Area	Croplands to the northwest and south; no impact expected. <u>Equally Preferred</u>	Croplands to the northwest and south; no impact expected. <u>Equally Preferred</u>	Croplands to the northwest and south; no impact expected. <u>Equally Preferred</u>
	Potential Impact on agricultural system (e.g., fragmentation	No potential impacts on broader agricultural system as the expansion land does not include agricultural amenities or assets that support the agri-food network. <u>Equally Preferred</u>	No potential impacts on broader agricultural system as the expansion land does not include agricultural amenities or assets that support the agri-food network. <u>Equally Preferred</u>	No potential impacts on broader agricultural system as the expansion land does not include agricultural amenities or assets that support the agri-food network. <u>Equally Preferred</u>
Preferred Alternative for Agriculture		**Equally Preferred**	**Equally Preferred**	**Equally Preferred**

As a result of the above comparison from an agriculture, which concluded that the expansion alternatives are equally preferred, there are no unique advantages or disadvantages when comparing the three alternatives for the Boyne Road Landfill expansion. There are no advantages or disadvantages to describe because from the perspective of the agriculture component the landfill expansion ‘Alternative Methods’ are quite similar.

The Do-Nothing scenario would see no change or effect regarding agricultural operations in the area of the existing landfill but could see random unorganized waste disposal in other agricultural areas. Any landfill expansion ‘Alternative Method’ requires some land to the south of the existing landfill that will reduce some existing agricultural operations on Township-owned lands. Therefore, an advantage of the Do-Nothing scenario is no loss of agricultural operations or lands near the existing landfill, although a disadvantage could be random loss of agricultural lands as a result of unorganized dumping. A disadvantage of any landfill expansion ‘Alternative Method’ is a small loss of agricultural lands on Township-owned property, although an advantage is no additional random loss of agricultural lands in other areas of the Township.

11.2.7 Cultural Heritage Resources

The cultural heritage resources environmental component has been divided into three sub-components: archaeology, cultural heritage landscapes and built heritage resources. The comparison of the expansion alternatives under each of these sub-components is provided in the following sub-sections.

11.2.7.1 Archaeology

The indicator associated with archaeology is:

- Expected archaeological resources potentially affected on-site.

The factors considered to differentiate between 'Alternative Methods' for landfill expansion, from the perspective of the archaeology component, were selected because they are most likely to result in an adverse effect. These factors are.

- Archaeological sites within the horizontal extent of the proposed landfill expansion
- Proximity to known areas of archaeological significance or potential in the adjacent site development area

The factors were selected for the reasons described below.

Archaeological sites within the horizontal extent of the proposed landfill expansion – if there are archaeological sites located within the expansion footprint of the 'Alternative Methods', then they could be affected by the landfill expansion.

Proximity to known areas of archaeological significance or potential in the adjacent site development area – If these areas are known to be present, then they could be affected by the landfill expansion.

The archaeological information used to complete this comparative assessment was the findings of the Stage 1 archaeological study carried out in the Site Study Area, which concluded that the study area was identified as having low archaeological potential and no further archaeological assessments are required (Volume 2 Appendix G-2).

The comparative evaluation of 'Alternative Methods' using these factors is presented in Table 11-14.

Table 11-14: Archaeology Evaluation of 'Alternative Methods'

Indicator	Differentiating Factors	Alternative 1	Alternative 2	Alternative 3
Expected archaeological resources potentially affected on-site.	Archaeological sites within the horizontal extent of the proposed landfill expansion	There were no archaeological sites identified within the proposed horizontal expansion area. Equally Preferred	There were no archaeological sites identified within the proposed horizontal expansion area. Equally Preferred	There were no archaeological sites identified within the proposed horizontal expansion area. Equally Preferred
	Proximity to known areas of archaeological significance or potential in the adjacent site development area	There were no known areas of archaeological significance or potential identified within the site development area. Equally Preferred	There were no known areas of archaeological significance or potential identified within the site development area. Equally Preferred	There were no known areas of archaeological significance or potential identified within the site development area. Equally Preferred
Preferred Alternative for Archaeology		**Equally Preferred**	**Equally Preferred**	**Equally Preferred**

As a result of the above comparison from an archaeology perspective, which concluded that the expansion alternatives are equally preferred, there are no unique advantages or disadvantages when comparing the three alternatives for the Boyne Road Landfill expansion. There are no advantages or disadvantages to describe because from the perspective of the archaeology sub-component the landfill expansion 'Alternative Methods' are quite similar.

The closure of the existing landfill under the Do-Nothing scenario will have no effect on expected archaeological resources in the area of the landfill but could result in disturbance of resources in other areas as a result of unorganized landfilling. Any landfill expansion 'Alternative Method' lands required will have no effect on expected archaeological resources. Therefore, a disadvantage of the Do-Nothing scenario is the potential for disturbance of archaeological resources elsewhere. An advantage of any landfill expansion 'Alternative Method' is no loss or disturbance of archaeological resources in the Township.

11.2.7.2 Cultural Heritage Landscapes

This indicator for cultural heritage landscapes is:

- Expected impact on identified cultural heritage landscapes within the Site-vicinity Study Area.

The factors considered to differentiate between ‘Alternative Methods’ for landfill expansion, from the perspective of the cultural heritage landscapes component, were selected because they are most likely to result in an adverse direct or indirect effect. These are:

- Alteration that is not sympathetic, or is incompatible, with the historic fabric and appearance (direct impact)
- Destruction of any, or part of any, significant heritage attribute or feature (direct impact)
- Shadow impacts on the appearance of a heritage attribute or an associated natural feature (indirect impact)
- Impact on significant views or vistas within, from, or of built and natural features (indirect impact)
- A change in land use where the change in use may impact the cultural heritage value or interest of the property area (indirect impact)

The factors to be evaluated for expected impact on identified cultural heritage landscapes within the Site-vicinity Study Area would be based on the following successive considerations:

- Whether there is an expected impact to identified cultural heritage landscapes
- The likely degree of expected impact to identified cultural heritage landscapes
- The potential to ameliorate or mitigate the expected impact to identified cultural heritage landscapes

Background research and desktop analysis of the study area based on the MHSTCI Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes (2016) checklist identified no potential cultural heritage landscapes (Volume 2 Appendix G-1).

The comparative evaluation of ‘Alternative Methods’ using these factors is presented in Table 11-15.

Table 11-15: Cultural Heritage Landscapes Evaluation of 'Alternative Methods'

Indicator	Differentiating Factors	Alternative 1	Alternative 2	Alternative 3
Expected impact on identified cultural heritage landscapes within the Site-vicinity Study Area	Direct Impact - Alteration that is not sympathetic, or is incompatible, with the historic fabric and appearance	No expected impacts	No expected impacts	No expected impacts
	Direct Impact - Destruction of any, or part of any, significant heritage attribute or feature	No expected impacts	No expected impacts	No expected impacts
	Indirect Impact - Shadow impacts on the appearance of a heritage attribute or an associated natural feature	No expected impacts	No expected impacts	No expected impacts
	Indirect Impact - Impact on significant views or vistas within, from, or of built and natural features	No expected impacts	No expected impacts	No expected impacts
	Indirect Impact - A change in land use where the change in use may impact the cultural heritage value or interest of the property area	No expected impacts	No expected impacts	No expected impacts
Preferred Alternative for Cultural Heritage Landscapes		**Equally Preferred**	**Equally Preferred**	**Equally Preferred**

As a result of the above comparison from a cultural heritage landscapes perspective, which concluded that the expansion alternatives are equally preferred, there are no unique advantages or disadvantages when comparing the three alternatives for the Boyne Road Landfill expansion. There are no advantages or disadvantages to describe because from the perspective of the cultural heritage landscapes sub-component the landfill expansion 'Alternative Methods' are quite similar.

Any landfill expansion 'Alternative Method' will not impact cultural heritage landscapes. It is possible that unorganized landfilling that could result from the Do-Nothing scenario could impact cultural heritage landscapes, although that possibility seems remote. Therefore, there are no distinct advantages or disadvantages when comparing any landfill expansion 'Alternative Method' and the Do-Nothing scenario considering cultural heritage landscapes.

11.2.7.3 Built Heritage Resources

The indicator for built heritage resources is:

- Expected impact on identified built heritage resources within the Site-vicinity Study Area.

The factors considered to differentiate between 'Alternative Methods' for landfill expansion, from the perspective of the built heritage resources component, were selected because they are most likely to result in an adverse direct or indirect effect. These are:

- Alteration that is not sympathetic, or is incompatible, with the historic fabric and appearance (direct impact)
- Destruction of any, or part of any, significant heritage attribute or feature (direct impact)
- Shadow impacts on the appearance of a heritage attribute or an associated natural feature (indirect impact)
- Isolation of a heritage attribute from its surrounding environment, context, or a significant relationship (indirect impact)
- Impact on significant views or vistas within, from, or of built and natural features (indirect impact)
- A change in land use where the change in use may impact the cultural heritage value or interest of the property area (indirect impact)
- Land disturbances such as a change in grades that alters soils and drainage patterns that may affect a built heritage resource (indirect impact)

Each of these factors was evaluated for expected impact on identified built heritage resources within the Site-vicinity Study Area based on the following successive considerations:

- Whether there is an expected impact to identified built heritage resources
- The likely degree of expected impact to identified built heritage resources
- The potential to ameliorate or mitigate the expected impact to identified built heritage resources

Background research and desktop analysis of the study area based on the MHSTCI Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes (2016) checklist identified:

- No listed or designated built heritage resources or cultural heritage landscapes
- No properties with buildings or structures 40 or more years old of potential CHVI

The checklist is provided in Volume 2 Appendix G-1

The comparative evaluation of 'Alternative Methods' using these factors is presented in Table 11-16.

Table 11-16: Built Heritage Resources Evaluation of 'Alternative Methods'

Indicator	Differentiating Factors	Alternative 1	Alternative 2	Alternative 3
Expected impact on identified built heritage resources within the Site-vicinity Study Area	Direct Impact - Alteration that is not sympathetic, or is incompatible, with the historic fabric and appearance	No expected impacts	No expected impacts	No expected impacts
	Direct Impact - Destruction of any, or part of any, significant heritage attribute or feature	No expected impacts	No expected impacts	No expected impacts
	Indirect Impact - Shadow impacts on the appearance of a heritage attribute or an associated natural feature	No expected impacts	No expected impacts	No expected impacts
	Indirect Impact - Isolation of a heritage attribute from its surrounding environment, context, or a significant relationship	No expected impacts	No expected impacts	No expected impacts
	Indirect Impact - Impact on significant views or vistas within, from, or of built and natural features	No expected impacts	No expected impacts	No expected impacts

Indicator	Differentiating Factors	Alternative 1	Alternative 2	Alternative 3
	Indirect Impact - A change in land use where the change in use may impact the cultural heritage value or interest of the property area	No expected impacts	No expected impacts	No expected impacts
	Indirect Impact Land disturbances such as a change in grades that alters soils and drainage patterns that may affect a built heritage resource	No expected impacts	No expected impacts	No expected impacts
Preferred Alternative for Built Heritage Resources		**Equally Preferred**	**Equally Preferred**	**Equally Preferred**

As a result of the above comparison from a built heritage resources perspective, which concluded that the expansion alternatives are equally preferred, there are no unique advantages or disadvantages when comparing the three alternatives for the Boyne Road Landfill expansion. There are no advantages or disadvantages to describe because from the perspective of the built heritage resources sub-component the landfill expansion 'Alternative Methods' are quite similar.

No landfill expansion 'Alternative Method' will impact built heritage resources. Although there is a small possibility that built heritage resources could be impacted as a result of the Do-Nothing scenario related to unregulated landfill, this possibility seems remote. Therefore, there are no distinct advantages or disadvantages when comparing any landfill expansion 'Alternative Method' and the Do-Nothing scenario.

11.2.8 Socio-economic

The socio-economic environmental component has been divided into three sub-components: local economy, residents and community, and visual. The comparison of the expansion alternatives under each of these sub-components is provided in the following sub-sections.

11.2.8.1 Local Economy

The indicators associated with the local economy are:

- Expected effect on local employment.
- Expected effects on local businesses and commercial activity.
- Expected effects on municipal finances.

The factors considered to differentiate between ‘Alternative Methods’ for landfill expansion, from the perspective of the local economy indicators were selected because they are most likely to result in an adverse effect. These consist of:

- Employment opportunities during landfill expansion construction and operation
- Potential impacts to local commercial businesses in the Site-vicinity Study Area (excludes agriculture, which is evaluated in Section 11.2.6 of this EASR
- Capital costs associated with construction and operational costs

The comparative evaluation of ‘Alternative Methods’ of expansion using these factors is presented in Table 11-17. Landfill expansion can provide economic benefits to the local community in the form of new employment opportunities during expansion activities and day-to-day operation. This also has the potential for increased employment opportunities for local firms supplying products or services directly, or as secondary suppliers, during expansion activities. Although a similar potential for employment positions is predicted to be required at the landfill site for ongoing operations regardless of the alternative selected, there is expected to be additional employment opportunities during construction associated with each of the expansion alternatives. There will be a number of capital costs associated with each of the expansion alternatives, with the main differentiator in costs among the alternatives related to the area of the expansion and the corresponding volume of excavation and quantity of fill material to be imported and placed for the constructed landfill base layer.

Table 11-17: Local Economy Evaluation of 'Alternative Methods'

Indicator	Differentiating Factors	Alternative 1	Alternative 2	Alternative 3
Expected effect on local employment.	Consideration of temporary employment positions generated during construction.	Similar potential for employment positions generated during construction of expansion components. Equally Preferred	Similar potential for employment positions generated during construction of expansion components. Equally Preferred	Similar potential for employment positions generated during construction of expansion components. Equally Preferred
	Consideration of new permanent employment positions generated during operation.	No expected change to existing employment numbers. Equally Preferred	No expected change to existing employment numbers. Equally Preferred	No expected change to existing employment numbers. Equally Preferred
	Ranking	**Equally Preferred**	**Equally Preferred**	**Equally Preferred**
Expected effects on local businesses and commercial activity.	Consideration of businesses in the area who may experience disruption.	No impacts to local business operations, as there are no local businesses or commercial activities in the area of the proposed expansion or in proximity to the landfill site. Equally Preferred	No impacts to local business operations, as there are no local businesses or commercial activities in the area of the proposed expansion or in proximity to the landfill site. Equally Preferred	No impacts to local business operations, as there are no local businesses or commercial activities in the area of the proposed expansion or in proximity to the landfill site. Equally Preferred

Indicator	Differentiating Factors	Alternative 1	Alternative 2	Alternative 3
	Consideration of potential revenue to businesses whose services may be required during landfill construction.	Second largest expansion footprint (3.9 ha); therefore, less potential revenue to businesses whose services may be required during expansion construction compared to Alternative 2 but similar to Alternative 3. Less Preferred	Largest expansion footprint area (4.5 ha); therefore, greatest potential revenue to businesses whose services may be required during expansion construction. Most Preferred	Smallest expansion footprint (3.8 ha); therefore, less potential revenue to businesses whose services may be required during expansion construction compared to Alternative 2 but similar to Alternative 1. Less Preferred
	Ranking	**Less Preferred**	**Most Preferred**	**Less Preferred**
Expected effects on municipal finances.	Relative cost of facility expansion.	Second largest cost to implement expansion, but similar to Alternative 3. Most Preferred	Largest capital cost to implement expansion. Less Preferred	Lowest capital cost to implement expansion, but similar to Alternative 1. Most Preferred
	Anticipated increase in revenue.	All alternatives will receive the same amount of incoming waste. Equally Preferred	All alternatives will receive the same amount of incoming waste. Equally Preferred	All alternatives will receive the same amount of incoming waste. Equally Preferred
	Ranking	**Most Preferred**	**Less Preferred**	**Most Preferred**
Preferred Alternative for Local Economy		**Equally Preferred**	**Equally Preferred**	**Equally Preferred**

In terms of effects on the local economy, the expansion alternative that has the largest capital cost to implement is most preferred in terms of potential revenue to local businesses, but less preferred in terms of capital costs to the municipality. It is considered that both perspectives are of equal importance. As a result of the comparison, there are no unique advantages or disadvantages when comparing the three alternatives for the Boyne Road Landfill expansion from a local economy perspective. There are no advantages or disadvantages to describe because from the perspective of the local economy sub-component the landfill expansion ‘Alternative Methods’ are quite similar.

The Do-Nothing scenario causes a negative effect with regard to local employment, while any landfill expansion ‘Alternative Method’ should have a positive effect on local employment during construction and continued operation. Neither the Do-Nothing nor any landfill expansion ‘Alternative Method’ are expected to cause effects to local businesses or commercial activity. The Do-Nothing scenario will cost the Township less than expanding the site, although there could be unaccounted-for costs resulting from unregulated landfilling. Therefore, an advantage of Do-Nothing is no construction or on-going operational costs for the Township, while a disadvantage is loss of local employment. An advantage of any landfill expansion ‘Alternative Method’ is continued and on-going local employment, while a disadvantage of any landfill expansion ‘Alternative Method’ is cost of construction and operation of the expanded landfill.

11.2.8.2 Residents and Community

The indicators associated with the residents and community are:

- Displacement of residents
- Expected interference with use and enjoyment of residential properties (nuisance effects)

The factors considered to differentiate between ‘Alternative Methods’ for landfill expansion, from the perspective of the residents and community indicators were selected because they are most likely to result in an adverse effect. These consist of:

- Proximity to nearby residences
- Biophysical and social interactions with nearby residential PORs (i.e., air quality, noise, litter, odour, nuisance wildlife/pests and traffic). Potential visual impacts are considered in Section 11.2.8.3 of this EASR

The comparative evaluation of ‘Alternative Methods’ using these factors is presented in Table 11-18. As previously described in Section 9.8.2.1, there are no existing residences within 500 m of the Site Study Area or the proposed expansion alternatives; the closest existing residence is on Boyne Road and is approximately 0.7 km east of the landfill site. There are 6 existing residences found between 700 m and 1 km of the Site Study Area. The proposed expansion alternatives 1) do not change the separation distances from the closest residences along Boyne Road, and 2) slightly decrease, but by the same amount, the separation distances from the closest residences to the south.

Table 11-18: Residents and Community Evaluation of 'Alternative Methods'

Indicator	Differentiating Factors	Alternative 1	Alternative 2	Alternative 3
Displacement of residents.	Displacement of residents during landfill expansion, construction and/or operation.	In view of the separation distance between the landfill site and the closest residences, no displacement anticipated. Equally Preferred	In view of the separation distance between the landfill site and the closest residences, no displacement anticipated. Equally Preferred	In view of the separation distance between the landfill site and the closest residences, no displacement anticipated. Equally Preferred
Expected interference with use and enjoyment of residential properties (nuisance effects).	Potential nuisance effects from air quality, noise, litter, odour, nuisance wildlife species and pests and traffic on nearby residential PORs.	With the proposed expansion alternatives, the distance to residential PORs does not change meaningfully from existing conditions and is similar among expansion alternatives. Landfill-related traffic will also be the same for all expansion alternatives. Equally Preferred	With the proposed expansion alternatives, the distance to residential PORs does not change meaningfully from existing conditions and is similar among expansion alternatives. Landfill-related traffic will also be the same for all expansion alternatives. Equally Preferred	With the proposed expansion alternatives, the distance to residential PORs does not change meaningfully from existing conditions and is similar among expansion alternatives. Landfill-related traffic will also be the same for all expansion alternatives. Equally Preferred
Preferred Alternative for Residents and Community		**Equally Preferred**	**Equally Preferred**	**Equally Preferred**

As a result of the above comparison from a residents and community perspective, which concluded that the expansion alternatives are equally preferred, there are no unique advantages or disadvantages when comparing the three alternatives for the Boyne Road Landfill expansion. There are no advantages or disadvantages to describe because from the perspective of the residents and community sub-component the ‘Alternative Methods’ are quite similar.

Under Do-Nothing conditions there is no expected displacement of residents, although nuisance from unregulated landfilling could happen. As noted from other components (noise, air quality, visual and traffic), the expectation is that neither the landfill expansion nor the Do-Nothing scenario will interfere with the use and enjoyment of residential properties. Therefore, there are no advantages or disadvantages when comparing any landfill expansion 'Alternative Method' or Do-Nothing when considering residents and community.

11.2.8.3 Visual

The indicators associated with visual are:

- Expected changes in landscape views from off-site

There is one factor that can be considered to assess potential visual impacts, as follows:

- Number of landscape views potentially impacted

As previously described, the terrain in the area of the Boyne Road Landfill site is flat lying with little topographic relief. The ground cover in the intervening area between the closest residences and the landfill site is a mixture of cleared agricultural fields and treed areas, whether they be rows along fence lines or remaining stands of forest. The southern and eastern portions of the Site Study Area are covered in semi-mature to early successional forest. The separation distance between residential PORs does not change meaningfully from existing conditions and is similar among expansion alternatives. The height of all three landfill expansion alternatives is approximately 15 m above existing grade, and only 2.5 m higher than the existing approved landfill.

The comparative evaluation of 'Alternative Methods' using these factors is presented in Table 11-19.

Table 11-19:Visual Evaluation of 'Alternative Methods'

Indicator	Differentiating Factors	Alternative 1	Alternative 2	Alternative 3
Expected changes in landscape views from off-site.	Number of landscape views potentially impacted.	In view of the large and essentially unchanging separation distances, the nature of the intervening terrain, and the equivalent height of the expansion alternatives, the number of landscape views potentially affected is expected to be small (if any) and the degree of visual effect is expected to be minor (if at all). Equally Preferred	In view of the large and essentially unchanging separation distances, the nature of the intervening terrain, and the equivalent height of the expansion alternatives, the number of landscape views potentially affected is expected to be small (if any) and the degree of visual effect is expected to be minor (if at all). Equally Preferred	In view of the large and essentially unchanging separation distances, the nature of the intervening terrain, and the equivalent height of the expansion alternatives, the number of landscape views potentially affected is expected to be small (if any) and the degree of visual effect is expected to be minor (if at all). Equally Preferred
Preferred Alternative for Visual		**Equally Preferred**	**Equally Preferred**	**Equally Preferred**

The expansion alternatives are equally preferred from a visual perspective. As a result, there are no unique advantages or disadvantages when comparing the three alternatives for the landfill expansion from a visual perspective. There are no advantages or disadvantages to describe because from the perspective of the visual sub-component the landfill expansion ‘Alternative Methods’ are quite similar.

The closure of the existing landfill under the Do-Nothing scenario will continue to have areas where the landfill is visible from off-site. Under the Do-Nothing scenario waste could be landfilled in an unregulated area of the Township causing unsightly visual impacts. With any proposed landfill expansion ‘Alternative Method’, it is expected that the landfill will have slightly greater visibility from off-site locations to the South, although mitigation could be effective. A small advantage of Do-Nothing is slightly less visibility of the landfill from the south and a disadvantage is potential for visual impact from unregulated waste placement in other parts of the Township. A small disadvantage of any landfill expansion ‘Alternative

Method' is slightly more visibility of the landfill to the south, noting that mitigation is expected to be helpful and an advantage is no visual impacts in other parts of the Township.

11.2.9 Transportation

The indicator for transportation is:

- Expected effect on traffic along haul routes

The factors considered to differentiate between 'Alternative Methods' for landfill expansion, from the perspective of the traffic indicator, were selected because they would be the most likely to result in an adverse effect, from a future traffic operation and safety perspective. These factors are:

- Changes in traffic volume
- Changes in required haul routes
- Changes in type of vehicle expected

From a traffic/transportation standpoint, all three alternatives are preferred equally. This is largely because additional vehicles and vehicle trips associated with the landfill expansion are expected to be the same no matter what alternative is selected as preferred. In addition, the landfill site access location and operations are expected to be the same as existing for all three expansion alternatives.

The comparative evaluation of 'Alternative Methods' using this traffic factor is presented in Table 11-20.

Table 11-20: Traffic Evaluation of 'Alternative Methods'

Indicator	Differentiating Factors	Alternative 1	Alternative 2	Alternative 3
Expected effect on traffic along haul routes.	Changes in traffic volume.	Same for each alternative. <u>Equally Preferred</u>	Same for each alternative. <u>Equally Preferred</u>	Same for each alternative. <u>Equally Preferred</u>
	Changes in required haul routes.	Same for each alternative (expected to remain the same). <u>Equally Preferred</u>	Same for each alternative (expected to remain the same). <u>Equally Preferred</u>	Same for each alternative (expected to remain the same). <u>Equally Preferred</u>
	Changes in type of vehicle expected.	Same for each alternative. <u>Equally Preferred</u>	Same for each alternative. <u>Equally Preferred</u>	Same for each alternative. <u>Equally Preferred</u>
Preferred Alternative		**Equally Preferred**	**Equally Preferred**	**Equally Preferred**

As a result, there are no unique advantages or disadvantages when comparing the three alternatives for the Boyne Road Landfill expansion from a transportation perspective. There are no advantages or disadvantages to describe because from the perspective of the traffic component the landfill expansion 'Alternative Methods' are quite similar.

No landfill expansion 'Alternative Methods' are expected to have an impact to traffic that will require the upgrade of any intersection over the life of the landfill. If the landfill were to close (Do-Nothing), this would also have no impact to traffic requiring upgrades to any intersections. Therefore, there are no distinct advantages or disadvantages of Do-Nothing versus any landfill expansion 'Alternative Method'.

11.2.10 Design and Operations

The indicator for design and operations is:

- Estimated costs associated with implementation of expansion alternatives

The factors considered to differentiate between 'Alternative Methods' for landfill expansion, from the financial perspective of the estimated costs for construction and operations, were selected because they are most likely to result in an adverse effect. These factors are:

- Capital costs for establishing the additional disposal capacity
- Additional ongoing operational and maintenance requirements and costs associated with the expansion

Capital Costs – The main components that will have different capital costs between the three expansion alternatives are: 1) the volume of excavation and 2) the supply and placement of material for the constructed landfill base layer.

The factual information relevant to this factor is provided below in Table 11-21.

Table 11-21: Capital Cost Information for Evaluation of 'Alternative Methods'

	Alternative 1	Alternative 2	Alternative 3
Total Additional Waste Footprint Area (ha)	3.9	4.5	3.8
Volume of Excavation (m^3)	12,650	14,150	12,100
Volume of Material for Constructed Landfill Base Layer (m^3)	39,000	45,000	38,000

Ongoing Additional Operational and Maintenance Costs – The approach to operations of the landfill expansion will be a continuation of current operations. The proposed expansion is as a natural attenuation landfill. As such, there is not expected to be a significant change in operational or maintenance requirements between the existing landfill and the proposed expansion, nor is there expected to be a difference between the three expansion alternatives.

The comparative evaluation of 'Alternative Methods' using these factors is presented in Table 11-22.

Table 11-22: Design and Operations Evaluation of 'Alternative Methods

Indicator	Differentiating Factors	Alternative 1	Alternative 2	Alternative 3
Costs associated with implementation of expansion alternatives.	Estimated capital costs for the additional disposal capacity.	Lower costs to construct the expansion than Alternative 2, and similar to Alternative 3. Most Preferred	Highest costs to construct the expansion. Less Preferred	Lowest costs to construct the expansion, but similar to Alternative 1. Most Preferred
	Additional ongoing operational and maintenance requirements and costs associated with the expansion.	No additional costs associated with the expansion. Equally Preferred	No additional costs associated with the expansion. Equally Preferred	No additional costs associated with the expansion. Equally Preferred
Preferred Alternative for Financial		**Most Preferred**	**Less Preferred**	**Most Preferred**

Based on this evaluation, Alternatives 1 and 3 are most preferred and considered equal, while Alternative 2 is less preferred.

In addition to the comparative evaluation using the indicator and factors of differentiation, the advantages and disadvantages identified by the comparative evaluation are shown in Table 11-23.

Table 11-23: Evaluation of Advantages and Disadvantages for Design and Operations

Design and Operations	Advantages	Disadvantages
Alternative 1	Lower overall capital costs at existing landfill (similar to Alternative 3). No capital costs at other unorganized landfill locations in the Township.	Higher capital cost to implement than Do-Nothing.
Alternative 2	None. No capital costs at other unorganized landfill locations in the Township.	Highest capital cost to implement expansion.
Alternative 3	Lowest overall capital costs at existing landfill (similar to Alternative 1). No capital costs at other unorganized landfill locations in the Township.	Higher capital cost to implement than Do-Nothing
Do-Nothing	No capital cost at existing landfill.	Potential for capital costs at other unorganized landfilling locations in the Township.

As outlined in Table 11.23, Alternative 3 has the advantage of having the lowest overall capital costs with Alternative 2 the next lowest. Alternative 2 has the disadvantage of having the highest capital cost to implement landfill expansion.

The costs for the Do-Nothing scenario are not zero, as on-going monitoring and maintenance will be required for decades post-closure of the existing landfill. Also, the Do-Nothing scenario could encourage unorganized landfilling in other areas of the Township that could incur costs to clean up. To expand the landfill, any ‘Alternative Method’ will incur some capital costs, although these will be relatively lower because a natural attenuation expansion design is proposed, and affordable for the Township as they are spread over time as the expansion is progressively developed. During operation of the landfill and post-closure, on-going monitoring will be required. Therefore, the Do-Nothing scenario has the advantage of less capital cost and a shorter duration of on-going monitoring and maintenance than any landfill expansion ‘Alternative Method, with potential for clean-up costs resulting from unorganized landfilling as a disadvantage. Any landfill expansion ‘Alternative Method’ has the disadvantage of more capital cost and longer duration of on-going monitoring and maintenance than Do-Nothing, and only a slight advantage with no unorganized landfill costs expected.

11.3 Public Input Regarding the Ranking of Alternatives

As described in Sections 4.6.3 and 4.8.2 of this EASR, throughout the consultation period for the EA process, by way of meetings with the public, the technical bulletins and the project website, feedback was solicited from the public. Among other things, feedback regarding the preferential ranking of components and sub-components was solicited from the public. The public was asked to consider if any component or sub-component was more or less important than another. The public was also provided an opportunity to comment on the individual component assessments or the identification of the preferred alternative, and whether they agreed or disagreed.

No feedback was received that conflicted with any of the analysis and ranking of individual components presented in Section 11.2. The opportunity for ranking of components and sub-components from stakeholders was provided mostly during Open House #1 during the ToR and Technical Bulletin #3. The rankings of the relative importance of the components by the stakeholders was considered in the overall identification of the preferred alternative, as described in Section 11.4.

11.4 Comparative Evaluation

The ranking of the 'Alternative Methods' for each of the components and sub-components and identification of the overall preferred alternative is presented in Table 11-24. The public ranking of the relative importance of the components and sub-components is also provided in Table 11-24. The comparative evaluation of 'Alternative Methods' of expanding the Boyne Road Landfill identified Alternative 3 as the preferred method of expanding the landfill.

Table 11-24: Summary of the Components and Sub-components Comparative Evaluation of 'Alternative Methods'

Component	Sub-component	Alternative 1	Alternative 2	Alternative 3	Public Ranking Group[1]
Atmosphere	Air Quality (dust, odour and GHG)	Equally Preferred	Equally Preferred	Equally Preferred	Important
Atmosphere	Noise	Equally Preferred	Equally Preferred	Equally Preferred	Less Important
Geology and Hydrogeology	Groundwater quality	Equally Preferred	Equally Preferred	Equally Preferred	Very Important
Surface Water	Surface water quality	Equally Preferred	Equally Preferred	Equally Preferred	Very Important
Surface Water	Surface water quantity	Most Preferred	Less Preferred	Most Preferred	Less Important
Biology	Aquatic ecosystems	Less Preferred	Least Preferred	Most Preferred	Less Important
Biology	Terrestrial ecosystems	Less Preferred	Least Preferred	Most Preferred	Less Important
Agriculture	Agriculture	Equally Preferred	Equally Preferred	Equally Preferred	Important
Land Use	Current and planned future land uses	Equally Preferred	Equally Preferred	Equally Preferred	Important
Cultural Heritage Resources	Archaeology	Equally Preferred	Equally Preferred	Equally Preferred	Less Important

Component	Sub-component	Alternative 1	Alternative 2	Alternative 3	Public Ranking Group[1]
Cultural Heritage Resources	Cultural Heritage Landscapes	Equally Preferred	Equally Preferred	Equally Preferred	Less Important
Cultural Heritage Resources	Built Heritage Resources	Equally Preferred	Equally Preferred	Equally Preferred	Less Important
Socio-economic	Local Economy	Equally Preferred	Equally Preferred	Equally Preferred	Not in survey at the time
Socio-economic	Residents and Community	Equally Preferred	Equally Preferred	Equally Preferred	Not in survey at the time
Socio-economic	Visual	Equally Preferred	Equally Preferred	Equally Preferred	Important
Transportation	Traffic	Equally Preferred	Equally Preferred	Equally Preferred	Not in survey at the time
Design and Operations	Financial	Most Preferred	Less Preferred	Most Preferred	Less Important
Overall Evaluation of Alternatives		**Less Preferred**	**Least Preferred**	**Most Preferred**	

Notes: [1] Only one member of the public commented on this during the ToR Open House #1 when components and sub-components were slightly different.

As shown in Table 11-24, there are 10 components and 17 sub-components.

Of the 17 sub-components that were comparatively assessed, 13 were ranked as equally preferred for the three expansion alternatives. These included components or sub-components that are often considered to be most important such as geology and hydrogeology and surface water quality. The high number of equally preferred rankings reflect the similarity among the available expansion alternative designs in terms of location on the landfill property, physical dimensions to provide the required airspace and considerable distance from potential off-site sensitive receptors.

Of the four sub-components where there are differences in preference, Alternative 3 was most preferred for all four. Alternative 1 was most preferred for two sub-components (ranked the same as Alternative 3) and less preferred for the other two. Alternative 2 was ranked as less preferred for two of the sub-components and least preferred for the other two.

The advantages and disadvantages for each of the components and sub-components and Do-Nothing scenario are presented in Table 11-25.

Table 11-25: Summary of the Components and Sub-components Advantages and Disadvantages

Component	Sub-component	Alternative 1	Alternative 2	Alternative 3	Do-Nothing
Atmosphere	Air Quality (dust, odour and GHG)	No advantages or disadvantages between 'Alternative Methods'. Disadvantage of greater but mitigable air quality impacts with landfill expansion.	No advantages or disadvantages between 'Alternative Methods'. Disadvantage of greater but mitigable air quality impacts with landfill expansion.	No advantages or disadvantages between 'Alternative Methods'. Disadvantage of greater but mitigable air quality impacts with landfill expansion.	Advantage of less air quality impacts at landfill location. Disadvantage of potential air quality impacts at other locations.
Atmosphere	Noise	No advantages or disadvantages between 'Alternative Methods'. Disadvantage of greater but mitigable noise impacts with landfill expansion.	No advantages or disadvantages between 'Alternative Methods'. Disadvantage of greater but mitigable noise impacts with landfill expansion.	No advantages or disadvantages between 'Alternative Methods'. Disadvantage of greater but mitigable noise impacts with landfill expansion.	Advantage of no noise impacts at landfill location.
Geology and Hydrogeology	Groundwater quality	No advantages or disadvantages between 'Alternative Methods'. Disadvantage of greater but mitigable groundwater quality impacts with landfill expansion.	No advantages or disadvantages between 'Alternative Methods'. Disadvantage of greater but mitigable groundwater quality impacts with landfill expansion.	No advantages or disadvantages between 'Alternative Methods'. Disadvantage of greater but mitigable groundwater quality impacts with landfill expansion.	Advantage of less groundwater quality impacts at landfill location. Disadvantage of potential groundwater quality impacts at other locations.

Component	Sub-component	Alternative 1	Alternative 2	Alternative 3	Do-Nothing
Surface Water	Surface water quality	No advantages or disadvantages between 'Alternative Methods'. Advantage of improved surface water quality impacts with landfill expansion.	No advantages or disadvantages between 'Alternative Methods'. Advantage of improved surface water quality impacts with landfill expansion.	No advantages or disadvantages between 'Alternative Methods'. Advantage of improved surface water quality impacts with landfill expansion.	Disadvantage of greater surface water quality impacts at landfill location.
Surface Water	Surface water quantity	Advantage of less reduction in site infiltration and small increase in off-site discharge volume. No advantages or disadvantages over Do-Nothing.	Disadvantage of greater reduction in site infiltration and greater increase in off-site discharge volume. No advantages or disadvantages over Do-Nothing.	Advantage of less reduction in site infiltration and small increase in off-site discharge volume. No advantages or disadvantages over Do-Nothing.	No advantages of disadvantages over other 'Alternative Methods'.
Biology	Aquatic ecosystems	Advantage of least increase in duration of off-site flows. Advantage of improved aquatic habitat over Do-Nothing. Disadvantage of greatest area of fish habitat removal.	Advantage of Improved aquatic habitat over Do-Nothing. Disadvantage of greatest increase in duration of off-site flows.	Advantage of least area of fish habitat remove. Advantage of improved aquatic habitat over Do-Nothing. Disadvantage of greatest increase in duration of off-site flows.	Advantage of no change in duration of off-site flows. Advantage of no fish habitat removal. Disadvantage of no improved aquatic habitat over 'Alternative Methods'. Disadvantage of potential aquatic habitat impacts at other locations.

Component	Sub-component	Alternative 1	Alternative 2	Alternative 3	Do-Nothing
Biology	Terrestrial ecosystems	Advantage of moderate disturbance footprint. Disadvantage of loss of some portion of each of the significant natural features identified. Advantage of no disturbance of additional natural habitat in the Township.	Disadvantage of loss of some portion of each of the significant natural features identified including Significant Wildlife Habitat Interior Forest. Disadvantage of greatest impact on bat habitat. Advantage of no disturbance of additional natural habitat in the Township.	Advantage of smallest disturbance footprint. Advantage of best protection for bat habitat. Disadvantage of loss of some portion of each of the significant natural features identified. Advantage of no disturbance of additional natural habitat in the Township.	Advantage of preservation of all identified habitat at the existing landfill. Disadvantage of potential for disturbance of other and unknown habitat throughout the Township.
Agriculture	Agriculture	Advantage of no random loss of agricultural land in the Township. Disadvantage of small loss of agricultural land south of the existing landfill.	Advantage of no random loss of agricultural land in the Township. Disadvantage of small loss of agricultural land south of the existing landfill.	Advantage of no random loss of agricultural land in the Township. Disadvantage of small loss of agricultural land south of the existing landfill.	Advantage of no loss of agricultural land near the landfill. Disadvantage of possible random loss of agricultural land in the Township.
Land Use	Current and planned future land uses	Advantage of being compatible with land use policy.	Advantage of being compatible with land use policy.	Advantage of being compatible with land use policy.	Disadvantage of possible incompatibility with land use policy.
Cultural Heritage Resources	Archaeology	Advantage of no archaeology resource losses.	Advantage of no archaeology resource losses.	Advantage of no archaeology resource losses.	Disadvantage of possible archaeology resource losses.

Component	Sub-component	Alternative 1	Alternative 2	Alternative 3	Do-Nothing
Cultural Heritage Resources	Cultural Heritage Landscapes	No advantages or disadvantages.	No advantages or disadvantages.	No advantages or disadvantages.	No advantages or disadvantages.
Cultural Heritage Resources	Built Heritage Resources	No advantages or disadvantages.	No advantages or disadvantages.	No advantages or disadvantages.	No advantages or disadvantages.
Socio-economic	Local Economy	Advantage of ongoing employment at the landfill. Disadvantage of capital and operating cost.	Advantage of ongoing employment at the landfill. Disadvantage of capital and operating cost.	Advantage of ongoing employment at the landfill. Disadvantage of capital and operating cost.	Advantage of no capital cost and lower, shorter duration operating cost. Disadvantage of no employment at the landfill.
Socio-economic	Residents and Community	No advantages or disadvantages.	No advantages or disadvantages.	No advantages or disadvantages.	No advantages or disadvantages.
Socio-economic	Visual	Advantage of no other visual impacts in the Township. Disadvantage of a mitigable slight increase in visibility from the south.	Advantage of no other visual impacts in the Township. Disadvantage of a mitigable slight increase in visibility from the south.	Advantage of no other visual impacts in the Township. Disadvantage of a mitigable slight increase in visibility from the south.	Advantage of no change in visibility at the existing landfill. Disadvantage of other potential visual impacts in the Township.
Transportation	Traffic	No advantages or disadvantages.	No advantages or disadvantages.	No advantages or disadvantages.	No advantages or disadvantages.

Component	Sub-component	Alternative 1	Alternative 2	Alternative 3	Do-Nothing
Design and Operations	Financial	Advantage of potential for clean-up costs throughout the Township. Disadvantage of capital costs and longer duration of operational costs.	Advantage of potential for clean-up costs throughout the Township. Disadvantage of capital costs and longer duration of operational costs.	Advantage of potential for clean-up costs throughout the Township. Disadvantage of capital costs and longer duration of operational costs.	Advantage of no capital costs and shorter duration of operational costs. Disadvantage of potential for clean-up costs throughout the Township.

Alternative 3 was identified as the preferred expansion alternative for the Boyne Road landfill. The advantages of Alternative 3 are that it has the least potential for disruption/adverse effects on the natural environment (both aquatic and terrestrial), the least potential for impacts on surface water quantity and the lowest capital cost for implementation of the expansion as compared to the other 'Alternative Methods'.

The Do-Nothing scenario provides a benchmark against which the consequences of the alternatives can be measured, to determine, among other things, the extent to which other alternatives address the problem or opportunity. In terms of waste management within the Township of North Dundas, the Do-Nothing scenario does not address the problem as it does not provide a long term residual waste management strategy for the Township. There are some advantages but likely more disadvantages with respect to any of the 'Alternative Methods' of landfill expansion when assessed against the Do-Nothing alternative; however, all identified potential disadvantages are considered small and mitigable.

12.0 Description of the Preferred Undertaking

This section presents a description of the preferred method of expansion of the Boyne Road Landfill site. The comparative evaluation presented in Section 11.0 of this document identified Alternative 3 - primarily horizontal expansion on the south side of the existing footprint- as the overall preferred landfill expansion alternative. The factors considered in the development of Alternative 3, as described in Section 10.0, have been further refined at an EA conceptual level of design and detail to prepare this description of undertaking to serve as the basis for detailed impact assessment (Section 13.0). This refinement and modifications do not change Alternative 3 as it was considered in the comparative evaluation; rather it simply updates it and provides some additional details for consideration in the detailed impact assessment.

12.1 Description of the Landfill Expansion

For Alternative 3, the vertical expansion above the approved top of waste contours is limited to the southern half of the current footprint, tying it with the horizontal expansion to the south where the majority of the additional disposal airspace will be achieved.

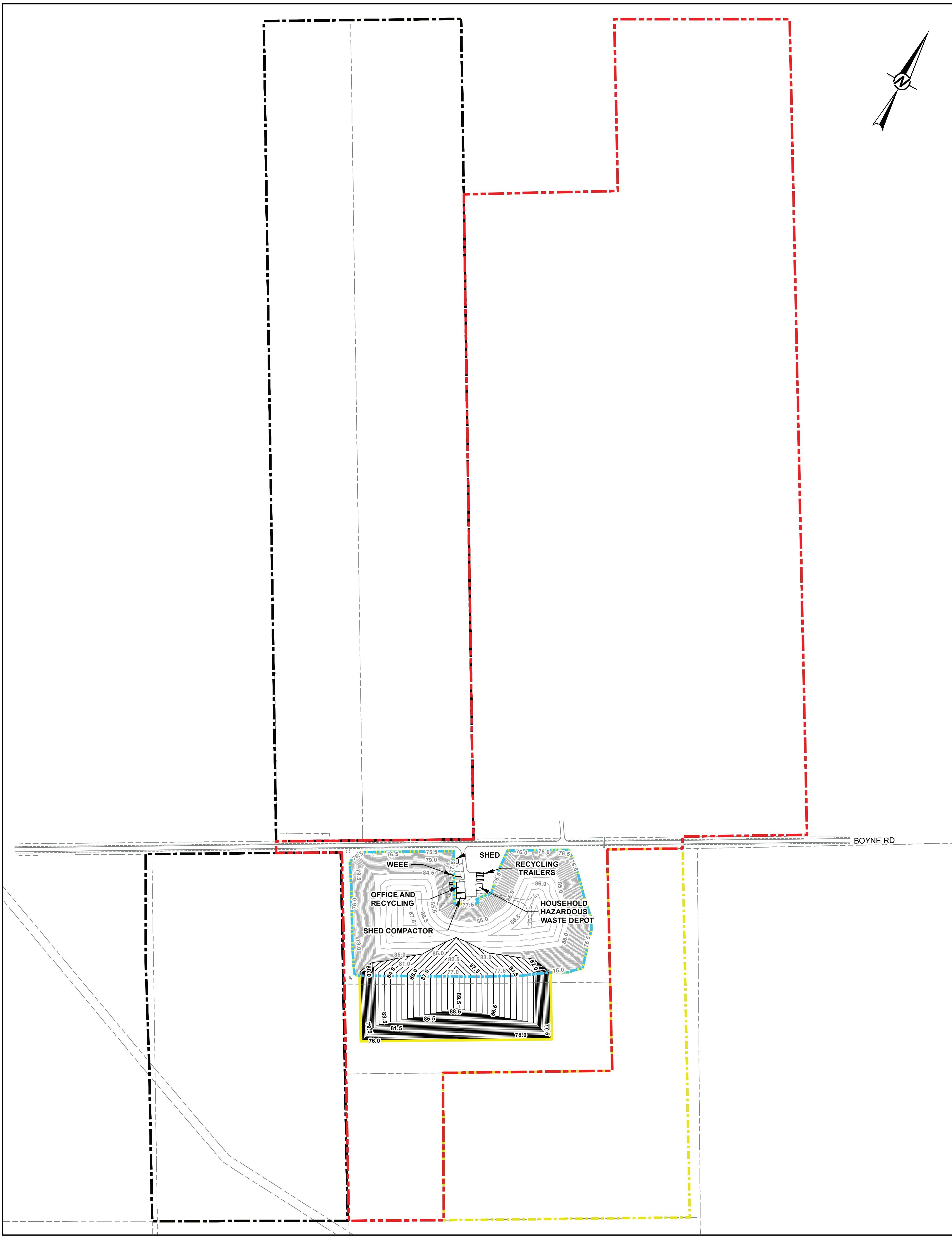
The horizontal expansion adds an additional 3.8 ha of footprint, for a total landfill footprint of 11.9 ha. The total expanded landfill capacity for waste and daily cover, including the additional 417,700 m^3 beyond 2023 provided by the expansion, is 1,060,750 m^3. Including the proposed 0.75 m thick final cover, the total airspace will be approximately 1,089,250 m^3. The maximum elevation of the landfill will be along its peak at elevation 89.75 masl, which is approximately 15 m above the average ground surface elevation in the vicinity of the landfill expansion and approximately 2.5 m higher than the existing approved landfill.

The landfill site property is currently 97.13 ha. It is proposed to add the 16.21 ha of Township-owned property to the east and southeast to the landfill property, resulting in a proposed total landfill property area of 113.3 ha. The proposed landfill property and expanded landfill footprint are shown on Figure 12-1.

The landfill expansion footprint will have a 30 m buffer within the landfill property on the west side (followed by the CAZ lands), and with the addition of the Township-owned lands to the east and southeast a 257 m wide buffer on the east side and a 313 m wide buffer on the south side.

Associated with the existing landfill is 71.25 ha of CAZ lands to the north and west of the landfill property. Determination of the need for additional CAZ lands and their location is discussed in Section 12.2.

The geometry of Alternative 3 follows the requirements of *O.Reg.* 232/98, i.e., landfill sideslopes of 4H:1V, 25 % or flatter and landfill top area slopes not flatter than 20H:1V (5 %). The configuration of the proposed landfill expansion is shown in plan view on Figure 12-2, with cross-sections provided on Figure 12-3.



LEGEND

- EXISTING LANDFILL FILL AREA
- PROPOSED LIMIT OF WASTE FOR THE LANDFILL EXPANSION AREA
- APPROXIMATE BOUNDARY OF CONTAMINATION ATTENUATION ZONE
- PROPOSED NEW LANDFILL PROPERTY BOUNDARY TO BE ADDED THROUGH AN ECA AMENDMENT
- APPROXIMATE LANDFILL SITE PROPERTY BOUNDARY
- GROUND SURFACE CONTOURS (mASL), BASED ON RESULTS OF THE SURVEYS CONDUCTED IN 2008, 2010, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019 AND 2020
- PROPOSED EXPANSION TOP OF WASTE ELEVATION CONTOURS (mASL)

REFERENCES

1. BASE PLAN SUPPLIED IN ELECTRONIC FORMAT BY STANTEC CONSULTING LTD.
2. 2008 AND 2010 SURVEYS COMPLETED BY STANTEC CONSULTING LTD.
3. MAY 2012, JULY 2013, NOVEMBER 2014, DECEMBER 2015, NOVEMBER 2016, AND DECEMBER 2017 SURVEYS COMPLETED BY GOLDER ASSOCIATES LTD.

DRAFT

0 60 120 180 240 300

1:6,500 METRES

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

CONSULTANT
GOLDER MEMBER OF WSP

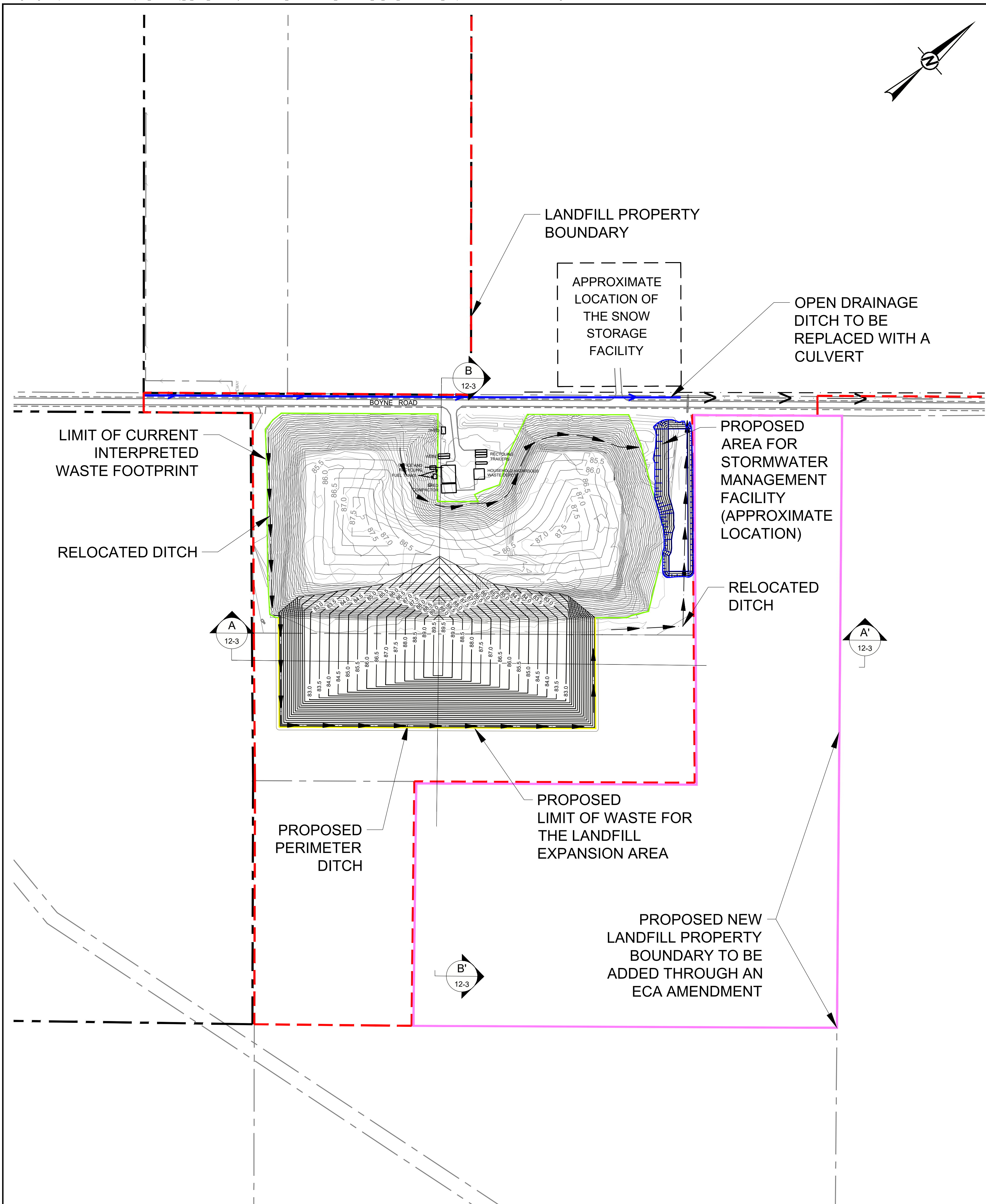
YYYY-MM-DD	2021-11-16
PREPARED	JEM
DESIGN	PLE
REVIEW	YJM
APPROVED	PLE

TITLE
PROPOSED LANDFILL PROPERTY AND EXPANDED LANDFILL FOOTPRINT

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	0	**12-1**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 25mm

Path: \\golder.gds\complexdata\office\ottawa\Active\Spatial_IM\Township_of_North_Dundas\BoyneRoadLandfill\99_PROJ\1648253\40_PROD\Phase_2.0_Task_2.2.0\DWG\0001_EA\ | File Name: 1648253-0001-CW-0001.dwg



LEGEND

85.0	GROUND SURFACE CONTOURS (MASL), BASED ON RESULTS OF THE SURVEYS CONDUCTED IN 2008, 2010, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019 AND 2020
89.5	PROPOSED EXPANSION TOP OF WASTE ELEVATION CONTOURS (MASL)
	APPROXIMATE PROPERTY BOUNDARY OF LANDFILL SITE
	APPROXIMATE BOUNDARY OF EXISTING CONTAMINANT ATTENUATION ZONE EASEMENT LANDS
	PROPOSED PERIMETER DITCH
	EXISTING ROADSIDE DITCH TO BE REPLACED WITH A CULVERT (APPROXIMATE LOCATION)
	PROPOSED NEW LANDFILL PROPERTY BOUNDARY TO BE ADDED THROUGH AN ECA AMENDMENT

NOT FOR CONSTRUCTION

DRAFT

REFERENCE(S)

1. BASE PLAN SUPPLIED IN ELECTRONIC FORMAT BY STANTEC CONSULTING LTD.
2. 2008 AND 2010 SURVEYS COMPLETED BY STANTEC CONSULTING LTD.
3. MAY 2012, JULY 2013, NOVEMBER 2014, DECEMBER 2015, NOVEMBER 2016, DECEMBER 2017, DECEMBER 2018 AND NOVEMBER 2019, APRIL 2020 AND DECEMBER 2020 SURVEYS COMPLETED BY GOLDER ASSOCIATES LTD.
4. COORDINATES SYSTEM: MTM ZONE 9 NAD83 DATUM CGVD28

0 100 200

1:4,000 METRES

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-16
DESIGNED	YJM
PREPARED	ABD
REVIEWED	PLE
APPROVED	PAS

TITLE
SITE PLAN OF PROPOSED EXPANSION

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0\2.2.0.	0	12-2

25 mm
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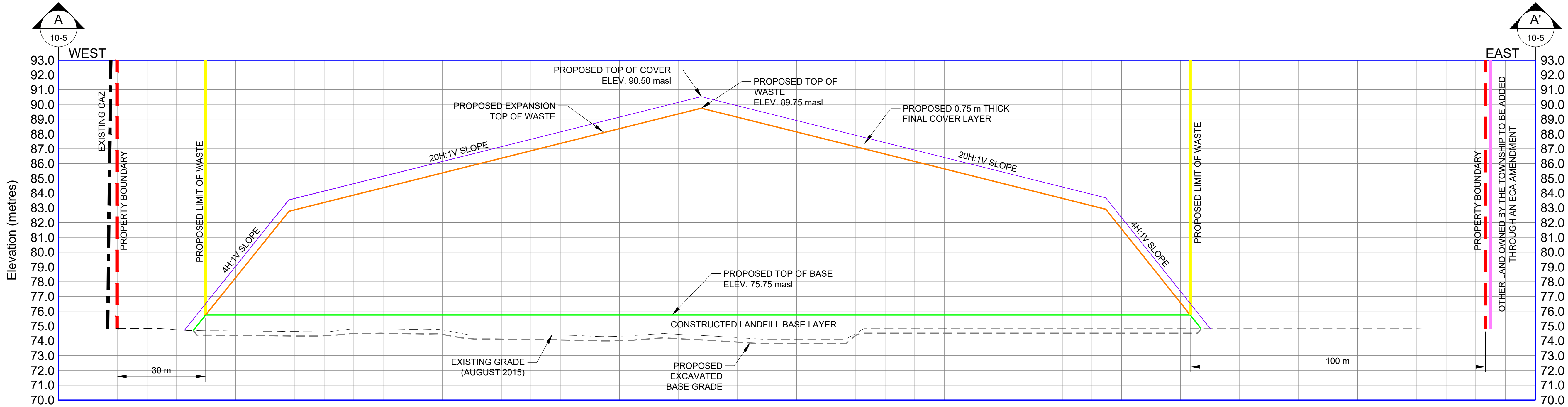
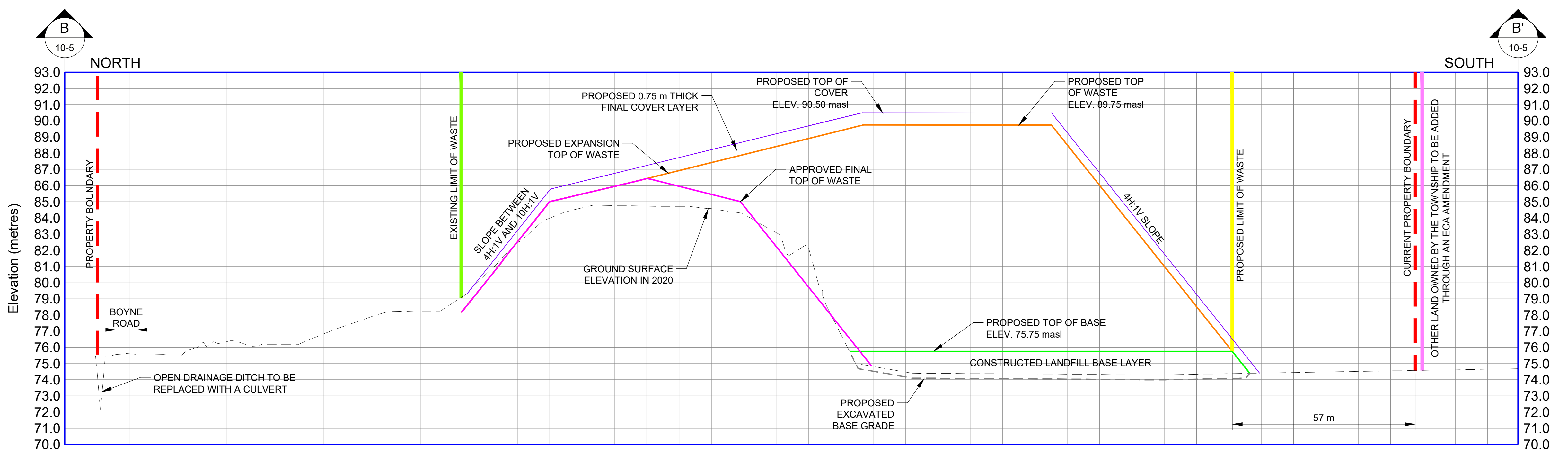


HORIZ. SCALE 1:1,500 m
VERT. SCALE 1:300 m
A-A' SECTION
10-5



HORIZ. SCALE 1:1,500 m
VERT. SCALE 1:300 m
B-B' SECTION
10-5

NOT FOR CONSTRUCTION

DRAFT

0 25 50
1:1,500 HORIZONTAL SCALE METRES

0 5 10
1:300 VERTICAL SCALE METRES

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-16
DESIGNED	YJM
PREPARED	ABD
REVIEWED	PLE
APPROVED	PAS

TITLE
CROSS-SECTIONS OF PROPOSED EXPANSION

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0\2.2.0.	0	12-3

12.2 Leachate Management and Groundwater Protection

As discussed in Section 10.1, it is proposed that the expanded Boyne Road Landfill will continue to operate as a natural attenuation site, noting that it may be necessary for the Township to acquire additional property and/or CAZ easement agreements to protect off-site groundwater quality in compliance with the Reasonable Use Guideline. The need for any additional CAZ lands and their location will be determined from the results of predictive modelling to be carried out as part of the detailed groundwater impact assessment for the proposed expansion (as described in Section 13.2).

The seasonally high groundwater table in the area of the proposed expansion is close to the existing ground surface. The MECP Landfill Standards require a minimum separation of 1 m between the high groundwater table and the base of the waste. Therefore, the design of the expansion will include an approximately 1 m thick pad of imported permeable fill material (for example, sandy material) above the existing ground surface (stripped of its thin layer of topsoil) to provide a base for waste disposal. As shown on the cross-sections on Figure 12-3, the proposed elevation of the top of the base pad is 75.75 masl. The base will be constructed in sections prior to waste placement in accordance with the site development plan for the expanded landfill cells/phases to be developed during detailed design prepared during the ECA application process. The use of permeable fill will also allow the leachate to infiltrate into the groundwater system while minimizing the potential for both the development of a leachate mound within the waste and lateral leachate seeps at the perimeter of the expanded disposal area footprint.

12.3 Geotechnical Assessment

A geotechnical assessment was carried out to confirm the stability of the proposed landfill configuration and the results are provided in Volume 2 Appendix D-2. The landfill expansion area is underlain by a layer of competent glacial till followed by bedrock. The proposed 4H:1V landfill sideslopes have an acceptable factor of safety in terms of slope stability.

The glacial till is a granular soil type that will undergo limited compression under the applied load of the landfilled waste. It is also noted that there is no landfill infrastructure beneath the existing landfill or proposed vertical and horizontal expansion that could be adversely affected by compression of subgrade soils under the weight of the waste.

12.4 Landfill Gas (LFG) Management

As per *O.Reg.* 232/98, there is no requirement for a landfill site with a total capacity of less than 1.5 million m^3 to include a landfill gas collection and control system. A landfill gas collection and flaring system is therefore not proposed for the Boyne Road landfill expansion (total capacity of 1,060,750 m^3, unless the detailed air quality impact assessment to be carried out for the proposed expansion (Section 13.1.1) indicates that a collection system is needed to achieve compliance with provincial requirements related to allowable air quality at off-site receptors.

Also, considering the high water table that is almost at ground surface on and in the area of the landfill site, off-site lateral migration of landfill gas through the subsurface is not expected.

Rather, the landfill gas generated at the site is expected to vent to atmosphere through the landfill cover soils. Methane detectors are in place at on-site buildings and are proposed to be maintained throughout the operating period. In addition, there are no existing structures in the 500 m Site-vicinity Study Area (refer to Figure 9-1).

12.5 Stormwater Management and Surface Water Protection

As described in Section 11.2.3, there is currently no quality or quantity control system for stormwater management in place for the existing landfill except for the existing perimeter ditch that collects and conveys runoff to the Volks Municipal Drain ditch along the north side of Boyne Road. For the expansion, it is proposed that a wetland type stormwater facility will be constructed at the northeast corner area of the landfill site on the south side of Boyne Road and outlet at the same as outlet as for the existing perimeter ditch. This wetland will be sized based on the following MECP criteria:

- Enhanced (80%) long-term TSS removal to provide the “highest level” of quality control of stormwater
- Water quality storage requirements will be determined based on Table 3.2 of the Ontario Stormwater Management Planning and Design Manual (MECP, 2003)

The general location of this stormwater management facility is shown on Figure 12-2. The required sizing and other features of this facility will be determined as part of the detailed impact assessment on surface water (Section 13.3). A ditch is also proposed on the north face of the existing landfill to help capture the majority of the existing disposal area that currently drains directly to the Boyne Road roadside ditch and is not first collected by an on-site perimeter ditch (see Figure 12-2); this north side ditch will connect to the proposed stormwater management facility.

Similarly, the existing perimeter ditch is proposed to be reconfigured and extended around the perimeter of the expansion footprint. As described in Section 10.1, the proposed location of this ditch is near the toe of the landfill sideslope but elevated in relation to adjacent grades around the expansion such that collected runoff is from the landfill cover only and does not intercept adjacent stormwater or leachate-impacted groundwater. This is shown in plan view on Figure 12-2.

As described in Section 10.1, it is also proposed as a component of the expansion design to install a culvert in the roadside ditch along the north side of Boyne Road (Volks Municipal Drain) opposite the landfill site frontage. This measure would isolate and convey surface water past the landfill site from upstream (west) to downstream (east) and prevent potential seepage of leachate-impacted groundwater into the surface water in the ditch. With the culvert installed and provided with periodic seepage collars to prevent water movement along the granular bedding and backfill, the groundwater would continue northward as groundwater flow into the landfill buffer zone located north of Boyne Road and the approved CAZ easement, with the intent that site compliance would be evaluated by the groundwater RUG rather than effects on ditch surface water quality. This culvert replacement of the existing open ditch is illustrated on Figure 12-2.

12.6 Site Operations

The expanded landfill will continue to operate from 8 a.m. to 4 p.m., Monday through Friday plus one hour before, i.e., 7 a.m. to 8 a.m., for site preparations and one hour after, i.e., 4 p.m. to 5 p.m. to complete placement of daily cover. The site will continue Saturday operations from 8 a.m. to 12 p.m. May through November and only one Saturday a month from 8 a.m. to 12 p.m. November through May. The site will be closed on Sunday.

The existing waste diversion facilities will continue to operate in the central portion of the landfill area. These facilities include preparation of recyclables in the material recycling building for transfer off-site; and acceptance of WEEE, HHW, tires, fluorescent bulbs, scrap metal and refrigerant appliances for temporary storage in the appropriate facilities/areas and/or preparation for transfer off-site. Wood and brush will also be accepted with planned grinding for use as alternative daily cover.

12.7 Maintenance and Monitoring

A program for operational and environmental monitoring will continue to be carried out at the expanded Boyne Road Landfill site. Operational monitoring includes ongoing inspections and recording of site conditions, maintenance, and repairs. Environmental monitoring is carried out as part of site operations to check for potential releases from the landfill and, if required, trigger investigation and mitigation measures before adverse effects occur off-site. The current environmental monitoring program consists of leachate, groundwater and surface water; it is expected that monitoring of the performance of the proposed stormwater management pond will be added to the program. The environmental monitoring programs are generally described in Section 16.0. Operational and environmental monitoring programs will continue in the post-closure period.

12.8 Closure and Post-closure

The landfill will be progressively closed in phases after the final waste contours have been reached and landfill operations have proceeded into the next Phase. The final cover on the landfill will consist of 600 mm of soil, which is expected to consist of imported materials from off-site sources. This is intended to be a permeable final cover design, to allow infiltrating precipitation to enter the waste and remove the contaminants from the waste as leachate, and thereby reduce the contaminating lifespan of the landfill site. This will be topped with 150 mm of soil capable of sustaining vegetation. This final cover design approach is in accordance with *O. Reg.* 232/98.

Post-closure activities will involve continued operation and maintenance of the stormwater management system. In addition to general inspection of the site, there will be inspection of the landfill cover for evidence of erosion, leachate seeps or instability, and maintenance / repair as required.

13.0 Impact Assessment of The Preferred Undertaking

13.1 Atmosphere

13.1.1 Air Quality

The effects of the proposed landfill expansion on air quality were identified through comparing the existing landfill and the proposed expansion, using the following three steps:

- Calculating representative emissions rates for each of the significant sources (detailed in Volume 2 Appendix B-2). The results are summarized in Sections 13.1.1.2 ad 13.1.1.3.
- Carrying out atmospheric dispersion modelling to predict off-Site concentrations of the indicator compounds (detailed in Volume 2 Appendix B-3). The results of the modelling are provided in Section 13.1.1.4.
- Comparison of predicted concentrations to existing conditions and the Applicable Guidelines (Section 9.1.1.5).

13.1.1.1 Emission Estimation

The method used for calculating and quantifying air emissions resulting from the existing and proposed landfill involved the following steps:

- **Identifying emissions sources:** Emission sources were identified based on information provided by the Township of North Dundas.
- **Calculating emission rates:** Air emission rates were calculated using MECP typically accepted methods, such as published emission factors, and were based on design activity data provided by the engineering team. Emission rates were conservatively calculated to estimate the release rates into the atmosphere.

The emission estimation methods followed accepted MECP practices including, where applicable, guidance in the Ontario MECP document *Procedure for Preparing an Emission Summary and Dispersion Modelling Report Version 4.1* (MECP, 2018b).

In calculating these emissions, all potential sources of emission at the proposed landfill expansion were considered; however, only sources with emissions rates that are expected to be either negligible or infrequent were not considered (e.g., household hazardous waste drop off). Details of the specific emissions calculation methods and resulting emissions are provided in Volume 2 Appendix B-2.

13.1.1.2 Identification of Emission Sources

Table 13-1 outlines the activities (i.e., sources of emissions) that have been assessed as part of the air quality assessment for both the existing landfill and the proposed landfill expansion. For sources that were identified and not included in the assessment, the rationale has also been presented.

The on-site sources of air emissions for the existing and the proposed landfill expansion include the following:

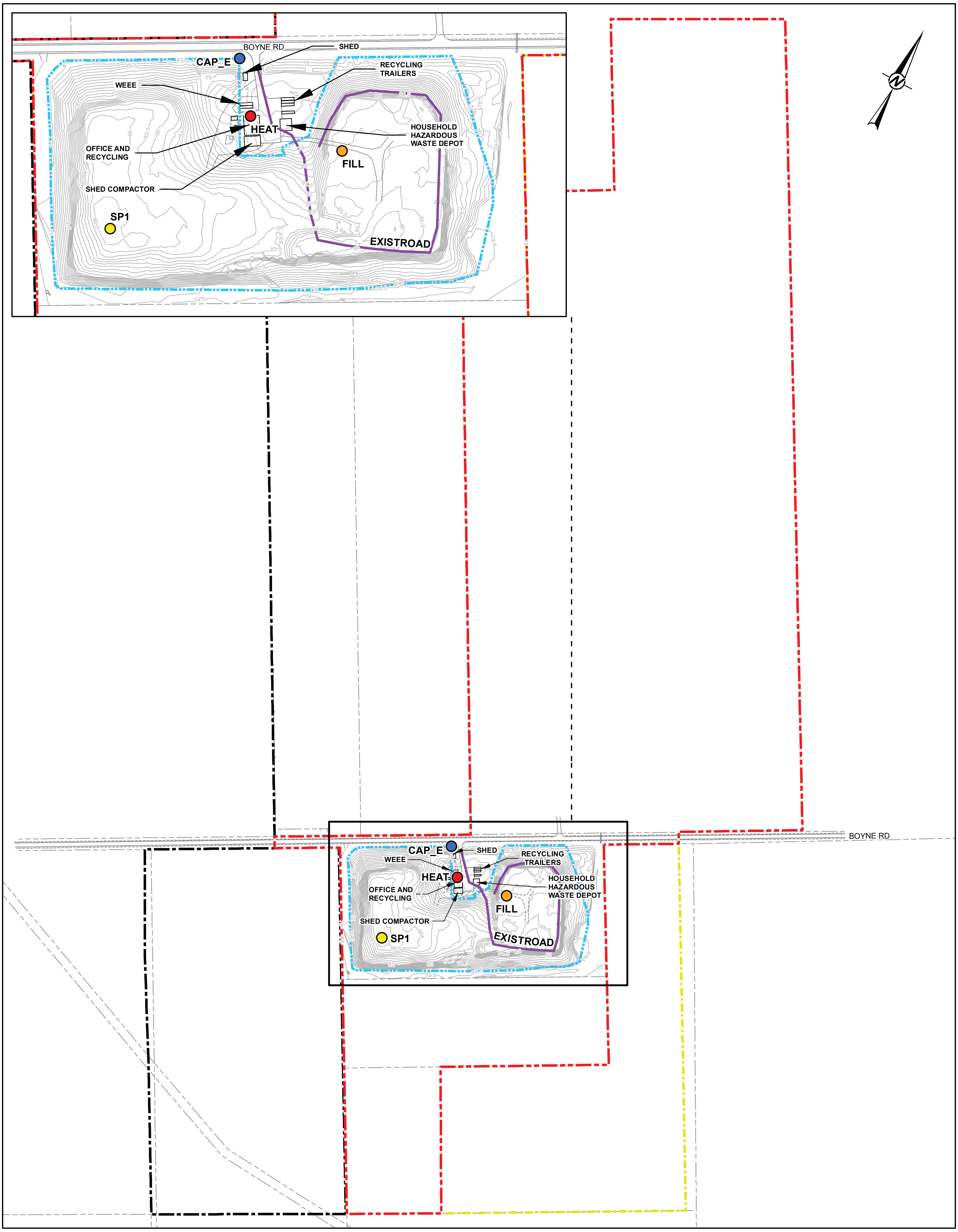
- landfill gas generated from waste decomposition
- traffic, loading and unloading
- on-site vehicle emissions
- landfill waste receipt activities
- landfill daily and final cover activities

Emissions during existing operations and after expansion are expected to be greater than during the post-operation phase (i.e., closure) because the level of on-site activities will be greater during the operational phase; therefore, the air emissions and associated effects during the operational phase represent the greatest potential impacts. The locations of the relevant sources under the existing and expansion scenarios are illustrated on Figures 13-1 and 13-2, respectively.

For LFG emissions, LFG generation from the Boyne Road landfill was estimated using LandGEM v.3.03 (US EPA, 2020). The LandGEM modelling software was developed by the United States Environmental Protection Agency. The predicted maximum LFG generation rate estimation for the expanded landfill was 136 standard cubic feet per minute (scfm) or 231.2 m^3/hr. This maximum generation is predicted to occur in 2049, one year after the planned closure date of the landfill. Predicted LFG generation declines each year after 2049 and by the year 2080 the predicted LFG generation rate falls to 39.4 scfm (67.0 m^3/hr). A summary of the LandGEM modelling inputs and predicted annual LFG generation rates are presented in Volume 2 Appendix B-4.

Table 13-1: Boyne Road Landfill Emission Sources

General Location	Source	Significant (Yes or No)?	Modelled (Yes or No)?	Rationale
Landfill Cap	Landfill gas emissions released passively through the landfill cap	Yes	Yes	—
Landfill Working Area	Fugitive dust and vehicle exhaust emissions from material handling activities at the working face	Yes	Yes	—
Paved and unpaved roads	Vehicle exhaust and fugitive road dust from travel on on-site roads	Yes	Yes	—
Storage piles	Wind erosion from on-site storage piles	Yes	Yes	—
Administration Building	Combustion emissions from comfort heating equipment at the administration buildings	Yes	Yes	—



LEGEND

EMISSION SOURCES

- COMFORT HEATING
- EXISTING LANDFILL CAP
- LANDFILL OPERATIONS
- STORAGE PILES
- EXISTING ROAD

- EXISTING LANDFILL FILL AREA
- APPROXIMATE BOUNDARY OF CONTAMINANT ATTENUATION ZONE
- TOWNSHIP OWNED PROPERTY
- APPROXIMATE LANDFILL SITE PROPERTY BOUNDARY
- GROUND SURFACE CONTOURS (mASL), BASED ON RESULTS OF THE SURVEYS CONDUCTED FROM 2008 TO 2020

REFERENCES

1. BASE PLAN SUPPLIED IN ELECTRONIC FORMAT BY STANTEC CONSULTING LTD.
2. 2008 AND 2010 SURVEYS COMPLETED BY STANTEC CONSULTING LTD.
3. MAY 2012, JULY 2013, NOVEMBER 2014, DECEMBER 2015, NOVEMBER 2016, AND DECEMBER 2017 SURVEYS COMPLETED BY GOLDER ASSOCIATES LTD.

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0 60 120 180 240 300

1:6,500 METRES

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

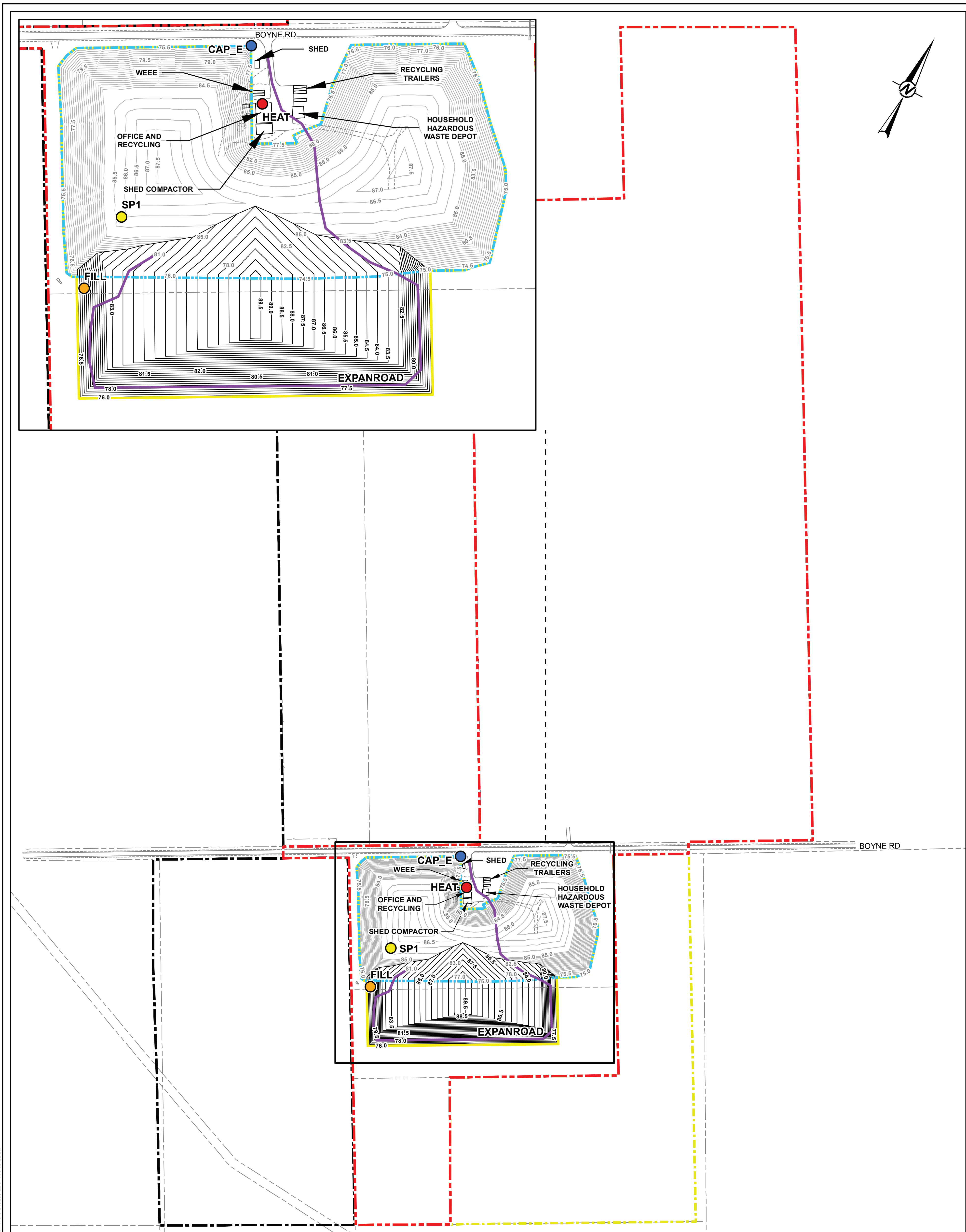
CONSULTANT

GOLDER MEMBER OF WSP

YYYY-MM-DD	2021-05-27
PREPARED	JEM
DESIGN	PLE
REVIEW	YJM
APPROVED	PLE

TITLE
SITE LAYOUT AND EMISSION SOURCE LOCATION: EXISTING

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	0	13-1



LEGEND

EMISSION SOURCES

- COMFORT HEATING
- EXISTING LANDFILL CAP
- LANDFILL OPERATIONS
- STORAGE PILES
- EXPANSION ROAD

- EXISTING LANDFILL FILL AREA
- PROPOSED LIMIT OF WASTE FOR THE LANDFILL EXPANSION AREA
- APPROXIMATE BOUNDARY OF CONTAMINANT ATTENUATION ZONE
- PROPOSED NEW LANDFILL PROPERTY BOUNDARY TO BE ADDED THROUGH AN ECA AMENDMENT
- APPROXIMATE LANDFILL SITE PROPERTY BOUNDARY

- GROUND SURFACE CONTOURS (mASL), BASED ON RESULTS OF THE SURVEYS CONDUCTED FROM 2008 TO 2020
- PROPOSED EXPANSION TOP OF WASTE ELEVATION CONTOURS (mASL)

REFERENCES

1. BASE PLAN SUPPLIED IN ELECTRONIC FORMAT BY STANTEC CONSULTING LTD.
2. 2008 AND 2010 SURVEYS COMPLETED BY STANTEC CONSULTING LTD.
3. MAY 2012, JULY 2013, NOVEMBER 2014, DECEMBER 2015, NOVEMBER 2016, AND DECEMBER 2017 SURVEYS COMPLETED BY GOLDER ASSOCIATES LTD.

DRAFT

0 60 120 180 240 300

1:6,500 METRES

CLIENT
TOWNSHIP OF NORTH DUNDAS

CONSULTANT

GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-05-27
PREPARED	JEM
DESIGN	PLE
REVIEW	YJM
APPROVED	PLE

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
SITE LAYOUT AND EMISSION SOURCE LOCATION: EXPANSION

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	0	13-2

25mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:

13.1.1.3 Emission Summary

Table 13-2 below summarizes the estimated emission rates for each indicator compound from the existing operations as identified in the previous sections, and the estimated emission rates for the expansion of the Landfill. Further details and the breakdown of emissions by source are provided in Volume 2 Appendix B-2.

Table 13-2: Summary of Emissions from Existing and Expansion Landfill Operations

Compound	Units	Existing Landfill Emission Rate	Proposed Landfill Expansion Emission Rate
SPM	g/s	2.832	6.472
PM_{10}	g/s	0.744	1.727
$PM_{2.5}$	g/s	0.113	0.212
NO_X	g/s	0.191	0.209
SO_2	g/s	0.0001	0.0001
CO	g/s	0.197	0.228
H_2S	g/s	0.002	0.003
C_2H_3Cl	g/s	0.001	0.001
Odour	OU/s	663.658	821.802

13.1.1.4 Dispersion Modelling

Atmospheric dispersion models were used to predict ground-level concentrations of indicator compounds. The models incorporate the emission rates for each scenario and local atmospheric conditions and terrain.

The AERMOD-PRIME (AERMOD) dispersion model (Version 19191) was used to predict ground-level concentrations for the indicator compounds. The AERMOD modelling system was developed by the United States Environmental Protection Agency (U.S. EPA) and has been adopted in Ontario as the regulatory model recommended by the MECP.

The AERMOD system consists of the dispersion model itself and two pre-processors; the AERMET meteorological pre-processor and the AERMAP terrain pre-processor. The following approved dispersion model and pre-processors were used in the assessment:

- AERMOD dispersion model (v.19191)
- AERMAP surface pre-processor (v.18081)

AERMET was not required since MECP provided a 5-year site-specific pre-processed meteorological dataset (2013-2017).

Results were predicted at the sensitive receptors, identified on Figure 9-1.

Additional details regarding the dispersion modelling inputs and source characterization are provided in Volume 2 Appendix B-3.

13.1.1.5 Effects Prediction

To determine potential effects of the proposed landfill expansion on air quality and odour, the predicted concentrations of indicator compounds were compared to the applicable guidelines identified in Section 9.1.1.5.

Background air quality conditions (i.e., the concentrations without any landfill activities) are also presented in Table 13-3, which are added to the predicted concentrations from the existing landfill to provide the cumulative concentration for each indicator compound.

Maximum predicted concentrations for the existing and expansion scenarios at the sensitive receptors are presented in Table 13-3 and Table 13-4. The location at which the maximum concentration occurs is also identified.

The maximum cumulative concentrations of all indicator compounds are below the relevant guidelines for all indicator compounds. As such, the predicted compound concentrations associated with the expansion are predicted to meet the relevant air quality criteria.

All predicted maximum concentrations for all compounds occurred at the closest residence west of the Boyne Road Landfill along Boyne Road, identified by a star icon on Figure 9-1.

Table 13-3: Maximum Predicted Concentrations at the Sensitive Receptors for the Existing Landfill

Indicator	Averaging Period	Air Quality Criteria (µg/m³)	Background Conditions(1) (µg/m³)	Maximum Predicted Concentration – Existing Landfill (µg/m³)	Cumulative Effect - Existing Landfill (µg/m³)	Percentage of Air Quality Criteria (%)
SPM	24-hour	120	38.58	43.92	82.50	68.7%
	Annual	60	21.50	1.29	22.79	38.0%
PM_{10}	24-hour	50	21.44	11.86	33.30	66.6%
$PM_{2.5}$	24-hour	27	11.58	1.90	13.48	49.9%
	Annual	8.8	6.45	0.05	6.50	73.9%
NO_2	1-hour	400/ 79	9.40	37.18	46.58	11.6/59%
	24-hour	200	8.91	3.31	12.22	6.1%
	Annual	32	4.93	0.09	5.02	22.3%
SO_2	10-min	180	4.32	0.03	4.35	2.4%
	1-hour	100	2.62	0.02	2.64	2.6%
	24-hour	150	3.06	0.002	3.06	2.0%
	Annual	10	1.12	0.0001	1.12	11.2%
CO	1-hour	15,000	343.57	38.13	381.70	2.5%
	8-hour	6,000	343.57	9.44	353.01	5.9%
H_2S	10-min	13	0.84	0.77	1.61	12.4%
	24-hour	7	0.21	0.14	0.350	5.0%
C_2H_3Cl	24-hour	1	0.0038	0.05	0.056	5.6%
	Annual	0.2	0.0015	0.003	0.00	2.2%
Odour(2)	10-min	1	—	0.216	0.22	Below 1 OU/m^3

Notes:

(1) Background conditions as described in Section 9.1.1.6.

(2) Values for odour are in OU/m^3 and presented at the 99.5 percentile.

"—" indicates that there is no data available for existing conditions.

Table 13-4: Maximum Predicted Concentrations at the Sensitive Receptors for Proposed Expansion Landfill

Indicator	Averaging Period	Air Quality Criteria (µg/m³)	Background Conditions[1] (µg/m³)	Maximum Predicted Concentration - Proposed Landfill Expansion (µg/m³)[3]	Cumulative Effect - Proposed Landfill Expansion (µg/m³)	Percentage of Air Quality Criteria (%)
SPM	24-hour	120	38.58	78.66	117.24	97.7%
	Annual	60	21.50	3.16	24.66	41.1%
PM_{10}	24-hour	50	21.44	21.03	42.47	84.9%
$PM_{2.5}$	24-hour	27	11.58	2.76	14.34	53.1%
	Annual	8.8	6.45	0.11	6.56	74.6%
NO_2	1-hour	400/ 79	9.40	41.79	51.19	12.8%/64.8%
	24-hour	200	8.91	0.12	9.03	4.5%
	Annual	32	4.93	0.12	5.05	22.4%
SO_2	10-min	180	4.32	0.04	4.36	2.4%
	1-hour	100	2.62	0.02	2.64	2.6%
	24-hour	150	3.06	0.002	3.06	2.0%
	Annual	10	1.12	0.0001	1.12	11.2%
CO	1-hour	15,000	343.57	43.48	387.05	2.6%
	8-hour	6,000	343.57	10.87	354.44	5.9%
H_2S	10-min	13	0.84	0.77	1.61	12.4%
	24-hour	7	0.21	0.18	0.39	5.6%
C_2H_3Cl	24-hour	1	0.0038	0.067	0.07	7.1%
	Annual	0.2	0.0015	0.004	0.01	2.6%
Odour[2]	10-min	1	—	0.20	0.20	Below 1 OU/m³

Notes:

(1) Background conditions as described in Section 9.1.1.6.

(2) Values for odour are in OU/m³ and presented at the 99.5 percentile.

"—" indicates that there is no data available for existing conditions.

13.1.1.6 Compliance with Ontario Regulation 419/05

In addition to the assessment of the effects of the proposed landfill expansion on ambient air quality and odour, consideration was given to an evaluation of compliance by determining whether an ECA for air and noise under Section 9 of the *Environmental Protection Act* (Ontario, 1990d) could be obtained based on whether the facility is in compliance for those sources regulated under *O. Reg.* 419/05. At the landfill, this would include landfill gases and materials handling emissions only. All mobile equipment is exempt from compliance requirements under *O. Reg.* 419/05. In addition, assessment of compliance with

O. Reg. 419/05 would not include any consideration of the background air quality. Table 13-5 below summarizes the estimated emission rates for each indicator compound from the proposed landfill expansion operations as identified in the previous sections suitable for assessment against *O. Reg.* 419/05. More details and the emissions per source are provided in Volume 2 Appendix B-2.

A modelling grid that satisfies s. 14 *O. Reg.* 419/05 assessment was used in modelling the indicator compounds. Emissions from vehicle tailpipes, bulldozing and road dust were not considered in *O. Reg*. 419/05 assessment as they can be excluded from modelling as per *O. Reg.* 524/98 and the Emissions Summary Dispersion Modelling Procedure Document.

Table 13-5: Summary of O. Reg. 419/05 Emission Rates

Compound	Units	Emission Rates from *O. Reg.* 419/05 Sources
SPM	g/s	0.400
NO_X	g/s	0.001
CO	g/s	0.010
H_2S	g/s	0.003
C_2H_3Cl	g/s	0.001
Odour	OU/s	821.802

Maximum concentrations at the property boundary and the gridded receptors as per section 14 of *O. Reg.* 419/05 are presented in Table 13-6 and were predicted with the AERMOD dispersion model (as described in Section 13.1.1.4).

Table 13-6: Predicted Air Quality Compliance with O. Reg. 419/05

Indicator	Averaging Period	Air Quality Criteria (µg/m³)	Maximum Predicted Point of Effect Concentration (µg/m³)	Percentage of Air Quality Criteria (%)
SPM	24-hour	120	57.11	47.6%
NO_X	1-hour	400	4.03	1.0%
NO_X	24-hour	200	1.42	<1%
CO	½-hour	6000	2.36	<1%
H_2S	10-min	13	1.02	7.8%
H_2S	24-hour	7	0.28	4.0%
C_2H_3Cl	24-hour	1	0.10	10.3%
Odour (1)	10-min	1	0.22	Below 1 OU/m^3

Notes: (1) Values for odour are in OU/m^3 and presented at the 99.5 percentile.

The assessment indicates that the proposed landfill expansion is expected to operate in compliance with Schedule 3 of *O. Reg.* 419/05.

13.1.1.7 Air Mitigation Measures

In determining the air emissions associated with the proposed landfill expansion works and activities, consideration was given to those mitigation measures that were considered to be integrated into the design and implementation of the works and activities. These mitigation measures, which are considered to be typical and consistent with best practices, were incorporated into the emission estimates presented in Section 13.1.1.3, and therefore were incorporated in the effects predictions presented in Section 13.1.1.5. The in-design mitigation measures that were included in the air quality and odour assessment are summarized in Table 13-7.

Table 13-7: Summary of In-Design Mitigation Incorporated into the Air Quality and Odour Assessment

Mitigation Measure	Mitigation Specifics	Works and Activities Affected	Compound Affected by Mitigation Measure	Landfill Phase where Mitigation is being Considered
On-site road ways Vehicle Speed	Restrict vehicle speed to 40 km per hour or less.	• Vehicle movements	• SPM • PM_{10} • $PM_{2.5}$	• Construction • Operation
Maintenance of on-Site vehicles and equipment	On-Site vehicles and equipment engines will meet Tier 3 emission standards and be maintained in good working order	• On-site Vehicles	• NO_2 • CO • SO_2 • SPM • PM_{10} • $PM_{2.5}$	• Construction • Operation
Minimize idling of vehicles on-Site	Minimize idling of vehicles on-site	• On-site vehicles	• NO_2 • CO • SO_2 • SPM • PM_{10} • $PM_{2.5}$	• Construction • Operation
Minimize working face/daily cover	Site will operate with approx. 200 m^2 maximum working face, daily cover of waste is required	• Landfill	• H_2S • C_2H_3Cl • Odour	• Operation
Capping of Landfill	Landfill will be capped progressively as cells are completed	• Landfill	• H_2S • C_2H_3Cl • Odour	• Operation • Post-closure

13.1.1.8 Consideration of Climate Change

The potential effects of climate change on infrastructure associated with the proposed landfill expansion have been included in this report to qualitatively assess potential climate change effects.

The activities associated with the landfill expansion that will produce GHGs include the following:

- landfill gas
- on-site transportation fuel combustion emissions
- stationary combustion emissions from propane used for comfort heating in the buildings
- land clearing as part of the expansion

The GHG emission estimates, where applicable, have followed quantification guidelines for both provincial and federal reporting:

- Federal reporting under Section 46 of the *Canadian Environmental Protection Act*, (CEPA), SC 1999: Greenhouse Gas Emissions Reporting Program (GHGRP).
- Provincial reporting under Ontario's Greenhouse Gas Emissions: Quantification, Reporting, and Verification Regulation, *O. Reg.* 390/18.

13.1.1.8.1 Boyne Road Landfill Greenhouse Gas Emissions

Table 13-8 presents the sources of emissions from the Boyne Road Landfill, the GHGs emitted, and the corresponding methodology used to estimate emissions.

GHG emissions from on-site transportation and stationary combustion have been estimated using emission factors from Tables 2-2 and 2-6 of Canada's ECCC Document "2020 Canada's Greenhouse Gas Quantification Requirements" dated December 2020 (GHGRP Guidance Document) (ECCC, 2020b). Fuel consumption for the on-Site transportation equipment was estimated using methods in the document titled *Exhaust and Crankcase Emission Factors for Non-road Compression-Ignition Engines in MOVES*' (US EPA, 2018). Stationary combustion emissions from propane used for comfort heating were estimated. There is no prescribed method in the 2020 GHGRP Guidance Document for estimating fugitive methane emitted through the landfill cap and therefore GHG emissions from these sources were estimated using engineering calculations. Fugitive methane that is oxidized in the atmosphere once emitted through the cap has not been taken into consideration for this assessment; however, it is commonly assumed that approximately 10% of the methane from landfill gas oxidizes.

The methods used to estimate GHG emissions from each source are summarized in Table 13-8 below.

Table 13-8: GHG Emissions Sources and Methods

Source Category	Emission Sources	Emissions Methodology	GHG
Stationary Combustion	• Propane	• 2020 GHGRP Guidance Document s.2.A.1 Equation 2-2 • 2020 GHGRP Guidance Document s.2.B Equation 2-13	• Carbon Dioxide (CO_2) • Methane (CH_4) • Nitrous Oxide (N_20)
On-site Transportation	• Diesel • Gasoline	• 2020 GHGRP Guidance Document s.2.A.1 Equation 2-2 • Crankcase Document (Fuel Consumption) • 2020 GHGRP Guidance Document s.2.B Equation 2-13	• CO_2 • CH_4 • N_20
Waste (Landfill Gas)	• Fugitive LFG	• Not prescribed in 2020 GHGRP Guidance Document • Engineering Estimate – Carbon Dioxide/Methane composition of LFG and the amount of LFG lost fugitively	• CO_2 • CH_4
Land Clearing	• Loss of CO_2 storage (sink) • Cleared trees and vegetation	• IPCC 2006 Vol 4, Chapter 4 and 2019 Refinement Document	• CO_2

Table 13-9 and Table 13-10 summarize the estimated annual GHG emission rates in tonnes per year for each activity at the existing landfill and the proposed expanded landfill, respectively.

Table 13-9: Summary of Estimated GHG Annual Emissions from the Existing (2021) Boyne Road Landfill

Source	CO_2 Estimated Annual Emissions [tonnes/yr]	CH_4 Estimated Annual Emissions [tonnes/yr]	N_2O Estimated Annual Emissions [tonnes/yr]	CO_2e Annual Total [tonnes/yr][1]
Landfill Gas	1380	501	0	13,897
Mobile Combustion Emissions (road and non-road vehicles)	1564	0.051	0.132	1605
Comfort Heating	22	0.0004	0.002	23

Note:
1. CO_2e equals carbon dioxide equivalence, which is the summation of multiplying the emissions of CO_2, CH_4, N_2O by their respective global warming potential of 1, 25, and 298, respectively (IPCC, 2012).

The existing annual emissions were estimated to represent the 2021 year.

Table 13-10: Summary of Estimated GHG Annual Emissions from the Proposed Expansion of the Boyne Road Landfill in Year 2049

Source	CO_2 Estimated Annual Emissions [tonnes/yr]	CH_4 Estimated Annual Emissions [tonnes/yr]	N_2O Estimated Annual Emissions [tonnes/yr]	CO_2e Annual Total [tonnes/yr][1]
Landfill	1831	664	0	18,438
Mobile Combustion Emissions (road and non-road vehicles)	1566	0.055	0.13	1607
Comfort Heating	22	0.0004	0.002	23
Land Clearing[2]	117	—	—	121

Notes:
1. CO_2e equals carbon dioxide equivalence, which is the summation of multiplying the emissions of CO_2, CH_4, N_2O by their respective global warming potential of 1, 25, and 298, respectively (IPCC, 2012).
2. Emissions represent the combination of the loss of CO_2 storage and the one-time land clearing emissions averaged over the life of the proposed landfill expansion (estimated at 25 years).

The peak annual GHG emissions were predicted to occur in 2049.

13.1.1.8.2 Reportable Greenhouse Gas Emissions

The tables below summarize the reportable GHG emissions under the GHGRP and *O. Reg.* 390/18. Table 13-11 and Table 13-12 present the annual GHG emission rates in tonnes per year for each activity at the Boyne Road Landfill for the existing landfill and the proposed expanded landfill, respectively. Carbon dioxide from the combustion of biomass is excluded from GHGRP per Schedule 3 s.2(b) of the Notice with respect to reporting of greenhouse gases for 2019 and it is not included in the Reporting Amount per s.6(2) of *O. Reg.* 390/18. Carbon dioxide from the decomposition of biomass is excluded from GHGRP per Schedule 3 s.2(c) of the Notice with respect to reporting of greenhouse gases for 2019 and from *O. Reg.* 390/18 per ON.191 of the MECP Guideline for QRV of GHG Emissions, Feb 2020.

Table 13-11: Summary of Reportable Annual GHG Emissions from the Existing (2021) Landfill

Source	CO_2 Estimated Annual Emissions [tonnes/yr]	CH_4 Estimated Annual Emissions [tonnes/yr]	N_2O Estimated Annual Emissions [tonnes/yr]	CO_2e Annual Total [tonnes/yr]
Landfill	—[1]	501	0	12,517
Mobile Combustion Emissions (road and non-road vehicles)	1,564	0.051	0.132	1,605
Comfort Heating	22	0.0004	0.002	23

Notes:

1 CO_2 from decomposition of biomass is excluded from GHGRP per Schedule 3 s.2(c) of the Notice with respect to reporting of greenhouse gases for 2020 and from the MECP per ON.191 of the MECP Guideline for QRV of GHG Emissions, Feb 2020.

The existing annual emissions were estimated to represent the 2021 year.

Table 13-12: Summary of Reportable Annual GHG Emissions from the Proposed Expansion of the Boyne Road Landfill in Year 2049

Source	CO_2 Estimated Annual Emissions [tonnes/yr]	CH_4 Estimated Annual Emissions [tonnes/yr]	N_2O Estimated Annual Emissions [tonnes/yr]	CO_2e Annual Total [tonnes/yr]
Landfill	—[1]	664	0	16,607
Mobile Combustion Emissions (road and non-road vehicles)	1,566	0.055	0.13	1,607
Comfort Heating	22	0.0004	0.002	23

Notes:

1 CO_2 from decomposition of biomass is excluded from GHGRP per Schedule 3 s.2(c) of the Notice with respect to reporting of greenhouse gases for 2020 and from the MECP per ON.191 of the MECP Guideline for QRV of GHG Emissions, Feb 2020.

The peak annual GHG emissions were predicted to occur in 2049.

13.1.1.8.3 Comparison to Provincial and Canadian Totals

Table 13-13 presents a comparison of the Boyne Road Landfill site's existing and proposed expansion GHG emissions to the provincial and Canadian totals. As indicated, the increase in emissions from the existing landfill to the proposed expansion would have a negligible contribution of less than 0.003% to the Ontario emissions and less than 0.0006% to the Canadian emissions; therefore, the proposed landfill expansion will have a negligible effect on climate change.

Table 13-13: Comparison of GHG Emissions from the Boyne Road Landfill Expansion to Ontario and Canadian Emission Totals

Ontario GHG Emissions (2019)		**163,200**	**163,200**
Canada-wide GHG Emissions (2019)		**730,000**	**730,000**
Source	**Existing Emissions [kt/year CO_2e]**	**Expansion Emissions [kt/year CO_2e]**	**Increase in Emissions [kt/year CO_2e]**
Landfill Expansion GHG Emissions	15.64	20.18	4.54
Comparison to Ontario Total	0.01%	0.01%	0.003%
Comparison to Canada-wide Total	0.002%	0.003%	0.0006%

13.1.1.9 Conclusion

This section evaluated the potential effects of the proposed landfill expansion on air quality and odour. The conclusions of the assessment are highlighted below. Emissions estimates and dispersion modelling were carried out to predict concentrations of the indicator compounds from all emission sources. Anticipated measurable air emissions were identified and evaluated to determine effects. The residual effects were evaluated and it is concluded that they do not result in adverse effects in terms of air quality or odour, as they are all below the relevant guidelines.

An assessment to demonstrate that the proposed landfill expansion can achieve compliance with *O. Reg.* 419/05 was also completed. Air modelling guidance for the Province of Ontario was followed where appropriate. This assessment demonstrates that the proposed landfill expansion can be expected to operate in compliance with s. 20 of *O. Reg.* 419/05.

13.1.2 Noise

This section presents the noise component impact assessment for the EA Study of the proposed expansion. In particular, this section describes and summarizes a noise assessment that considers the existing conditions and potential effects of the landfill expansion on the outdoor acoustic environment. Specifically, environmental effects relevant to human noise receptors are assessed in accordance with the applicable MECP guidance documents. This work has been conducted in accordance with the requirements set out in the work plan developed with MECP feedback and provided in Section 8.

13.1.2.1 Methodology

The following methodology was carried out to assess the potential impacts due to the proposed landfill expansion:

- determination of future noise levels with the Boyne Road Landfill proposed expansion
- determination of potential noise impact due to the Boyne Road Landfill proposed expansion
- assessment of noise mitigation, if required

The methodology used for the noise assessment was based on the Landfill Guidelines (MECP 1998) and NPC-300 (MECP 2013).

A desktop assessment was completed to assess the potential impacts due to the proposed landfill expansion. Based on information provided by the Township, noise levels from the following activities were assessed to determine potential impacts due to the Boyne Road Landfill:

- landfilling operations, which occur between 8:00 a.m. to 4:00p.m.
- landfill ancillary equipment, which operate for up to 24 hours per day
- landfill traffic along off-site Haul Routes

The Boyne Road Landfill does not use pest control devices and there are no plans to use them in the future; therefore, no assessment of pest control devices was carried out.

The following sections outline the modelling completed to establish Boyne Road Landfill noise levels.

13.1.2.1.1 Noise Prediction Modelling

Noise prediction methodology for the haul route analysis is described in Section 9.1.2.3.1.

Noise predictions of the landfill operations and ancillary equipment noise sources were carried out using the Computer Aided Noise Attenuation (CadnaA) noise modelling software to support the assessment of potential Boyne Road Landfill noise impacts within the Site-vicinity Study Area. The CadnaA noise modelling software (version 2021 MR 2), developed by DataKustik GmbH, is widely accepted for evaluating environmental noise. Numerous algorithms are made available for use within CadnaA but, for the purposes of the EA, the model algorithm International Organization for Standardization (ISO) 9613 Acoustics: Attenuation of Sound during Propagation Outdoors (ISO 1993 and 1996) was considered.

The ISO 9613 prediction method is conservative as it assumes that all PORs are always downwind from the noise source or that a moderate ground-based temperature inversion exists. In addition, ground cover and physical barriers, either natural (terrain-based) or constructed and atmospheric absorption are included as they relate specifically to the proposed landfill expansion. Noise sources for the landfill operations and ancillary equipment were characterized by entering the sound power and/or sound pressure octave band spectrum associated with each source. Other parameters including frequency of use, hours of operation, and enclosure attenuation ratings also define the nature of sound emissions.

A summary of CadnaA model input parameters is presented in Table 13-14.

Table 13-14: CadnaA Model Input Parameters

Parameter	Model Setting	Notes
Software	CadnaA Version 2021 MR 2	CadnaA is a widely used environmental noise monitoring software package developed by DataKustik GmbH
Standards	ISO 9613-2	All sources and attenuation effects were treated as required by this standard
Ground effect	G = 0.5	
Temperature/ humidity	10°C / 70% relative humidity	
Other meteorological conditions	**Wind**: 1 to 5 m/s; all receivers downwind from all sources; or	Consistent with standard ISO 9613-2

Parameter	Model Setting	Notes
	Temperature Inversion: Moderate temperature inversion	
Receptor height	1.5 m (outdoor PORs, POW one-storey homes) 4.5 m (vacant lots, POW two-storey homes)	Conservatively assumed all POW locations are a two-storey home.
Terrain	Contour lines (75 to 80 masl)	Terrain has been accounted for in the model within the Site-vicinity Study Area.

Source operations, locations and elevations were selected such that the predicted Site-vicinity Study Area noise levels were expected to result in the worst-case noise predictions at all representative PORs.

13.1.2.2 Noise Emissions

Noise emissions from the existing landfill, both from the landfill operations and ancillary equipment, were used as inputs for the noise prediction model to assess the potential proposed landfill expansion noise impacts in the Site-vicinity Study Area at identified representative PORs.

13.1.2.2.1 Landfill Operations Noise Emissions

The assessment considered the noise emissions associated with the Boyne Road Landfill proposed expansion. The noise emissions for the landfilling operations for both the existing landfill and proposed expansion are the same other than an increase in on-site truck traffic. It was assumed the same noise sources are required for site preparation, normal operations and cell cover. Table 13-15 provides a summary of the overall sound power data and expected quantity for each noise source considered in the assessment of landfilling operations. Noise emissions (i.e., sound power levels) were established using the project information and Golder's database of similar noise sources. When assessing compliance with MECP sound level limits it was conservatively assumed that when a piece of equipment was operating, it would operate continuously for any one-hour period.

Table 13-15: Landfilling Operations Noise Sources Summary

Source	Quantity	Overall Sound Power Level (dBA)
Landfilling Compactor	1	108
Loader	1	105
Township Waste/Recycling Truck [1]	5	105
Roll-Off Truck [1]	4	105

Notes:

[1] Quantity expected to arrive to the landfill during the maximum worst case predictable hour

13.1.2.2.2 Ancillary Equipment Noise Emissions

The existing landfill includes a recycling compactor, exhaust fans and a heating, ventilation and air conditioning (HVAC) unit on the Office building. The use of the recycling compactor is variable due to changes to the recycling program on-site, but it has been included in the assessment of ancillary equipment noise emissions. Table -16 provides a summary of the overall sound power data for each noise source considered in the assessment of ancillary equipment for the Boyne Road Landfill proposed expansion. Noise emissions (i.e., sound power levels) were established using the project information and Golder's database of similar noise sources. When assessing compliance with MECP sound level limits it was conservatively assumed that when a piece of equipment was operating, it would operate continuously for any one-hour period.

Table 13-16: Ancillary Facilities Noise Sources Summary

Source	Quantity	Overall Sound Power Level (dBA)
Recycling Compactor	1	89
Exhaust Fan	2	90
HVAC	1	81

13.1.2.3 Potential Noise Effects

The following presents the noise prediction results of landfilling operations, ancillary equipment, and traffic along the off-site Haul Routes.

13.1.2.3.1 Landfilling Operations

Table 13-17 provides a summary of the predictable worst-case hour predicted noise levels for the landfill operation scenario described in Section 13.1.2.1. Noise levels were predicted at the identified representative PORs in the Site-vicinity Study Area.

Noise predictions were carried out for the landfill operations, which are expected to occur during the daytime only and therefore are compared to the Landfill Guidelines daytime sound level limit of 55 dBA.

Table 13-17: Daytime Landfilling Operations Predictable Worst Case Hour Noise Predictions

Receptor	Normal Operations Noise Level (dBA)	Landfill Guidelines Daytime Sound Level Limit (dBA)
R01	39	55
R02	40	55
R03	31	55
R04	37	55
R05	39	55
R06	33	55
R07	38	55
R08	36	55

The results presented in Table 3-17 indicates that the Boyne Road Landfill is expected to meet the Landfill Guidelines sound level limits at all representative PORs.

13.1.2.3.2 Ancillary Equipment

Table 13-18 provides a summary of the predictable worst-case hour predicted noise levels associated with ancillary equipment. As it is assumed the equipment will operate continuously for 24 hours per day, the predicted noise levels from the ancillary equipment are compared to the nighttime NPC-300 stationary source sound level limits as the nighttime limits are most stringent.

Table 13-18: Ancillary Equipment Predictable Worst Case Hour Noise Predictions

Receptor	Ancillary Equipment Noise Level (dBA)	NPC-300 Nighttime Stationary Source Sound Level Limit (dBA)	Meets NPC-300 Sound Level Limit?
R01	< 30	40	Yes
R02	< 30	40	Yes
R03	< 30	40	Yes
R04	< 30	40	Yes
R05	< 30	40	Yes
R06	< 30	40	Yes
R07	< 30	40	Yes
R08	< 30	40	Yes

As shown in Table 13-18, the ancillary equipment is expected to operate below the NPC-300 sound level limits at the representative PORs.

13.1.2.3.3 Off-Site Haul Route

As discussed in Section 9.1.2.2, the Landfill Guidelines outline the protocol for evaluating the noise impact due to off-site haul road vehicles. Following the methodology presented in Section 9.1.2.3.1, predicted noise levels due to the 2023 background traffic (without the traffic associated with the Boyne Road Landfill) were compared to the expected noise levels in 2023 with the Boyne Road Landfill during the predictable worst case hour (i.e., the hour when impacts are predicted to be the greatest). The road traffic modelling indicated the predictable worst-case hour was from 2:00 p.m. to 3:00 p.m. Table 13-3-19 summarizes the expected change in noise levels due to the Boyne Road Landfill at representative PORs along the Haul Routes as well as the associated qualitative rankings (as summarized in Table 9-4 in Section 9.1.2.2). Results are shown for all representative PORs in Table 9-3 that are located within 500 m of the Haul Routes.

Table 13-19: Predicted Worst-Case One Hour Change in Noise Levels along Haul Routes

Receptor	2023 Traffic Worst Case One-Hour Noise Level[1] – Without Landfill (dBA)	2023 Traffic Worst Case One-Hour Noise Level – With Landfill (dBA)	Change in Noise Level (dB)	Qualitative Rating[2]
R01	56	59	3	Insignificant
R04	52	53	1	Insignificant
R09	60	61	1	Insignificant
R10	58	62	4	Noticeable
R11	53	54	1	Insignificant
R12	54	55	1	Insignificant

Notes:

1 Hour with worst case predicted noise impact due to the Boyne Road Landfill is 2:00 p.m. to 3:00 p.m.

2 See Table 9-4 for details of qualitative ranking system

The results in Table 13-19 indicate that during the proposed landfill expansion predictable worst-case hour, the change in noise levels ranges from insignificant to noticeable. General industry practice typically does not require action to be carried out unless a significant rating is predicted. Note that if the Boyne Road Landfill proposed expansion worst case hour noise levels were compared to existing worst case hour noise levels with the existing Boyne Road Landfill traffic included, more representative of current conditions, changes in noise level would be insignificant.

13.1.2.4 Best Management Practices

The following best management practices have been considered in design to help minimize potential noise effects due to the Boyne Road Landfill proposed expansion and are recommended to be implemented:

- Limit landfill activities to the hours described in Section 13.1.2.1 to reduce the potential effect of noise on nearby PORs.
- All mobile equipment properly maintained according to manufacturers' recommendations and be in accordance with the noise emissions specified in Section 13.1.2.2 and MECP NPC-115 – Construction Equipment.
- When possible, maintain an acceptable setback distance from the identified PORs.
- Maintain on-site roadways to minimize vehicles travelling over ruts.
- Address noise concerns if they arise through a compliant resolution mechanism whereby persons can contact the landfill if there are perceived noise issues.
- Design on-site access roads to minimize reversing, which is expected to minimize use of backup warning devices where possible.
- Operate vehicles and equipment such that impulsive noise is minimized (i.e., truck tailgate closing), where possible.
- Where reasonable and practical, turn off vehicles and equipment when not in use, unless weather and/or safety conditions dictate the need for them to remain idling and in a safe operating condition.

13.2 Geology and Hydrogeology

A series of analytical contaminant transport calculations were conducted based on a conceptual model of groundwater flow and contaminant transport at the site to calibrate to current conditions and assess expected future compliance with MECP Reasonable Use Guideline B-7. The calculations were completed using GoldSim, a flexible, non-specific modelling code, designed to provide the user with an understanding of the factors that control the performance of an engineered or natural system (as defined by a user-specified mathematical model) and to predict the future behaviour of the defined system. With respect to addressing the landfill expansion groundwater quality, GoldSim was used to simulate the passage of contaminants in the landfill leachate from the source area (i.e., the active and expanded landfill area) through the downstream groundwater flow systems to the downgradient boundary of the CAZ. GoldSim is fully documented in the Main Users Guide (GTG, 2010a) and the Contaminant Transport Module Users Guide (GTG, 2010b). These calculations were completed for both current conditions at the Site, and expected conditions under the proposed expansion option.

This impact assessment describes the background information and provides a summary of the conceptual hydrogeological model in Section 13.2.1, and the analytical screening calculation set-up, calibration to current conditions, adaptation for predictive simulations, and assumptions in Section 13.2.2. The calculation results and a summary discussion are provided in Section 13.2.3.

13.2.1 Conceptual Model Background Information

The general hydrogeological conditions of the Site are documented in Section 9.2 of this EASR.

13.2.1.1 Geology

Based on the landfill expansion area subsurface conditions encountered during borehole drilling programs completed at the site, overburden in the area consists of discontinuous topsoil/peat (between 0 and 2 m in thickness), underlain by discontinuous silt/clay (between 0 and 2.9 metres in thickness), underlain by silty sand/sandy silt till (between 0.9 and 6.0 metres in thickness). Bedrock, consisting of limestone (interbedded with shale), has been encountered at between 1.4 and 9.0 mbgs.

13.2.1.2 Groundwater Flow Directions

Based on existing groundwater elevations and groundwater flow directions as described in Section 9.2.2.2.1 of the EASR, the model considered two groundwater pathways from the disposal area, one towards the south and one towards the north. One-dimensional contaminant transport pathways were represented assuming that the flow path is linear between points in the model represented by existing monitoring locations.

13.2.1.3 Hydraulic Conductivity, Hydraulic Gradients, and Groundwater Velocity

Estimates of horizontal hydraulic conductivity of overburden materials in the area of the Site and Site-vicinity Study Areas, as determined based on the results of slug tests and grain size distribution analysis completed as part of previously completed studies, are presented in Section 9.2.2.2.3 of the EASR.

13.2.1.4 Groundwater Quality and Leachate Indicators

Monitoring wells MW13 and BR07-26 (to the east of the Site Study Area) have been established as representative of background water quality in the overburden and the bedrock, respectively. Monitoring well MW06-22 and the replacement well MW06-22R are screened in the silty sand unit immediately below the waste mound and have been used as indicators of leachate strength at the existing landfill. Based on a comparison of background groundwater quality, leachate quality and mobility of the leachate parameters, leachate indicator parameters for the existing landfill are: alkalinity, aluminum, ammonia, barium, BOD, boron, chloride, cobalt, conductivity, DOC, hardness, iron, manganese, phenols, potassium, sodium, and TDS. Use of chloride as a leachate indicator parameter is complicated due to the additional sources of chloride such as road salting activities along Boyne Road and the snow storage facility on the north side of Boyne Road to the northeast of the landfill footprint. Based on the relatively low concentrations of chloride observed at the background monitoring locations, chloride remains a useful leachate indicator parameter for monitoring locations upgradient (south) of Boyne Road and the snow storage facility.

Conservative and mobile leachate indicators were considered for the contaminant transport calculations. Of those available, chloride and boron were considered most appropriate as they are present in low concentrations in background groundwater in both the overburden and the bedrock, and generally show decreasing concentration trends in the downgradient direction. A summary of the observed concentrations of boron and chloride are shown in Table 13-20 for groundwater monitoring wells included in the areas of consideration for the north and south groundwater flow pathways.

Table 13-20: Existing Chloride and Boron Concentrations in Groundwater

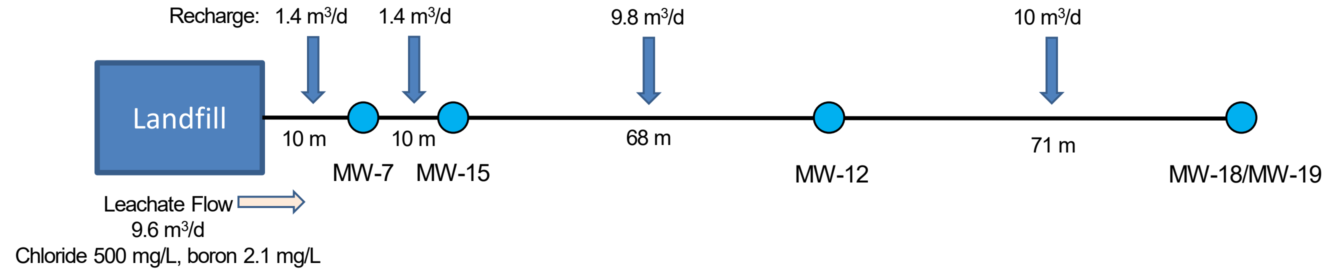
Location	Distance from landfill area (m)	Chloride Observed Concentration (mg/L) Maximum	Chloride Observed Concentration (mg/L) Minimum	Chloride Observed Concentration (mg/L) Average	Boron Observed Concentration (mg/L) Maximum	Boron Observed Concentration (mg/L) Minimum	Boron Observed Concentration (mg/L) Average
Source							
MW06-22R	0	521	170	367	2.5	2	2.1
North							
MW10	101	343	44	266	0.73	0.53	0.62
MW16	205	484	180	283	1.20	0.54	0.81
MW07-25	325	130	3	75.2	0.60	0.21	0.43
South							
MW7	11	510	390	456	1.1	0.7	0.89
MW15	16	670	140	356	1.10	0.1	0.77
MW12	94	390	40	175	0.84	0.23	0.50
MW18	165	430	74	201	0.95	0.35	0.63
MW19	172	460	36	207	1.4	0.05	0.61

13.2.2 Analytical Calculations

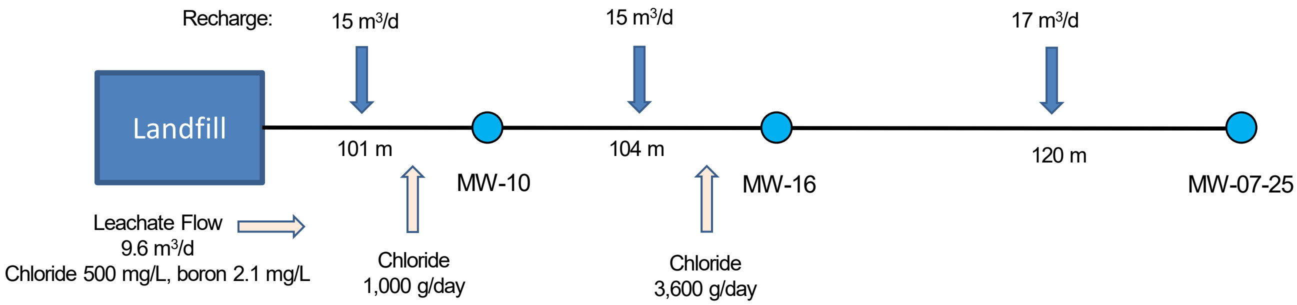
13.2.2.1 Assumptions

One-dimensional contaminant transport calculations were completed to provide an assessment of contaminant transport based on the available data for the existing landfill. The model setup for the calibration and predictive simulations is illustrated on Figure 13-3.

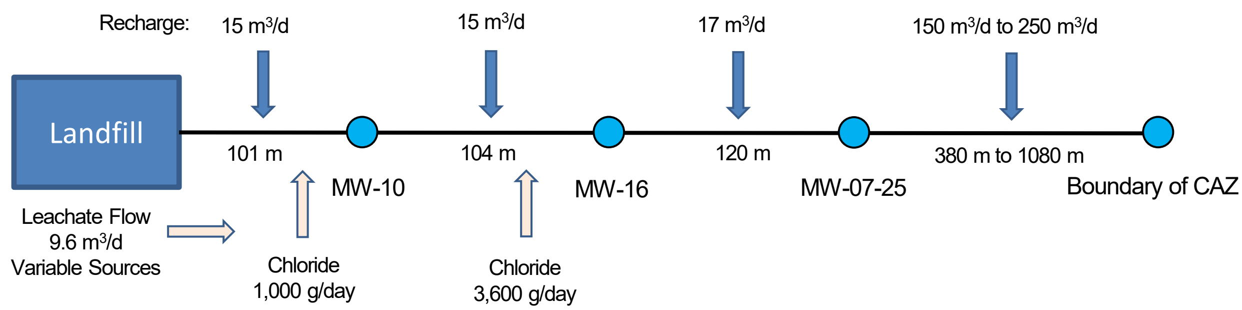
South Pathway - Calibration



North Pathway - Calibration



North Pathway - Predictive



Note:

1) Time-variable source terms for the predictive simulation were calculated using POLLUTE (refer to the memo text)

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

CONSULTANT
GOLDER MEMBER OF WSP

YYYY-MM-DD	2022-01-31
PREPARED	NB
DESIGN	NB
REVIEW	TE
APPROVED	TE

TITLE
SOLUTE TRANSPORT CALCULATION SCHEMATIC

DRAFT

PROJECT No.	PHASE	Rev.	FIGURE
1648553		A	13-3

The following assumptions were made for the calculations:

- One-dimensional contaminant transport pathways were represented. This representation assumes that the flow path is linear between points.
- The leachate plume in the overburden is assumed to be more extensive than the plume in the bedrock. For the purposes of the calculations, leachate source concentrations were applied to overburden only. It is acknowledged that some portion of the plume may extend into bedrock. The vertical spreading of the plume to the bedrock would result in lower concentrations in the bedrock relative to what is represented in the one-dimensional calculations. As such, it is assumed that if regulatory compliance is met in the overburden, compliance would also be met in the bedrock at the same distance from the disposal area.
- The overburden pathway thickness in the model was specified as the average saturated overburden thickness from available data (4.4 m). The analytical solute transport simulations were completed using the geometric mean hydraulic conductivity of 3.0 x 10-4 cm/s for the overburden.
- The calibration is considered at steady-state (long term) conditions; data for calibration was limited to points within 200 m to the north and south of the fill area.
- For current conditions, a leachate chloride concentration of 500 mg/L was applied based on approximate maximum concentrations of chloride in leachate-impacted groundwater at MW-06-22R. For the expansion, a chloride concentration of 1,500 mg/L was applied (as per O. Reg. 232/98 (MECP, 2012)). For the closure period, a chloride source depletion curve was generated using POLLUTEv7 (Rowe and Booker, 2005).
- The leachate source term for boron under current conditions was set at 2.1 mg/L based on approximate average boron concentrations in leachate-impacted groundwater from MW06-22R. For the expansion, a boron concentration of 5 mg/L was applied based on historical data from landfills in Eastern Ontario of similar size to the proposed expansion. For the expansion, in the post-closure period, a boron source depletion curve was generated using POLLUTEv7 (Rowe and Booker, 2005).
- The contaminant depletion within the source, as accounted for in the POLLUTE model, is due to wash-out by moisture infiltration/percolation through the waste mass for the contaminants of interest. Output files for each of the POLLUTE source concentration models are provided in Volume 2 Appendix D-3.
- Advection of chloride and boron was assumed to be conservative in the assessment (i.e., retardation and decay rates of chloride or boron in the downgradient flow path, which would decrease the concentrations in groundwater, were assumed to be zero).

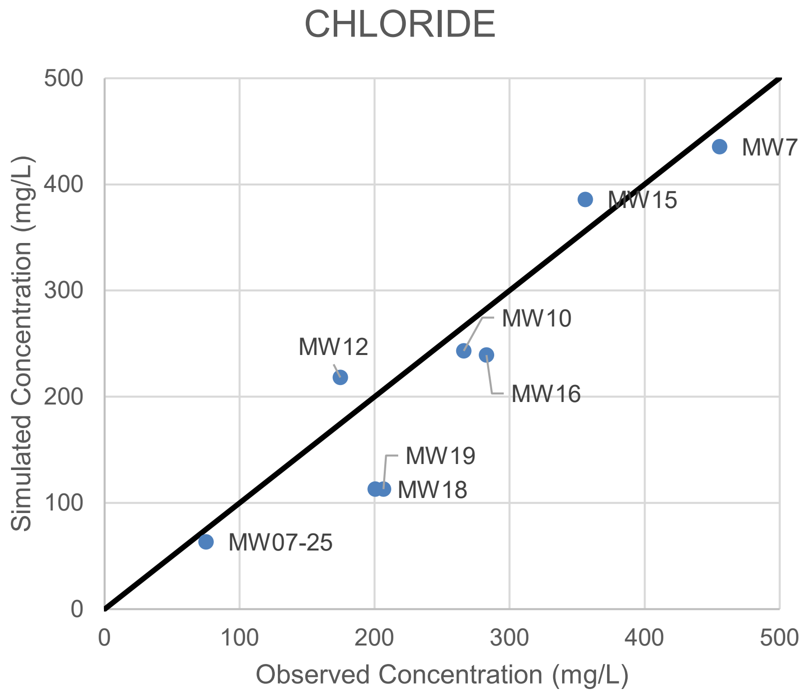
- To account for the potential impacts on groundwater quality due to the Township-owned snow storage facility to the northeast of the disposal area, additional loading of chloride (associated with snow melt) was applied to the flow path adjacent to the snow storage facility. Between the landfill area and MW-10, a loading rate of 1,000 grams/day (g/d) of chloride was applied; between MW-10 and MW-16, a loading rate of 3,600 g/day was applied.
- As the transport calculations are one-dimensional, any transverse dispersion or spreading of the plume is not explicitly accounted for. To account for these processes, along with potential recharge of unimpacted water downgradient, the calculations were calibrated by “mixing” additional volumes of groundwater, at background concentrations, between the landfill source area and the CAZ. These volumes were estimated based on the model calibration to existing groundwater parameter concentrations.
- The expansion of the landfill is not expected to affect existing groundwater flow directions or gradients.
- Considering that the groundwater flow systems are similar in the northward and southward directions, predictive calculations were carried out to the north only. Results for the northern flow path apply to the south of the proposed landfill expansion.

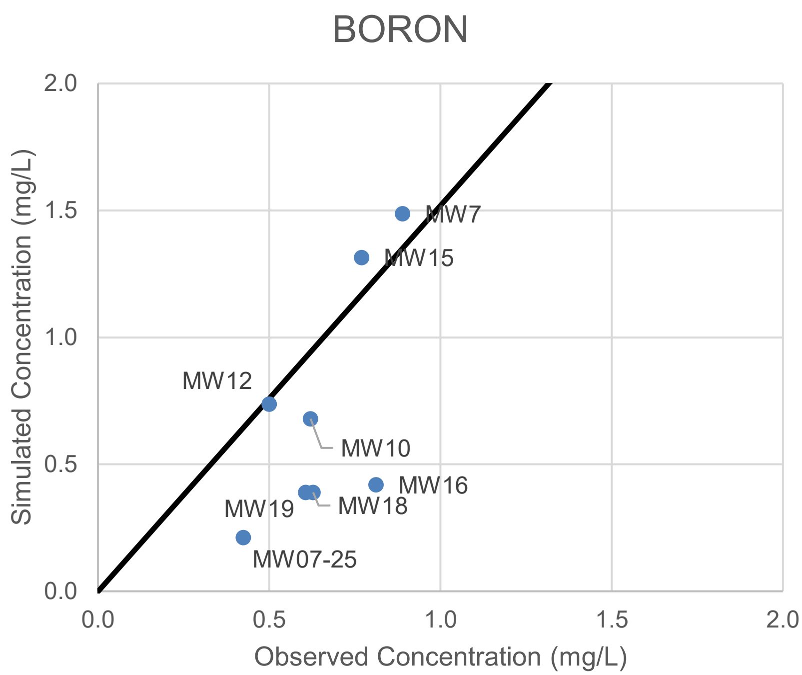
13.2.3 Results

13.2.3.1 Calibration to Current Conditions

As described above, screening calculations were calibrated to existing conditions by adding recharge volumes of water (at background groundwater concentrations) to the northward and southward downgradient flow paths until calculated steady-state concentrations were similar to the average concentrations from observed data at each monitoring location in the groundwater flow paths. For the northern flow path, an additional chloride load was added between the landfill and MW10 and between MW10 and MW16 to account for the effects of the snow storage facility on groundwater quality. As shown on Figure 13-3, mixing volumes equivalent to 150 mm per year were added to each portion of the flow path. For the northern flow path, an additional chloride load of 1,000 g/d was added between the landfill and MW10, and 3,600 g/d was added between MW10 and MW16. Calibration results are shown on Figure 13-4.

For both the southward and northward pathways, the simulated steady state groundwater concentrations of chloride and boron provided an acceptable match to the observed concentrations. For chloride, the simulated values were generally consistent with the observed values, with no indication of spatial bias in the residual error (i.e., simulated minus observed values) for the northward or southward pathways. At the furthest downgradient location along the southward pathway (i.e., MW18/MW19), the simulated chloride concentration was lower than the measured value by a factor of approximately 2. For boron, the average observed concentrations decrease with distance from the landfill in both the northward and southward directions, which was well represented in the model.





Note:

1) Observed concentrations represent average measurements for the period of record at each individual monitoring well.

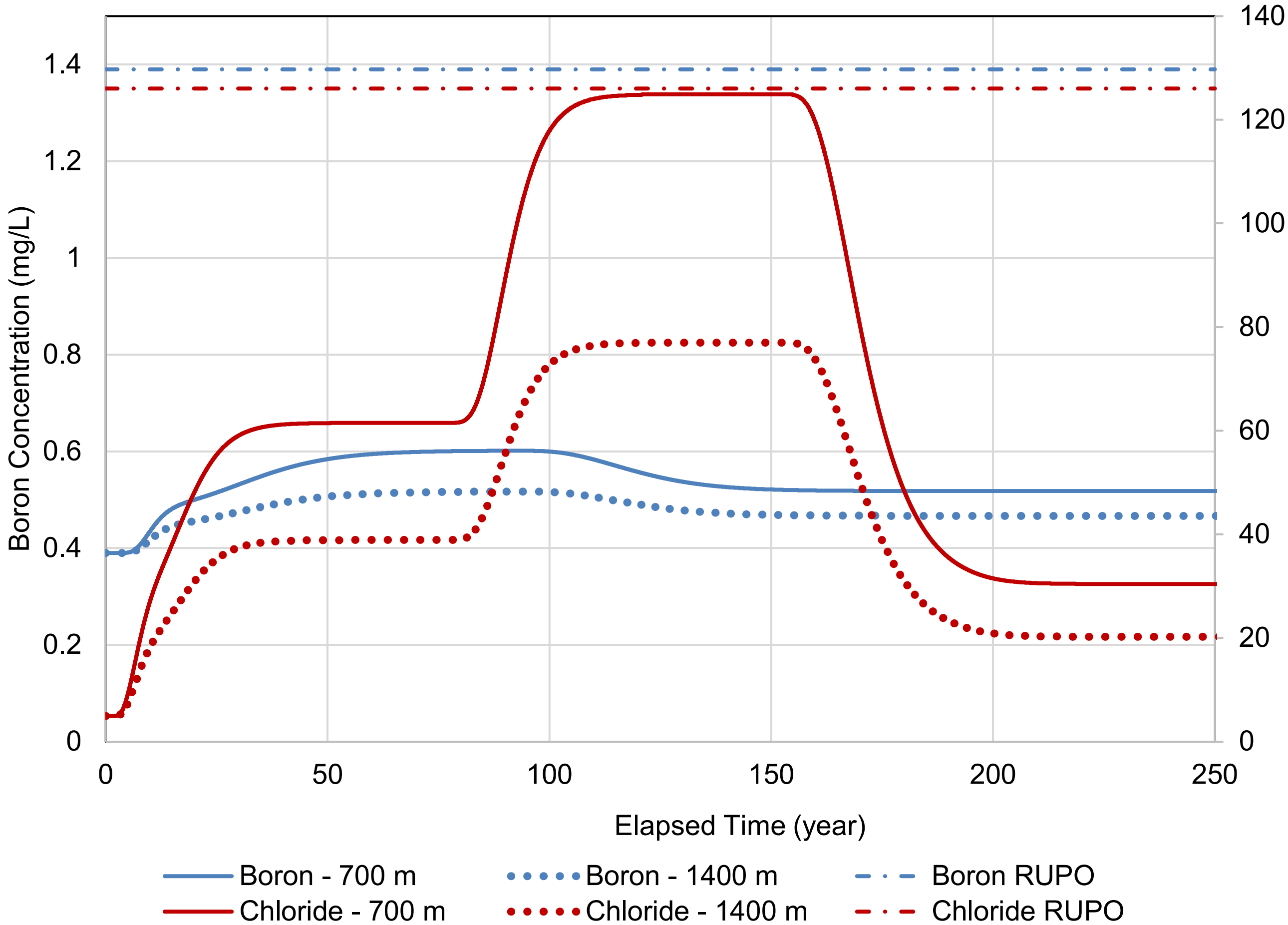
CLIENT	TOWNSHIP OF NORTH DUNDAS	PROJECT	INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN
CONSULTANT	GOLDER MEMBER OF WSP	TITLE	CALIBRATION
YYYY-MM-DD	2022-01-31		DRAFT
PREPARED	NB	PROJECT No.	1648553
DESIGN	NB	PHASE	
REVIEW	TE	Rev.	A
APPROVED	TE	FIGURE	13-4

13.2.3.2 Predictive Calculations

Predictive calculations were used to determine the peak chloride and boron concentrations at various distances downgradient from the fill area. Results were compared to the 2020 calculated Reasonable Use Performance objectives (RUPO) for chloride and boron for the landfill (as described under Guideline B-7 (MOE, 1994)). Results of the predictive simulations are provided in Figure 13-5. As shown, chloride concentrations are simulated to be closer to the RUPO as compared to boron. The predictive results indicate that chloride concentrations are likely to meet the RUPO for overburden groundwater beyond 700 m downgradient of the fill area. The current landfill site property and/or CAZ lands currently available to the Township for leachate-impacted groundwater plume attenuation consist of the following: 1) a 1,200 m distance from the north side of the disposal area on the north side of Boundary Road as part of the landfill site property and CAZ easement; and 2) a 313 m distance from the edge of the proposed landfill expansion southward to the property and/or CAZ boundary. As such, to achieve compliance with the RUPO in future, it will be necessary for the Township in future to obtain control over an additional 400 m of groundwater travel distance towards the south as CAZ through either property acquisition or groundwater easement below this land area. The approximate extent of CAZ required in the southward direction is illustrated on Figure 13-5A; it is note that this additional CAZ land is not needed immediately, and the timing such that the landfill site remains in compliance with the Reasonable Use Guideline will be dependent on the ongoing groundwater monitoring program results.

13.2.3.3 Discussion

The analysis presented above was completed to provide an estimate of landfill contaminant concentrations in groundwater at the downgradient boundaries of the landfill property or CAZ for both current conditions and the proposed landfill expansion. Based on this analysis, chloride and boron concentrations are expected to meet RUPO at 700 m downgradient from the fill area (for the northward and southward groundwater flow pathways) for the proposed landfill expansion. As such, to achieve compliance with the RUPO in future, it will be necessary for the Township in future to obtain control over an additional 400 m of groundwater travel distance towards the south as CAZ through either property acquisition or groundwater easement below this land area.



Note:

1) Elapsed time zero corresponds to the beginning of landfilling operations.

CLIENT

TOWNSHIP OF NORTH DUNDAS

PROJECT

INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

CONSULTANT

GOLDER
MEMBER OF WSP

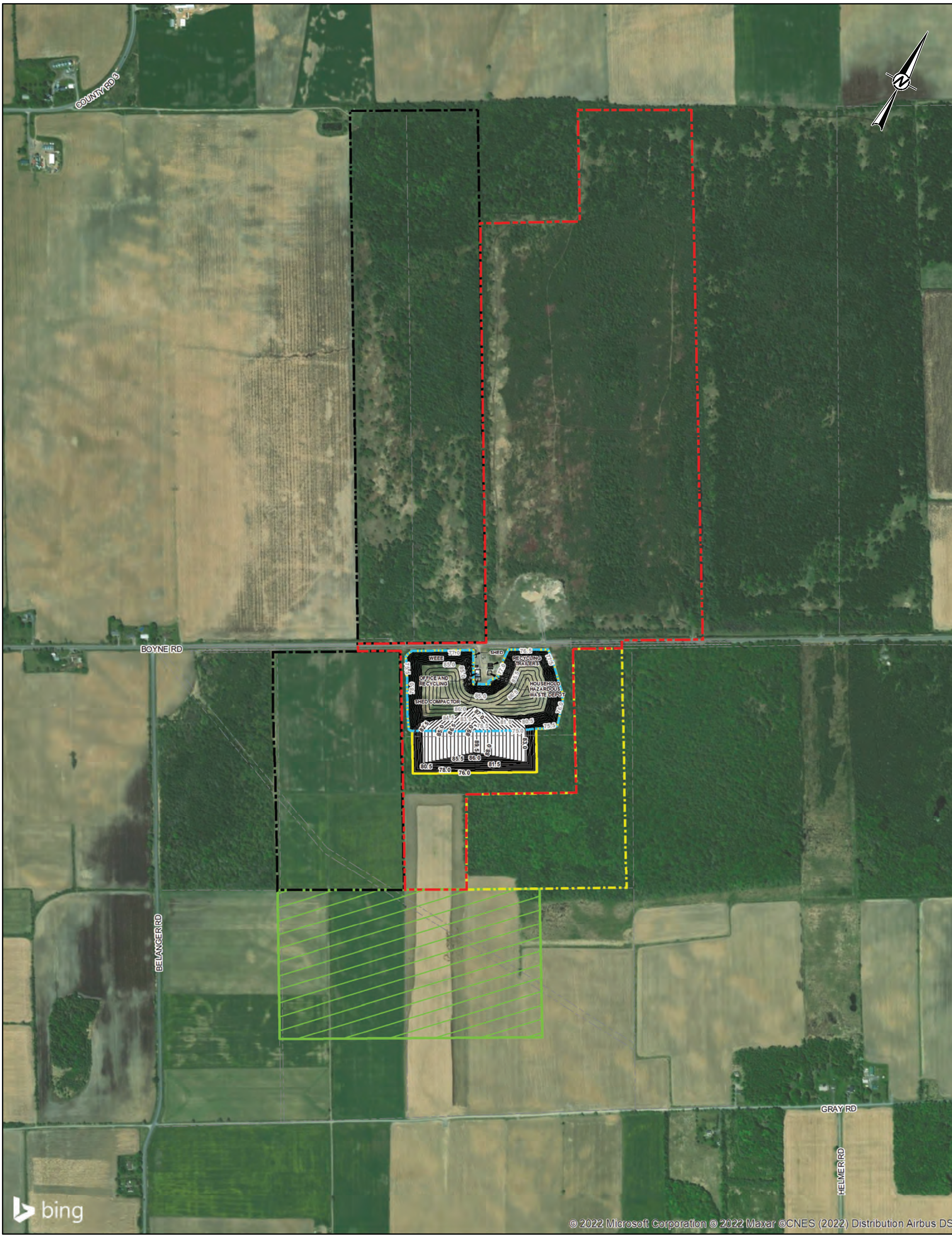
YYYY-MM-DD	2022-01-31
PREPARED	NB
DESIGN	NB
REVIEW	TE
APPROVED	TE

TITLE

SOLUTE TRANSPORT CALCULATION RESULTS

DRAFT

PROJECT No.	PHASE	Rev.	FIGURE
1648553		**A**	**13-5**



LEGEND

- EXISTING LANDFILL FILL AREA
- PROPOSED LIMIT OF WASTE FOR THE LANDFILL EXPANSION AREA
- APPROXIMATE BOUNDARY OF CONTAMINATION ATTENUATION ZONE
- APPROXIMATE BOUNDARY OF ADDITIONAL CAZ FOR FUTURE RUPO COMPLIANCE
- PROPOSED NEW LANDFILL PROPERTY BOUNDARY TO BE ADDED THROUGH AN ECA AMENDMENT
- APPROXIMATE LANDFILL SITE PROPERTY BOUNDARY
- PROPOSED EXPANSION TOP OF WASTE ELEVATION CONTOURS (mASL)

REFERENCES

1. BASE PLAN SUPPLIED IN ELECTRONIC FORMAT BY STANTEC CONSULTING LTD.
2. 2008 AND 2010 SURVEYS COMPLETED BY STANTEC CONSULTING LTD.
3. MAY 2012, JULY 2013, NOVEMBER 2014, DECEMBER 2015, NOVEMBER 2016, AND DECEMBER 2017 SURVEYS COMPLETED BY GOLDER ASSOCIATES LTD.

DRAFT

0 100 200 300 400 500

1:10,000 METRES

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2022-02-09
PREPARED	JEM
DESIGN	PLE
REVIEW	YJM
APPROVED	PLE

TITLE
PROPOSED ADDITIONAL CONTAMINANT ATTENUATION ZONE FOR EXPANDED LANDFILL

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	0	**13-5A**

13.2.4 Source Water Protection

The proposed Boyne Road Landfill expansion is within the existing WHPA-D of the Chesterville wellfield with a vulnerability score of 4. Also, the current Source Protection Plan (SNC and RRC, 2016a) for the Chesterville wellfield indicates that the provincial policies concerning waste only apply to WHPAs A and B and portions of WHPA-C for which the vulnerability score is 8 or higher. Waste sites are not prohibited within WHPA-D. Additionally, the groundwater flow direction of leachate impacted groundwater is not indicated to be traveling eastward (as discussed in Section 9.2.2.2.1) towards the Chesterville Wells. The proposed expansion is on the south side of the existing waste disposal area, so further from what is shown as the central portion of mapped WHPA-D. A portion of the CAZ for the existing landfill is located on the north side of Boyne Road within WHPA-D; as described in Section 13.2.2 and 13.2.3, this same portion of the CAZ is also proposed to serve the same function for the expanded landfill.

An assessment of the definition of the current WHPA's was provided in Section 9.2.2.3, which concluded that the majority of the recharge to the Maple Ridge Esker is much more local than identified in the Source Protection mapping and occurs on the mapped esker itself. The potential for an actual connection between the groundwater in the area of the Boyne Road landfill and recharge to Chesterville wells No. 5 and 6 (to which the source water protection requirements currently apply) is unlikely to be as reflected by the capture zones of the WHPA.

The proposed Boyne Road Landfill expansion is not interpreted to have an impact on the Winchester, Chesterville, or nearby residential wells due to its location within the geological setting, the local hydrogeology and its remote location from residents.

13.2.5 Contaminating Lifespan

Using the source concentration output files from POLLUTE (Volume 2 Appendix D-3), the contaminating lifespan of the proposed expanded landfill can be determined using the parameter chloride and the RUPO. It is anticipated that chloride concentrations in the leachate beneath the landfill expansion will be below the RUPO at approximately year 2070 or 22 years post closure. This is a relatively short amount of time but not unexpected for a natural attenuation landfill with a permeable soil cover.

13.3 Surface Water

This section provides the assessment of impacts on surface water quality and quantity for the proposed expansion of the Boyne Road Landfill as described in Section 12 of this EASR. This assessment was conducted in accordance with the requirements set out in the work plan provided in Section 8.

13.3.1 Stormwater Management System Design

As described in Section 11.2.3, there is currently no quality or quantity control system for stormwater management in place for the existing landfill except for the existing perimeter ditch that collects and conveys runoff to the Volks Municipal Drain ditch along the north side of Boyne Road. For the expansion, it is proposed that a wetland type stormwater facility will be constructed at the northeast corner area of the landfill site on the south side of Boyne Road and outlet at the same location as the existing perimeter ditch. This wetland will be sized based on the following MECP criteria:

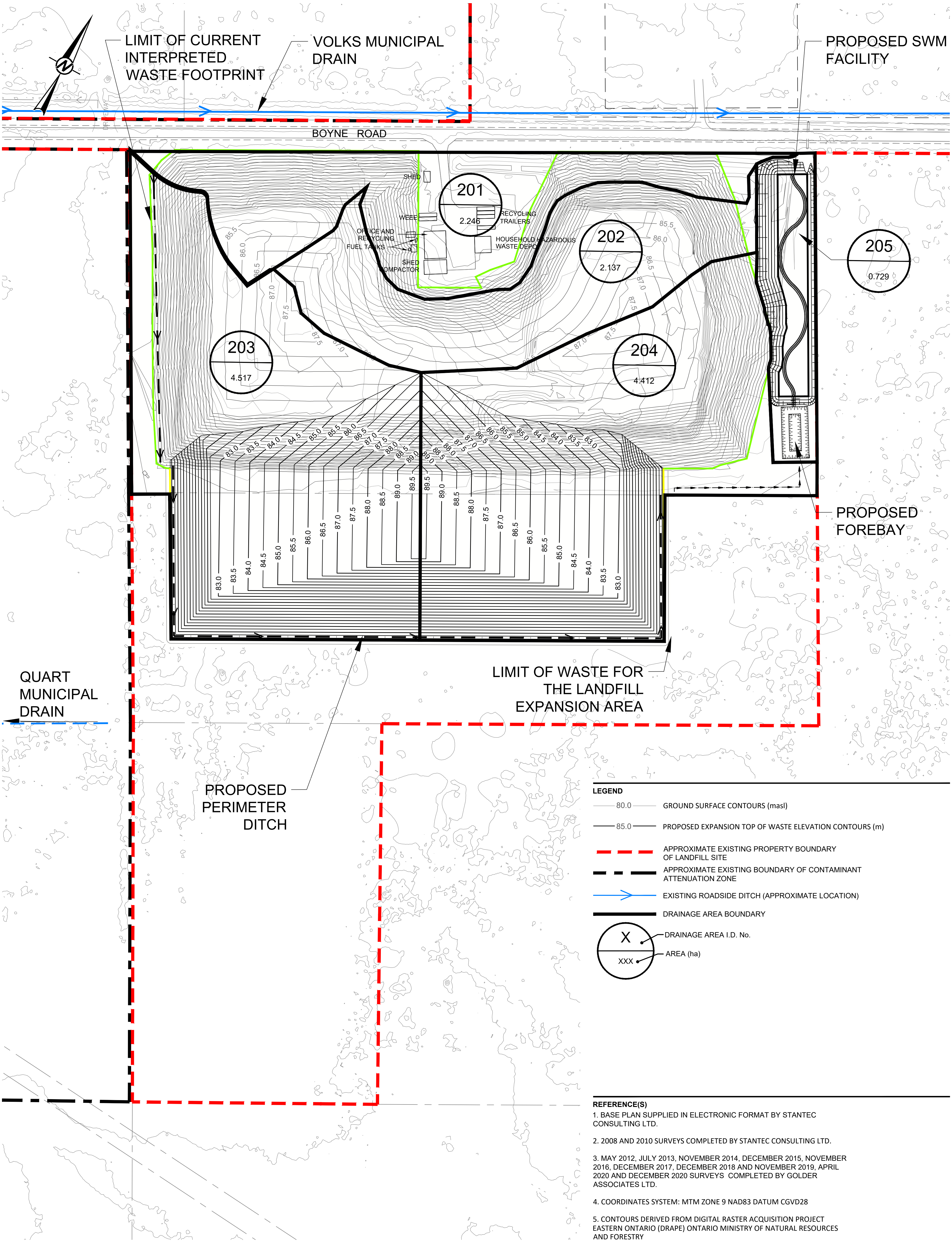
Enhanced (80%) long-term TSS removal to provide the “highest level” of quality control of stormwater.

Water quality storage requirements will be determined based on Table 3.2 of the Ontario Stormwater Management Planning and Design Manual (MECP, 2003).

- Match post-expansion outlet flows to corresponding pre-expansion flows for the 1:5 year through the 1:100 year return period design storm.
- Surface drainage from potentially contaminated areas, i.e., originating from active landfilling areas, will be contained locally within berms and will discharge into the waste. Surface drainage from non-contaminated areas such as road areas and areas with interim or final landfill cover will be conveyed to the SWM pond via the internal drainage ditches.
- Ditches will be sized to convey the 1:100 year return period design storm and culverts sized to convey a 1:25 year return period design storm as per *O. Reg.* 232/98.
- A 20% increase of intensity values will be applied to the 1:100 year return period design storm to “stress test” the proposed SWMS and evaluate potential climate change effects.

Runoff scenarios for the proposed expansion under the range of storm events were assessed with U.S. Environmental Protection Agency (EPA) Storm Water Management Model (SWMM) for the 1:2, 1:5, 1:25, 1:50 and 1:100 year return period design storm provided in the City of Ottawa Sewer Design Manual (City of Ottawa, 2012) with a Soils Conservation Service (SCS) Type II 24-hour design storm to determine storage requirements and a 4-hour Chicago distribution to size conveyance ditches and culverts. Intensity duration frequency (IDF) curves were obtained from the City of Ottawa Sewer Manual, which are derived from the Ottawa Macdonald-Cartier International Airport Environment Canada Station. Pre-expansion and post-expansion conditions used a Curve Number of 74 based on open space with good condition grass cover >75% and hydrologic soil group C with an antecedent moisture condition of AMC II. The pre-expansion drainage areas are smaller, based on the smaller footprint of the existing landfill. The proposed SWMS for the proposed expansion is shown on Figure 13-7. To achieve the design objectives and criteria described above, the proposed SWM pond is described below.

The following Tables 13-21 and 13-22 provides a summary of model inputs used in SWMM.



LEGEND

- 80.0 GROUND SURFACE CONTOURS (masl)
- 85.0 PROPOSED EXPANSION TOP OF WASTE ELEVATION CONTOURS (m)
- APPROXIMATE EXISTING PROPERTY BOUNDARY OF LANDFILL SITE
- APPROXIMATE EXISTING BOUNDARY OF CONTAMINANT ATTENUATION ZONE
- EXISTING ROADSIDE DITCH (APPROXIMATE LOCATION)
- DRAINAGE AREA BOUNDARY
- X DRAINAGE AREA I.D. No.
- XXX AREA (ha)

REFERENCE(S)

1. BASE PLAN SUPPLIED IN ELECTRONIC FORMAT BY STANTEC CONSULTING LTD.
2. 2008 AND 2010 SURVEYS COMPLETED BY STANTEC CONSULTING LTD.
3. MAY 2012, JULY 2013, NOVEMBER 2014, DECEMBER 2015, NOVEMBER 2016, DECEMBER 2017, DECEMBER 2018 AND NOVEMBER 2019, APRIL 2020 AND DECEMBER 2020 SURVEYS COMPLETED BY GOLDER ASSOCIATES LTD.
4. COORDINATES SYSTEM: MTM ZONE 9 NAD83 DATUM CGVD28
5. CONTOURS DERIVED FROM DIGITAL RASTER ACQUISITION PROJECT EASTERN ONTARIO (DRAPE) ONTARIO MINISTRY OF NATURAL RESOURCES AND FORESTRY

NOT FOR CONSTRUCTION

DRAFT

0 50 100

1:2,500 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
A	2022-01-11	ISSUED FOR CLIENT REVIEW	MHK	ZS/ABD	MHK	DVK

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

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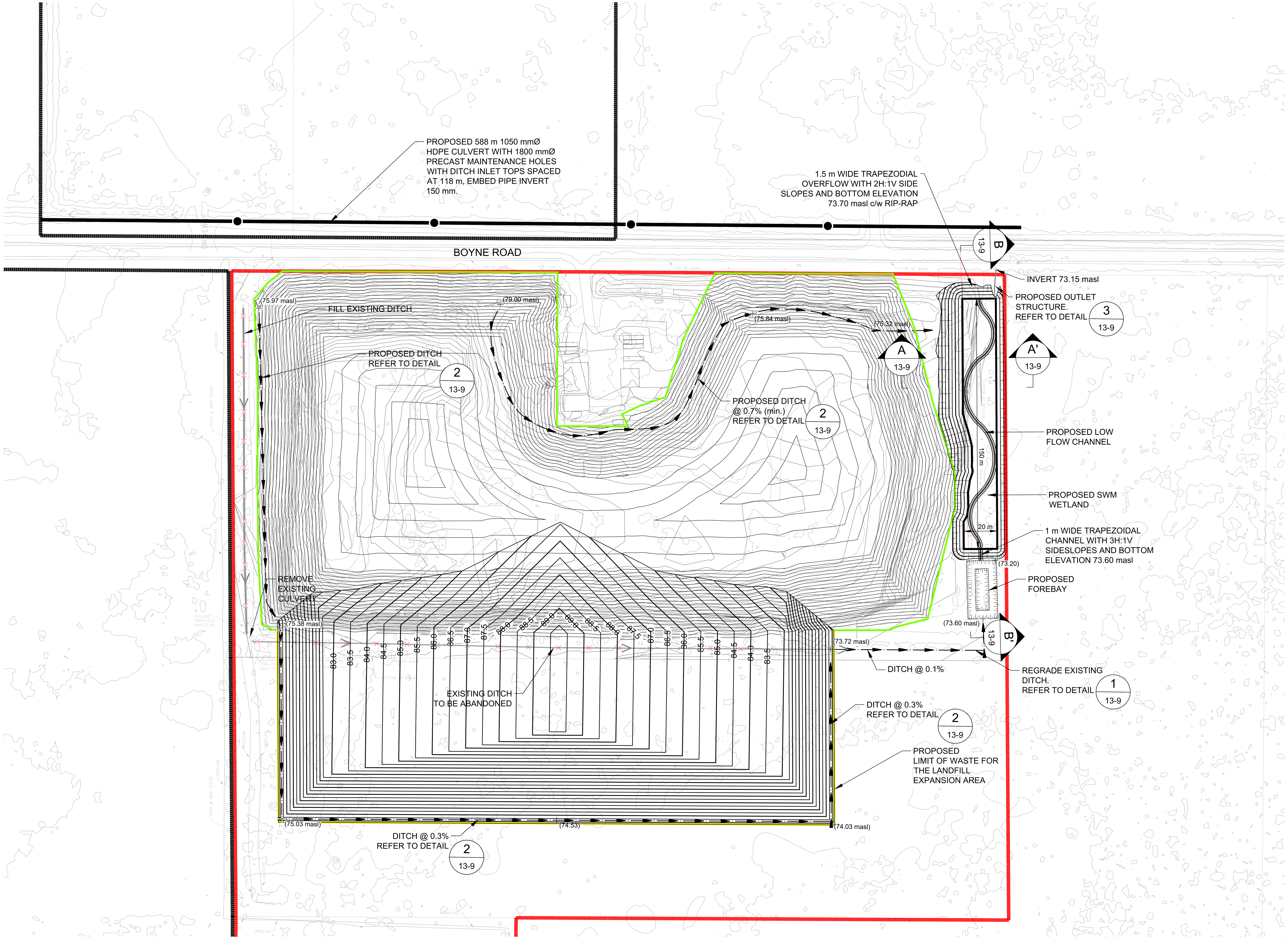
TITLE
PROPOSED EXPANSION POST-CLOSURE AREA DRAINAGE PLAN

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	A	13-6



LEGEND

- GROUND SURFACE CONTOURS (masl), BASED ON RESULTS OF THE SURVEYS CONDUCTED IN 2008, 2010, 2012, 2013, AND 2014
- APPROXIMATE EXISTING PROPERTY BOUNDARY OF LANDFILL SITE
- APPROXIMATE EXISTING BOUNDARY OF CONTAMINANT ATTENUATION ZONE
- APPROXIMATE LOCATION OF EXISTING PERIMETER DITCH AND INFERRED FLOW DIRECTION
- EXISTING GRADE (FROM STANTEC) (masl)
- (73.20)+ PROPOSED DITCH GRADE ELEVATION (masl)
- PROPOSED CULVERT
- PROPOSED DITCH INLET MAINTENANCE HOLE

REFERENCE(S)

1. BASE PLAN SUPPLIED IN ELECTRONIC FORMAT BY STANTEC CONSULTING LTD.
2. 2008 AND 2010 SURVEYS COMPLETED BY STANTEC CONSULTING LTD.
3. MAY 2012, JULY 2013, NOVEMBER 2014, DECEMBER 2015, NOVEMBER 2016, DECEMBER 2017, DECEMBER 2018 AND NOVEMBER 2019, APRIL 2020 AND DECEMBER 2020 SURVEYS COMPLETED BY GOLDER ASSOCIATES LTD.
4. COORDINATES SYSTEM: MTM ZONE 9 NAD83 DATUM CGVD28
5. CONTOURS DERIVED FROM DIGITAL RASTER ACQUISITION PROJECT EASTERN ONTARIO (DRAPE) ONTARIO MINISTRY OF NATURAL RESOURCES AND FORESTRY

NOT FOR CONSTRUCTION

DRAFT

0 50 100

1:1,250 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
A	2022-01-11	ISSUED FOR CLIENT REVIEW	MHK	ABD	DVK	DVK

CLIENT
TOWNSHIP OF NORTH DUNDAS

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PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
PROPOSED EXPANSION - PROPOSED STORMWATER MANAGEMENT DESIGN CONCEPT PLAN

PROJECT NO.	PHASE/TASK	REV.	of	FIGURE
1648253	2.0/2.2.0	A		13-7

Table 13-21: Model Inputs – Subcatchments

Subcatchment	Area (ha)	Width (m)	Slope (%)	% Impervious	Mannings N Impervious	Mannings N Pervious	Depression Storage Impervious (mm)	Depression Storage Pervious (mm)	Curve Number	Drying Time (days)
Existing Conditions										
101	4.90	363.0	7.2	6	0.015	0.25	1	5	74.96	7
102	6.92	875.9	11.4	0	0.015	0.25	1	5	74	7
Proposed Conditions										
201	2.14	319.9	6.7	0	0.015	0.25	1	5	74	7
202	4.52	354.3	10.6	0	0.015	0.25	1	5	74	7
203	4.41	331.0	10.1	0	0.015	0.25	1	5	74	7
204	0.73	50.0	2.0	50	0.015	0.25	1	5	74	7
205	2.14	319.9	6.7	0	0.015	0.25	1	5	86	7

Table 13-22: Model Inputs – Pond Geometry/Storage

Elevation (masl)	Depth (m)	Area (m^2)	Extended Detention Volume (m^3)
72.9	0	2,780	0
73.0	0.1	2,910	0
73.1	0.2	3,047	0
73.2	0.3 (Normal Water Level)	3,185	0
73.3	0.4	3,324	326
73.4	0.5	3,465	666
73.5	0.6	3,607	1,021
73.6	0.7	4,018	1,391
73.7	0.8	4,187	1,887
73.8	0.9	4,359	2,321
73.9	1.0	4,532	2,773
74.0	1.1	4,708	3,243
74.1	1.2	4,886	3,699
74.2	1.3	5,067	4,171
74.3	1.4	5,250	4,658

13.3.2 Quality Control

A wetland stormwater management pond is proposed to be located in the northeast corner of the Site adjacent to the landfill.

The proposed extended detention wetland pond outlet structure provides a 33-hour draw-down time for runoff produced by a 25 mm rainfall event with a 4-hour duration modified Chicago distribution. The time period included in the draw-down noted has been limited to the period when flow through the pond orifice in the model is greater than or equal to 0.2 L/s. The pond hydrograph is provided in Volume 2 Appendix E-3. The proposed outlet structure includes a 75 mm diameter orifice at elevation 73.20 masl. The outlet pipe from the wetland to the outlet structure is designed as a submerged reverse sloped pipe to promote separation/floating of oils (if any), providing potential for spilled material to be recovered prior to an off-site release occurring. The proposed outlet structure for the pond has a sluice gate to allow emergency closure to assist in spill / leachate containment activities, if needed. A 1.0 m wide trapezoidal outlet with 2 horizontal to 1 vertical side slopes and a bottom elevation of 73.70 masl is proposed to provide discharge control for larger storm events, including the 1:5 year through 1:100 year return period and climate change storm event, which were confirmed to flow without flooding to the existing ditch and culvert.

Table 3.2 of the MECP Manual (MECP, 2003) provides storage volume design requirements based on specific site imperviousness levels to achieve required TSS removal objectives. Table 3.2 indicates that the minimum storage volume should be based on 80.0 m3/ha, for 80% TSS removal at an impervious level of 35%. The site has a drainage area of 14.041 ha post-expansion, of which 2.246 will continue to be conveyed directly to the existing Boyne Road municipal ditch. For the remaining drainage area of 11.795 ha, this results in a minimum total required pond volume of 957 m^3, with 40 m^3/ha required as extended detention. Therefore, 478 m^3, at minimum, is required for both the permanent pool and extended detention. A permanent pool volume of 895 m^3 is provided in the proposed wetland pond at the normal water level depth of 0.3 m, which exceeds the required permanent pool volume. An additional 168 m^3 of extended detention storage is provided for the 25 mm design storm 4-hour duration with a modified Chicago storm distribution and 1,238 m^3 for the 1:2 year return period 24-hour duration SCS Type II distribution storm using a minimum sized orifice of 75 mm.

Table 13-23 provides the design values for the wetland pond and compares these values to the minimum or preferred criteria as per Table 4.7 of the MECP Manual.

Table 13-23: Proposed Wetland Pond – MECP Design Criteria

Design Element	Design Value	Comparison to MECP Criteria
Drainage Area	14.78 ha	Meets preferred criteria (> 10 ha)
Treatment Volume	Permanent Pool – 895 m^3 Active Storage (for 25mm event) – 168 m^3 Active Storage (for 1:2 year event) – 1,238 m^3	Permanent Pool Meets Minimum Criteria. Active Storage does not meet minimum criteria, but the combined storage volume exceeds the minimum criteria – a minimum sized orifice was used.
Active Storage Detention Time	33 hours	Meets Preferred Criteria (>24 hrs)
Forebay	0.3 m permanent pool and 1 m total depth. Less than 20% of permanent pool area.	Meets criteria: minimum depth 1 m and less than 20% of permanent pool area.
Length-to-Width Ratio	Overall – 7.5:1	Exceeds Minimum Criteria (3:1)
Permanent Pool Depth	Permanent pool depth 300 mm	Meets Criteria (depth 150 mm – 300 mm)
Active Storage Depth	The 1:10 year return period design storm is 0.56 m above the permanent pool	Meets Minimum Criteria (<1.0 m for up to 1:10 year return period design storm)
Side Slopes	4H:1V	Does not meet Minimum Criteria of 5H:1V for 3 m above and below permanent pool due to space limitations. However, this is acceptable since the landfill site has controlled access.
Inlet	Ditch	N/A

Design Element	Design Value	Comparison to MECP Criteria
Outlet	450 mm diameter outlet pipe at 1.0% slope 75 mm orifice for quality control outlet 1.0 m wide trapezoidal weir for quantity control outlet	Meets Minimum Criteria
Maintenance Access	No maintenance drawdown pipe provided. Access for backhoes or dredging equipment provided.	Meets Minimum Criteria
Buffer	Not provided	Does not meet Minimum Criteria of 7.5 m above maximum water quality/erosion control water level due to space constraints. However, this is a landfill site with restricted access.

The following calculations summarize the design requirements of the forebay as per Section 4.6.2 of the MECP Manual:

Minimum Forebay Settling Length

$$Dist = \sqrt{\frac{rQ_p}{V_s}}$$

Where: Dist = forebay length (m)

r = length-to-width ratio

Q_p = peak flow rate from the pond during design quality event (25 mm storm event) (m^3/s)

V_s = settling velocity (m/s)

$$Dist = \sqrt{\frac{(2.75)(0.002)}{0.003}}$$

$$Dist = 4.3\ m$$

Minimum Dispersion Length

$$Dist = \frac{8Q}{dV_f}$$

Where: Dist = length of dispersion (m)

Q = inlet pipe capacity (10 year storm event) (m^3/s)

d = depth of permanent pool in the forebay (m)

V_f = desired velocity in the forebay (m/s)

$$Dist = \frac{8(0.285)}{(0.2)(0.5)}$$

$$Dist = 22.8\,m$$

The proposed forebay length is 25.0 metres and is therefore greater than the required lengths for settling and dispersion.

Minimum Forebay Bottom Width

$$Width = \frac{Dist}{8}$$

Where: Dist = greater value of minimum forebay length or length of dispersion (m)

Width = minimum forebay bottom width (m)

$$Width = \frac{22.8}{8}$$

$$Width = 2.9\ m$$

The proposed bottom width is 8.0 metres (average) and is therefore greater than the required width.

13.3.3 Quantity Control

A comparison of pre-expansion to the proposed post-expansion site discharge rates is provided in Table 13-24 for the 25 mm and 1:2 year through the 1:100 year return period design storm events. The pond storage and peak flow rates were assessed using the 24-hour duration SCS Type II distribution which resulted in the largest storage requirements and resulting peak flows while the 25 mm design storm used a 4-hour modified Chicago storm distribution. In addition, a 20% increase has been applied to the 1:100 year return period IDF values to stress test potential impacts of climate change. Details of the model input and outputs are provided in Volume 2 Appendix E-2.

Table 13-24: Pre-Expansion and Post Expansion Storage and Peak Flows

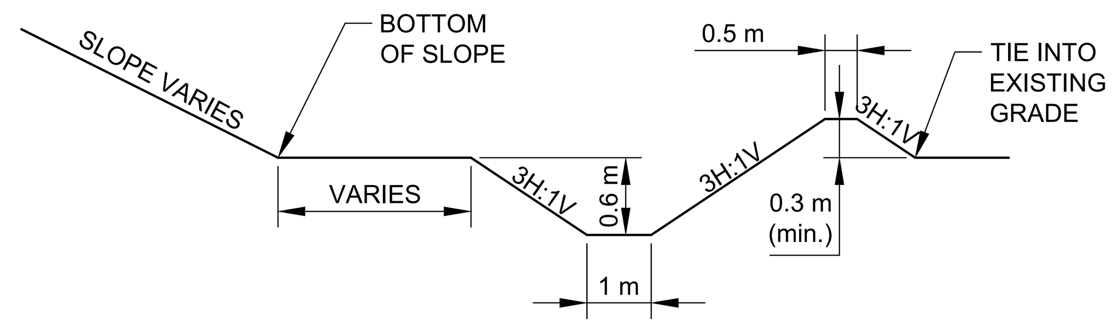
Return Period	Pre-Expansion Peak Flow (L/s)	Post-Expansion Uncontrolled Peak Flow (L/s)	Post-Expansion Controlled Peak Flow (L/s)	Storage Volume (m3)	Depth above Perm. Pool (m)	Elevation (masl)
25mm 4-hr	46	105	49	97	0.03	73.23
2-yr	155	237	88	1,186	0.35	73.55
5-yr	452	587	176	1,917	0.53	73.73
10-yr	703	873	241	2,051	0.56	73.76
25-yr	1050	1,275	323	2,245	0.60	73.80
50-yr	1341	1,613	388	2,452	0.65	73.85
100-yr	1644	1,972	454	2,671	0.70	73.90
100-yr + 20%	2309	2,757	672	3,170	0.81	74.01

The post-expansion controlled discharge from the site are reduced from current conditions for all modelled storm events except for the 25mm event. For the 25mm event, the peak post-development flows are expected to be approximately 6% larger than the current conditions. A minimum sized 75 mm orifice is proposed to control discharge from the pond from the 25 mm and 1:2 year return period design storm.

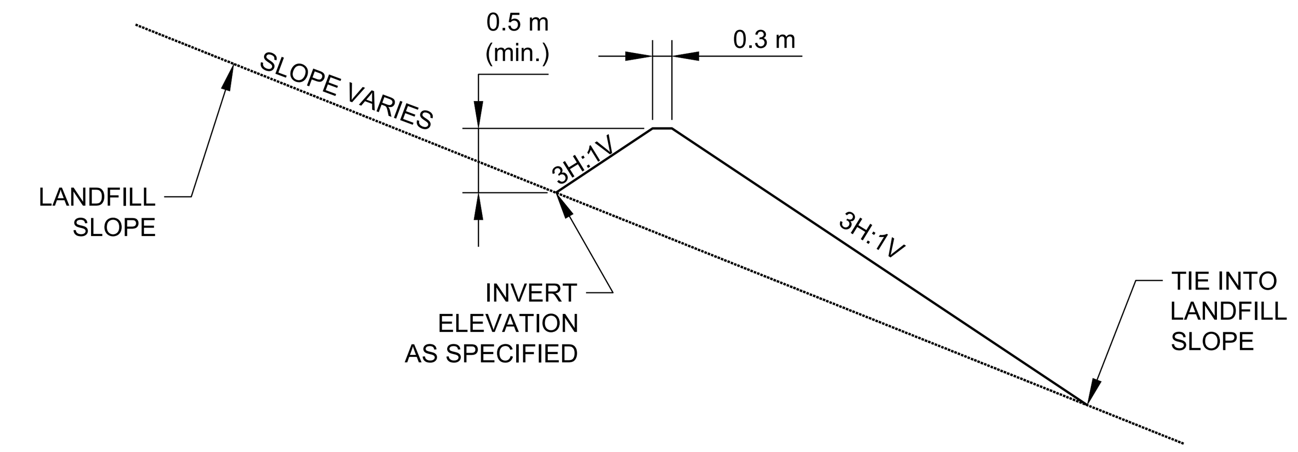
13.3.4 Surface Water Conveyance

During the continuing operations phase of the expanded landfill and post-closure, it is proposed that stormwater from the landfill will be collected by existing and proposed grass-lined ditches and will be directed to a stormwater management wetland located at the northeast corner of the landfill. The stormwater wetland will be located within an existing partially filled, partially low area adjacent to the landfill. The depth of the excavation will be limited to the existing grades of the existing perimeter ditch in the area, to limit the possibility of interception of groundwater potentially impacted by leachate. The stormwater run-off from the wetland will discharge via an existing 900 mm culvert into the roadside ditch on the north side of Boyne Road. The culvert has been confirmed to convey the 1:25 year return period storm event with a 3-hour duration and modified Chicago distribution.

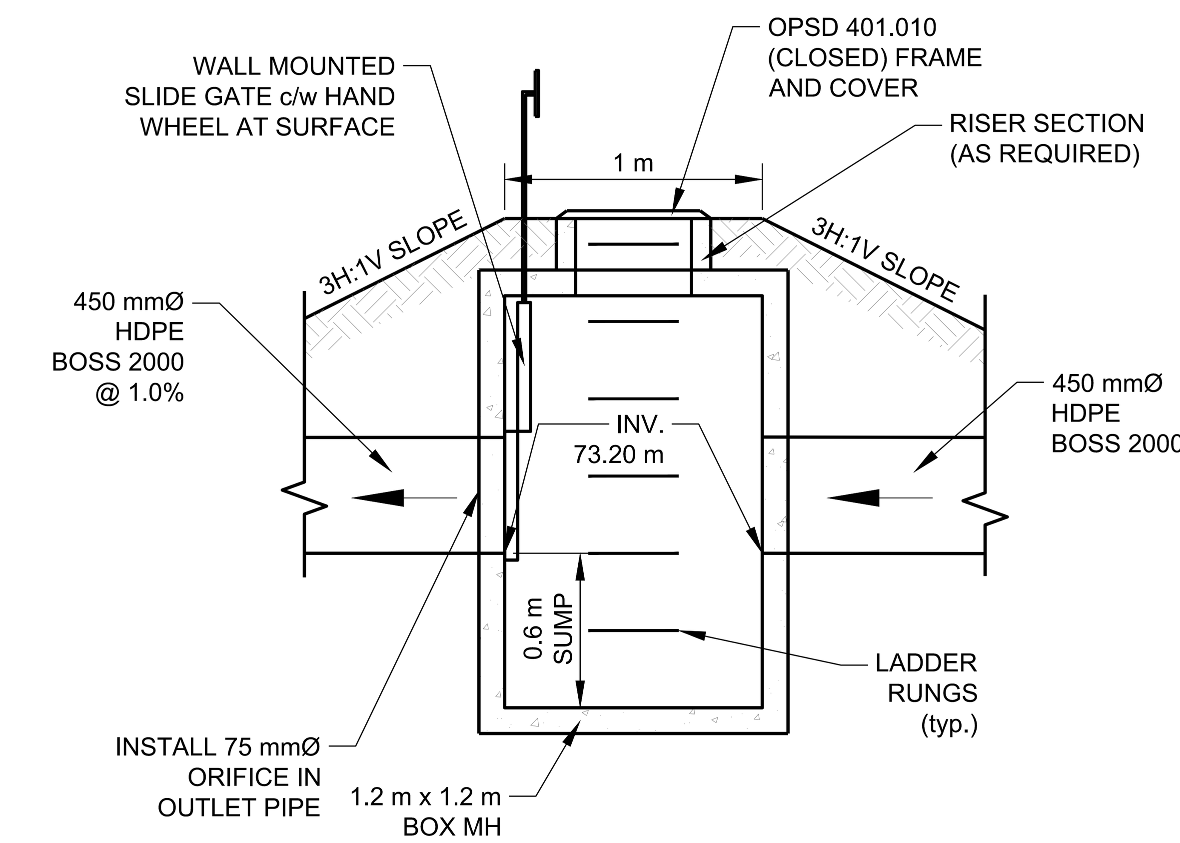
The on-site ditches have been designed to convey the peak runoff rate from the 1:100 year storm event. A 3-hour modified Chicago distribution design storm was used to assess the surface water runoff from the contributing drainage areas for each ditch. The drainage areas for each ditch are shown on Figure 13-6. The detailed calculations for the ditch sizing are in Table 13-25 and in Appendix E-5. Refer to Figure 13-8 for details.



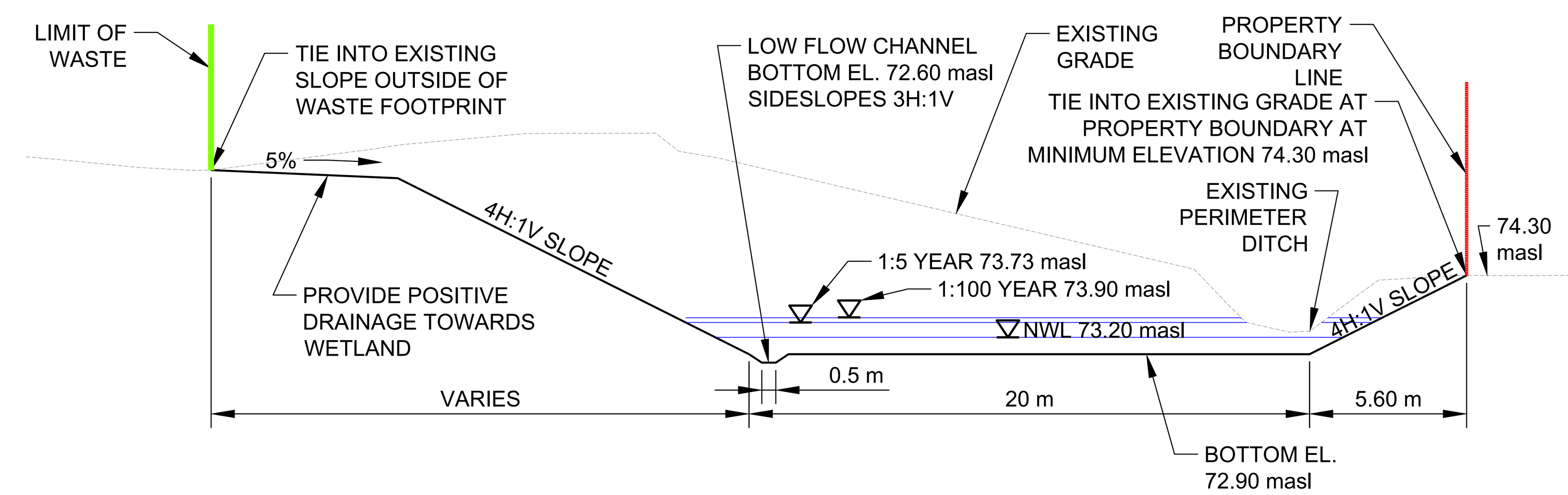
SCALE NTS 1 13-8 PROPOSED DITCH DETAIL



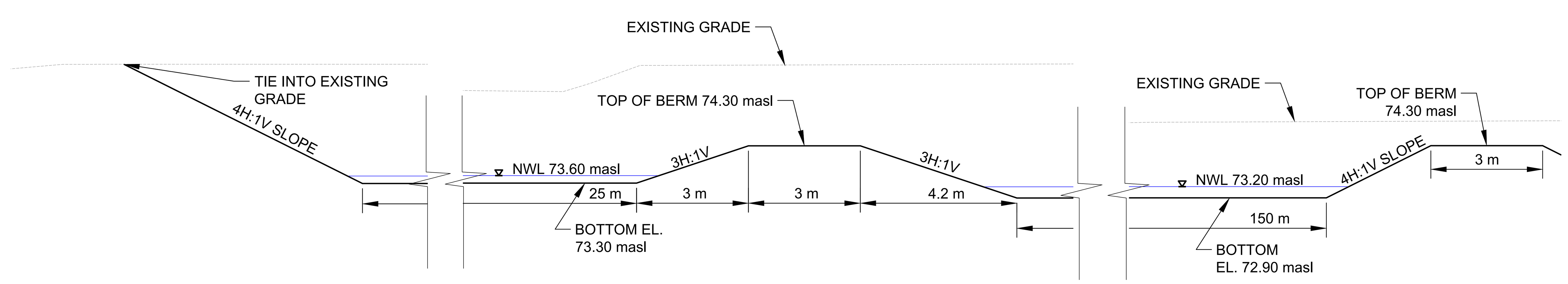
SCALE NTS 2 13-8 PROPOSED DITCH DETAIL ON SIDESLOPE



SCALE NTS 3 13-8 PROPOSED OUTLET STRUCTURE DETAILS



SCALE NTS A-A' 13-8 SECTION



SCALE NTS B-B' 13-8 SECTION

NOT FOR CONSTRUCTION

DRAFT

0 50 100
1:1,250 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
A	2022-01-11	ISSUED FOR CLIENT REVIEW	MHK	ABD	DVK	DVK

CLIENT
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PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
PROPOSED EXPANSION - STORMWATER MANAGEMENT DESIGN DETAILS

PROJECT NO.	PHASE/TASK	REV.	of	FIGURE
1648253	2.0/2.2.0	A		13-8

Table 13-25: Ditch Sizing

	Area 203 Ditch	Area 203 / 204 Ditch	Area 202 Ditch
DRAINAGE AREA			
A (ha)	4.517	8.929	2.137
Q 100yr (model) (m^3/s)	0.2500	0.4800	0.1500
Manning's Roughness Coefficient n	0.035	0.035	0.035
DITCH CHARACTERISTICS			
Slope S (mm)	0.003	0.003	0.003
Bottom Width (m)	0.00	1.00	0.00
Side Slope X:1	3	3	3
From Manning's Equation (Q)n/(√ S)	0.160	0.531	0.096
CHECK			
Depth of Flow (m)	0.401	0.488	0.332
From Manning's Equation $A^{5/3}/P^{2/3}$	0.160	0.532	0.096
Cross-Sectional Area (m^2)	0.482	1.202	0.331
Actual Velocity (m/s)	0.52	0.40	0.45

There is an existing drainage feature, labelled Reach #2 in Figure 9-10 and described in Section 9.4.2, which is located in the southern portion of the proposed expansion. The field to the south of the landfill is owned by the Township and is currently tile drained. The existing tile drainage piping will be removed as required for the expansion and drainage will be directed to the existing natural wetland area.

As described previously, the flow in the open section of the Volks Municipal Drain north of the landfill site is proposed to be conveyed via a new culvert. The culvert proposed is a 1050 mm diameter high density polyethylene culvert with a length of approximately 588 m. The culvert sizing will be confirmed with the Township Drainage Superintendent. It is anticipated that a shallow ditch will still exist above the top of the culvert to provide drainage and snow storage for the adjacent section of road. Four ditch inlet catchbasins/maintenance holes are proposed along the length to limit each individual section of pipe to around 118 m. Seepage collars around the piping will be installed periodically along the length of the culvert to reduce the potential groundwater flow within the pipe bedding.

13.4 Biology

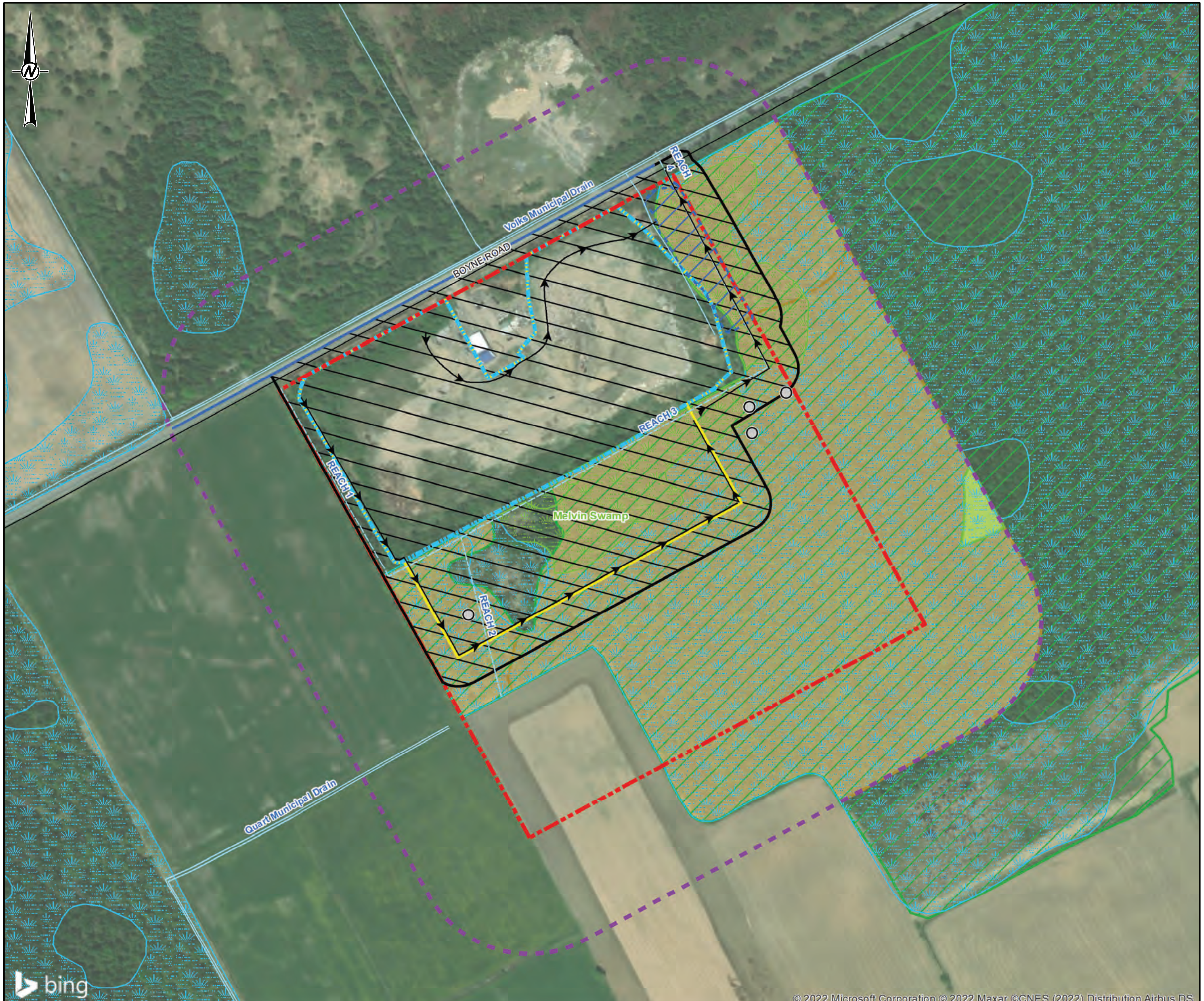
This section provides the assessment of impacts on the biology (aquatic and terrestrial) aspects of the environment associated with the proposed landfill expansion as described in Section 12 of this EA study report. This assessment was conducted in accordance with the requirements set out in the work plan provided in Section 8.

Figure 13-9 shows the proposed expansion in relation to natural heritage features and existing infrastructure.

The following impact assessment considers the potential direct and indirect impacts of the proposed expansion on the aquatic and terrestrial ecosystems within the Site and Site-vicinity Study Area for the construction, operations and closure stages of the landfill expansion.

Potential direct impacts to natural heritage features and functions are those that result in an immediate loss of the feature or function as a consequence of the landfill expansion. This may include the removal of a vegetation community or habitat within the area of expansion or ancillary facilities and related works or work areas. Potential indirect impacts are those whereby the landfill expansion cause impacts to an adjacent or downstream feature or function through the alteration of the site.

When considering and assessing the potential environmental impacts of a project on natural heritage features and functions, the first approach is to avoid potential impacts through layout and design of the project. Where impacts cannot be avoided, then mitigation of those impacts should be implemented to reduce the severity of those impacts. If mitigation measures are not possible or sufficient to mitigate potential impacts, then compensation for the loss of features and/or functions may be required.



LEGEND

- SUITABLE MATERNITY ROOST TREES FOR LITTLE BROWN MYOTIS
- FISH HABITAT - PERMANENT
- FISH HABITAT - INTERMITTENT
- ROADWAY
- RELOCATED DITCH/PROPOSED PERMIETER DITCH
- OPEN DRAINAGE DITCH TO BE REPLACED WITH A CULVERT
- UNEVALUATED WETLAND
- EVALUATED NON-PSW WETLAND
- SIGNIFICANT WILDLIFE HABITAT - WOOD THRUSH AND EASTERN WOOD-PEWEE
- SIGNIFICANT WOODLAND
- SIGNIFICANT WILDLIFE HABITAT - INTERIOR FOREST
- APPROXIMATE PROPOSED AREA FOR STORMWATER MANAGEMENT FACILITY
- LIMIT OF CURRENT INTERPRETED WASTE FOOTPRINT
- PROPOSED LIMIT OF WASTE FOR THE LANDFILL EXPANSION AREA
- SITE STUDY AREA
- 120 m STUDY AREA
- AREA OF DISTURBANCE

REFERENCE(S)

1. LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2014
2. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: MTM ZONE 9 VERTICAL DATUM: CGVD28

DRAFT

0 40 80 160

1:4,000 METRES

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
BIOLOGY IMPACT OF PREFERRED EXPANSION ALTERNATIVE

CONSULTANT
GOLDER MEMBER OF WSP

YYYY-MM-DD	2022-02-04
DESIGNED	----
PREPARED	JEM
REVIEWED	----
APPROVED	----

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	A	13-9

25mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:

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13.4.1 Construction Stage

13.4.1.1 Aquatic Ecosystems

Components of the proposed landfill expansion near and within surface water features on site are summarized below. The landfill expansion activities that could potentially affect aquatic features are currently high-level and may change through detailed landfill expansion design.

The proposed landfill expansion includes the removal of an area of evaluated and unevaluated wetland and relocation and / or re-grading of the existing perimeter ditch (Reaches 1, 3, 4 in Section 9.4), as well as removal of part of the small tile-drain outlet feature (Reach 2 in Section 9.4). For the most part, the reaches of the perimeter ditch are considered as supporting fish habitat in that they contribute flows and beneficial materials. However, there is low likelihood the perimeter ditch directly supports fish due to its ephemeral nature. New perimeter ditches will be constructed along the new perimeter of the landfill following expansion to convey surface water runoff from the landfill area and groundwater seepage from the adjacent wetlands. A new SWMP will be constructed at the existing Reach 4 confluence with Volks Municipal Drain and will be designed so that it provides enhanced (80%) TSS removal and controls peak flows off-site.

The proposed landfill expansion also includes activities to modify Volks Municipal Drain to reduce potential contamination from leachate-impacted groundwater in periods of elevated groundwater levels, as well as reduce contaminated surface runoff from Boyne Road into the drain to protect fish habitat and surface water quality in the drain. The proposed modification is enclosing Volks Municipal Drain in an approximately 588 m long pipe along the north side of Boyne Road to isolate and convey surface water past the landfill site from upstream (west) to downstream (east); refer to Figure 12-2).

13.4.1.1.1 Potential Direct Impacts

Based on the aquatic habitat observed in the perimeter ditch and Volks Municipal Drain (Section 9.4), the preliminary conceptual landfill expansion activities described above were assessed at a high-level to determine potential impacts and measures to avoid or mitigate impact to observed fish habitat from the proposed landfill expansion activities in accordance with the *Fisheries Act* (Canada, 1985). Potential residual effects of the expansion (i.e., those that cannot be fully mitigated) that could result in the death of fish or the harmful alteration, disruption, or destruction of fish habitat (HADD) will need to proceed through the DFO review process, and a DFO *Fisheries Act* Authorization for the landfill expansion may be required. The DFO permit application will include a comprehensive impact assessment that will incorporate the landfill expansion detailed design.

In the following assessment, the DFO Pathways of Effects (PoE) will be used to describe potential impacts of the proposed expansion activities on aquatic ecosystems in detail. Most of these effects can be eliminated and/or minimized by using appropriate mitigation measures and best practices. The PoE, applicable mitigation measures, and assessment of residual effects to fish and fish habitat during the construction stage are discussed below and summarized in Table 13-26.

Potential direct PoE resulting from activities carried out during the construction stage include:

- fish habitat loss and alteration
- fish passage and fish access to habitats
- mortality of fish/eggs/ova
- displacement or stranding of fish or incubating eggs
- incidental entrainment and impingement of resident species

Most of these potential effects, including mortality of fish/eggs/ova, fish displacement, and incidental entrainment/impingement can be eliminated and fish habitat loss and alteration can be minimized using appropriate mitigation measures and best practices.

The proposed expansion of the landfill will result in the removal of the wetland areas and relocation of the perimeter ditch. A SWMP will be built at the downstream end of the new perimeter ditch in the vicinity of Reach 4 before the confluence with Volks Municipal Drain. These proposed works will alter flow regimes, prevent fish access and remove supporting fish habitat in the perimeter ditch. Approximately 1,622 m (10,011 m^2) of supporting fish habitat in the perimeter ditch will be altered/lost. However, the habitat in the ditch is seasonal and of marginal quality, and new ditches will be created around the expanded landfill. The habitat created through reinstating the perimeter ditches is approximately 1,414 m, with approximately 170 m being part of the SWMP. The aquatic habitat in the new ditches will be similar in fish habitat quality and function; however, it will not directly connect to the Volks Drain but instead flow into the SWMP that discharges to the Volks Drain.

The SWMP will act to receive runoff from the new perimeter ditch, allow sediment to settle out in the pond and slowly release to the drain to minimize runoff with elevated TSS from entering Volks Municipal Drain. The construction of the SWMP at the reinstated perimeter ditch will eliminate fish access to habitats in the new perimeter ditch. Due to very low water flow in the existing perimeter ditch, it was determined that direct fish usage of most of the ditch was unlikely, but there is some potential that fish could inhabitant waters within Reach 4 near the confluence of Volks Municipal Drain when spring water is high enough. So, the creation of a SWMP at the confluence of Reach 4 and the Drain eliminates the potential for fish to directly inhabit this area during seasonal high flow. However, the resulting improvements in water quality from the SWMP into Volks Municipal Drain, a fish bearing watercourse, will outweigh the loss of access to the seasonal, low quality habitat within the perimeter ditch.

The proposed modifications (Option 1 and 2) to Volks Municipal Drain are proposed to improve water quality by preventing potentially leachate-impacted groundwater seepage from entering the drain. This project work will result in impacts to fish habitat. The 588 m long pipe (which will be referred to as Option 1) would eliminate fish passage and fish access to upstream habitats, including access to the perimeter ditch. The potential effects of Option 1 include permanent changes to fish habitat, flow and fish access to habitats upstream of the landfill expansion in Volks Municipal Drain as the length of the culvert is impassable for fish (Di Rocco and Gervais, 2021), and flow velocity during high-flow periods is expected to increase following construction. In addition, Option 1 is expected to result in the permanent loss of approximately 588 m of fish habitat in the watercourse as fish cannot pass the long culvert and the existing channel will be enclosed within the culvert. As an alternative, maintaining the watercourse as an open ditch with installation of a low permeability liner system in the base and sides of the ditch, incorporating a liner such as a geomembrane or geosynthetic clay liner (which will be referred to as Option 2) would reduce the likelihood of potentially leachate-impacted groundwater seepage entering the watercourse and also maintain fish passage and access to upstream habitats. The potential effects of Option 2 include alteration of fish habitat, temporary changes to fish passage and flows during construction. Option 2 will result in the alteration of fish habitat structure through the placement of the geomembrane along the drain channel bed. However, once the liner system is in place, natural substrates are expected to establish over the liner system and support aquatic macrophyte re-growth. The existing bed and bank elevations would be maintained as well. Therefore, the potential effects on fish habitat and structure in the drain are anticipated to be short-term and not expected to interrupt key life processes for fish. Overall, the effects of these modification options should be weighed with the quality of the fish habitat that is in the existing Volks Municipal Drain. This reach of the drain (Class F) experiences intermittent flow and lacks depth and connection to upstream and downstream habitats except for in high flow periods. The habitat in the affected reach of Volks Municipal Drain is not critical to support specialized fish life history processes (e.g., spawning). In addition, modifications will be designed to reduce the risk of contamination entering the watercourse, protecting surface water quality and thereby improving downstream fish habitat and reduce the likelihood of harm to fish over time.

13.4.1.1.2 Potential Indirect Impacts

Potential indirect PoE resulting from activities carried out during the construction stage include:

- Changes in water quality including a change in:
  - contaminant concentrations
  - water temperature
  - nutrient concentrations
  - dissolved oxygen concentrations
- Change in base flow
- Changes in sediment concentrations
- Change in food supply
- Change in habitat structure and cover

Potential effects can be minimized or eliminated using appropriate mitigation measures and best practices, and development and implementation of an Erosion and Sediment Control Plan and Spill Contingency Plan (Table 13-26).

There will be an increase in peak flow in the new perimeter ditch compared to current conditions and an increase in total volume of runoff leaving the Site, resulting in a residual change to flow and water quality (e.g., dissolved oxygen, TSS). The SWMP will be implemented to control peak flows off-site to pre-expansion conditions and achieve 80% TSS removal. Therefore, there is only the potential for increased flow in the perimeter ditch during storm events. These potential changes to flow are considered to be minor.

Excavation and grading during the proposed modifications (Option 1 or 2) to Volks Municipal Drain have the potential to increase sediment concentrations, alter flows and water temperature, and alter fish habitat and structure. No residual effects from these stressors are anticipated if mitigation measures are implemented and properly maintained and construction activities are conducted according to best management practices. Indirect effects resulting from the use of construction equipment can be mitigated (Table 13-26).

The intent of the modifications to Volks Municipal Drain is to protect it from seepage of potentially leachate-impacted groundwater, thereby improving fish habitat and preventing harm to fish over time. Minor residual effects to fish habitat structure, cover, food supply and nutrient concentrations are expected due to removal of aquatic vegetation in the Volks Municipal Drain. However, aquatic vegetation currently inhibits fish passage in the watercourse and it is expected to naturally regenerate if Option 2 is selected.

There are no residual indirect effects to fish and fish habitat expected, resulting from the temporary diversion system during construction in Volks Municipal Drain if mitigation measures are properly implemented and maintained. Both modifications options are expected to improve and protect water quality in Volks Municipal Drain and hydrologically connected watercourses following construction, outweighing residual effects to fish and fish habitat.

Table 13-26: Aquatics Effects Assessment During the Construction Stage, Boyne Road Landfill Expansion

Surface Water Feature	Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects
Perimeter Ditch (Reaches 1, 2, 3, 4); Volks Municipal Drain	Fish Passage Issues	• removal and re-establishment of the perimeter ditch alters supporting fish habitat and changes flow regime • construction of the stormwater management pond in Reach 4 of the perimeter ditch will reduce or eliminate fish access to habitats upstream permanently • modification to Volks Municipal Drain (Option 1) will permanently alter flows and restrict fish access to upstream habitats. • the temporary diversion of flow in Volks Municipal Drain during construction (of either Option 1 or 2) will obstruct fish movement temporarily.	• fish passage in Volks Municipal Drain is currently inhibited by abundant aquatic vegetation and low water levels in summer/fall low flow periods • Option 2 includes incorporating streambed elevations that approximately mirror existing elevations, maintaining existing flows and fish passage • modifications to Volks Municipal Drain may improve fish passage by removing barriers to fish (aquatic vegetation), • temporary flow management will be the responsibility of the contractor but will be maintained via a temporary flow management system to maintain flow during construction (i.e., dam and pump). • temporary flow control structures will be installed upstream of the work area in Volks Municipal Drain • accumulated sediment from the isolated area will be removed before the isolation barrier.	Permanent change to flow, fish passage, and fish access to habitats is anticipated due to infilling the perimeter ditch. The perimeter ditch is supporting fish habitat, contributing flows downstream, but unlikely to directly support fish use. The habitat in the ditch is seasonal and of marginal quality, and new ditches will be reinstated around the expanded landfill. Anticipated residual effects to fish passage issues upstream of the SWMP in the perimeter ditch are minor as the improvements in Volks Municipal Drain water quality resulting from the SWMP are expected to outweigh the loss of

Surface Water Feature	Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects
			• cofferdams, if needed, will consist of clean material and adequately sized to withstand high-flow events and prevent sedimentation of the watercourse • fish will be removed from the isolated work area • water pumps will be screened to prevent accidental entrainment of fish • prior to dewatering, any fish stranded within the dewatering area will be rescued and immediately released as specified in a license to collect fish • all pumped water will be discharged to a sediment filtration bag/straw bales within a well vegetated riparian area, which will allow water to infiltrate before re-entering the drain downstream of the work area.	access to the seasonal, low quality habitat within the perimeter ditch. In general, the reinstated upstream reaches of the perimeter ditch and upstream Volks Municipal Drain are seasonally wetted and low in habitat quality, providing limited ecological functions. Option 1 is expected to result in permanent changes to flow and fish access to habitats upstream of the landfill expansion in Volks Municipal Drain. The length of the culvert is impassable for fish. No permanent effect to fish passage at Volks Municipal Drain is expected as a result of Option 2 modifications.

Surface Water Feature	Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects
				The temporary obstruction of fish passage due to temporary flow structures in Volks Municipal Drain is of short duration and is not anticipated to interrupt key life processes of fish, if applicable mitigation measures are carried out
Perimeter Ditch (Reaches 1, 2, 3, 4); Volks Municipal Drain	Change in Timing, Duration, and Frequency of Flow	• temporary dewatering to accommodate infilling of perimeter ditches and modification to Volks Municipal Drain can displace fish and impact fish access to habitats • flow changes can impact water temperature, contaminant concentrations, sediment concentrations, nutrient concentrations, and habitat structure and cover in the watercourses	• in-water work will avoid wet and rainy periods and sensitive periods for fish • the temporary diversion of flow in Volks Municipal Drain will be limited in duration • accumulated sediment from the Volks Municipal Drain isolated area will be removed before the isolation barrier. • cofferdams will be clean and adequately sized to withstand high-flow events and prevent sedimentation of the watercourse	Permanent change to flow and fish access to habitats is anticipated due to infilling the perimeter ditch. The habitat in the ditch is seasonal and of marginal quality, and new ditches will be reinstated around the expanded landfill, which are expected to provide similar flows and fish habitat compared to the existing ditch.

Surface Water Feature	Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects
		• increased flows and runoff volume in the reinstated perimeter ditch compared to current conditions are expected to alter flow regime and water quality in the perimeter ditch and Volks Municipal Drain	• Option 2 is expected to result in flows similar to existing flows in Volks Municipal Drain • fish stranded within dewatering areas will be rescued immediately and released as specified in a license to collect fish	Option 1 is expected to result in permanent changes to flow and fish access to habitats upstream of the landfill expansion in Volks Municipal Drain. The length of the culvert is impassable for fish and flow is expected to increase through the culvert in high-flow periods. No residual effects to fish passage at Volks Municipal Drain is expected as a result of Option 2 modifications. There are no residual effects to fish habitat as a result of the temporary dewatering and obstruction of flow in Volks Municipal Drain if applicable mitigation measures are carried out.

Surface Water Feature	**Pathway of Effect(s)**	**Stressor (Potential Impact)**	**Mitigation Measures**	**Residual Effects**
				Minor residual changes to base flow and water quality (e.g., dissolved oxygen, TSS) in the reinstated perimeter ditch and Volks Municipal Ditch are expected; however, the SWMP will be implemented to control peak flows off-site to pre-expansion conditions and achieve 80% TSS removal.
Perimeter Ditch (Reaches 1, 2, 3, 4); Volks Municipal Drain	Placement of materials in the water	• the placement of fill in perimeter ditch permanently removes an area of fish habitat in the drainage feature • enclosing Volks Municipal Drain will remove an area of fish habitat in the watercourse as fish cannot pass the long culvert (Option 1).	• Option 2 minimizes the intensity and extent of in-water work relative to Option 1 • the water quality in Volks Municipal Drain will be protected in the long term following modification Option 1 or 2, improving fish habitat over time • natural fine substrates will likely attenuate over the pipe material (Option 1) or liner system (Option 2), mimicking existing substrates	Permanent loss of 1,622 m of fish habitat is anticipated due to infilling the perimeter ditch. New ditches will be reinstated around the expanded landfill, creating approximately 1,414 m of potential fish habitat, with approximately 170 m part of the SWMP. However, fish access to

Surface Water Feature	Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects
		• the placement of the liner system (Option 2) along the length of Volks Municipal Drain will permanently change fish habitat structure • Volks Municipal Drain modifications have the potential to change sediment and nutrient concentrations in the watercourse • a temporary flow diversion system (i.e., cofferdams) will be installed in Volks Municipal Drain to isolate the work area prior to construction	• all in-water work will avoid wet and rainy periods will sensitive life stages for fish • in-water work will be carried out in isolation of flowing water using isolation techniques in Volks Municipal Drain and perimeter ditch (if wetted at the time of construction). • the temporary flow diversion system will use clean materials, adequately sized to withstand high-flow events and prevent sedimentation of the watercourse • fish located within the dewatering area will be rescued immediately and released as specified in a license to collect fish • after construction, the cofferdams will be removed and the upstream dam will be gradually removed first, to equalize water levels inside and outside of the isolated area and to allow suspended sediments to settle prior to removing the upstream dam	the reinstated ditches may not be possible due to the SWMP. Permanent changes to Volks Municipal Drain are expected following modifications (Options 1 or 2). However, water quality will be protected following construction. The Option 2 liner system is expected to support aquatic revegetation growth, the existing bed and bank elevations will be approximately maintained, natural substrates are expected to attenuate over the liner system. Option 1 is expected to result in the loss of approximately 588 m of fish habitat in the watercourse as fish cannot pass the long culvert. However, the fish habitat in the

Surface Water Feature	Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects
			• accumulated sediment from the isolated area will be removed before the isolation barrier	existing watercourse is intermittent and does not support specialized life history functions for fish (e.g., spawning). The temporary change in fish habitat in Volks Municipal Drain due to cofferdam placement is minor and is not anticipated to interrupt key life processes of fish.
Volks Municipal Drain	Excavation and Grading	Excavation and grading can result in: • bank instability and soil exposure leading to increased erosion potential, resulting in sediment concentration changes and thus changes in aquatic habitat in the watercourse	• the contractor will develop an Erosion and Sediment Control (ESC) Plan and Spill Contingency Plan for the landfill expansion. • ESC measures will be installed upstream of the work area and along the banks in Volks Municipal Drain. • ESC measures will be regularly inspected to isolate the work area to prevent sediment from entering the watercourse.	Option 1: Residual effects to fish habitat structure and cover are anticipated due to modification to the watercourse bed and banks that will not be reinstated to pre-construction conditions. However, water quality will be protected following construction.

Surface Water Feature	Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects
		• slope changes can alter drainage patterns and lead to increase erosion potential and sedimentation of the watercourse • excavation can alter base flows and change water temperature	• disturbed areas will be stabilized and reinstated, including minimizing changes to existing drainage patterns, implementing bioengineering and rock reinforcement, if required (Option 2; Option 1 to the extent possible) • machinery will be operated on land with appropriate erosion control measures as needed (swamp mats) to eliminate disturbance to watercourse bed and banks • exposed soils will be stabilized and revegetated and drainage will be directed away from steep slopes where required	Option 2: No residual effects are anticipated to the fish and fish habitat in Volks Municipal Drain if mitigation measures are properly implemented and maintained.
Volks Municipal Drain	Use of Construction Equipment	• potential to create bank instability and soil exposure leading to changes in sediment concentrations • potential for equipment leaks and spills changing contaminant concentrations • potential for fish and fish egg mortality caused by machinery	• work will implement ESC measures described in the Erosion and Sediment Control Plan and Spill Contingency Plan • in-water work will be carried out during low water levels and will avoid wet and rainy periods	No residual effects to the fish and fish habitat in Volks Municipal Drain are anticipated if mitigation measures are properly implemented and maintained.

Surface Water Feature	Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects
			• in-water work will be conducted from 29 June to 14 March (no in-water work from 15 March to 28 June) to avoid sensitive periods for fish spawning • machinery will be operated on land with appropriate erosion control measures as needed (swamp mats) to reduce disturbance to watercourse banks • all equipment will be clean and maintained so that no fluids or contaminants are leaked and no invasive weeds or pests are transferred to the watercourse • sediment and erosion control measures will be installed upstream and along the banks of Volks Municipal Drain and regularly inspected to isolate the work area to prevent sediment from entering the watercourse • a spill prevention and response plan to be developed by the contractor to minimize the risk of accidental spills or releases will be kept on site at all times.	

Surface Water Feature	Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects
			• all stockpiled materials, including but not limited to excavated overburden and topsoil, excess materials, construction debris and containers shall be stored and stabilized in a manner that prevents them from entering the watercourse. All construction materials will be removed and properly disposed of from site following construction.	
Volks Municipal Drain	Removal of Aquatic Vegetation	Removal of aquatic vegetation to accommodate modifications to Volks Municipal Drain can result in: • changes in water temperature and dissolved oxygen • changes in food supply and nutrient concentrations available to fish • changes characteristics of fish habitat and cover	• the removal of aquatic vegetation is limited to the footprint of the watercourse adjacent to the Site (approximately 588 m in length) • aquatic vegetation is expected to naturally regenerate following construction (Option 2 only)	Minor, short-term residual effects to fish habitat structure, cover, food supply and nutrient concentrations are expected due to removal of aquatic vegetation in the Volks Municipal Drain.

Source: DFO Pathways of Effects (2018).

Potential residual effects to flow, fish passage, and fish access to habitats are anticipated due to infilling the perimeter ditch, and there will be a permanent loss of approximately 1,622 m of fish habitat. However, the habitat in the ditch is seasonal and of marginal quality. New ditches will be reinstated around the expanded landfill; however, fish may not be able to access the ditches upstream of the SWMP. Minor residual changes to flow and water quality (e.g., dissolved oxygen, TSS) in the reinstated perimeter ditch and Volks Municipal Ditch are expected; however, the SWMP will be implemented to control peak flows off-site to pre-expansion conditions and achieve 80% TSS removal. Residual effects to fish passage issues upstream of the SWMP in perimeter ditch are minor as the improvements in Volks Municipal Drain water quality resulting from the SWMP are expected to outweigh the loss of access to the seasonal, low quality habitat within the perimeter ditch.

Potential residual effects to flow and fish access to habitats upstream of the landfill expansion in Volks Municipal Drain are anticipated due to enclosing the Drain in a culvert as part of modification Option 1. The length of the culvert is impassable for fish preventing fish access to upstream reaches of the Drain, removing fish access to the perimeter ditch, and increasing flows through the culvert in high-flow periods relative to existing conditions. Option 1 is expected to result in the loss of approximately 588 m of fish habitat in the watercourse (within the long culvert), and permanent changes to fish structure and cover are expected as the bed and banks will not be restored to pre-construction conditions. However, the fish habitat in the existing watercourse is intermittent and does not support specialized life history functions for fish (e.g., spawning).

Potential residual effects to flow and fish access to habitats upstream of the landfill expansion in Volks Municipal Drain are anticipated due to installation of a liner system as part of modification Option 2; however, modification Option 2 is expected to have less of an impact to fish and fish habitat compared to modification Option 1. Potential residual effects are expected to be minor following application of mitigation measures, as the proposed liner system is expected to support aquatic revegetation growth, the existing bed and bank elevations will be maintained, and natural substrates are expected to attenuate over the channel, maintaining natural conditions as much as possible.

The temporary change in fish habitat in Volks Municipal Drain due to cofferdam placement is minor and is not anticipated to interrupt key life processes of fish. The temporary obstruction of fish passage due to temporary flow structures in Volks Municipal Drain is of short duration and is not anticipated to interrupt key life processes of fish, if applicable mitigation measures are carried out.

13.4.1.2 Terrestrial Ecosystems

13.4.1.2.1 Potential Direct Impacts

The proposed expansion will result in disturbance of 9.3 ha of naturally occurring vegetation (i.e., outside of the current interpreted waste footprint shown on Figure 13-9), which includes the proposed limit of waste for the proposed expansion, the relocated perimeter ditches, the SWMP, and an assumed offset of approximately 30 m to allow for construction access (offset does not extend off-site to the west or north). The disturbance area values discussed below (e.g., significant woodlands, wetlands, etc.) are overlapping features in many cases, and all occur within the total 9.3 ha of anticipated disturbance. While the proposed expansion avoids some areas of natural heritage features and functions, some direct impacts are anticipated. These impacts are based on the occurrence of:

- Habitat for endangered or threatened species (little brown myotis)
- Significant woodland
- Evaluated non-PSW (Melvin Swamp) and unevaluated wetlands
- Significant wildlife habitat - species of conservation concern (wood thrush and eastern wood-pewee)
- Significant wildlife habitat – interior forest

The proposed expansion will result in the loss of three trees that were identified as potential maternity roost habitat for little brown myotis, which is designated endangered under the ESA. In addition, 5.2 ha of the contiguous ELC ecosite associated with the potential roost trees, and foraging habitat, will be removed. As this species and its habitat is protected under the ESA, an Information Gathering Form must be prepared and submitted to the MECP prior to any works being undertaken to initiate permitting under the ESA, which will include compensation and appropriate mitigations. Additional endangered and threatened species have the potential to be present off-site but may have protected habitats that extend onto the Site Study Area. For this reason, barn swallow, bobolink, eastern meadowlark, American ginseng and butternut should be included on the Information Gathering Form submitted to the MECP to confirm that no permitting under the ESA related to those species is required.

The proposed expansion will result in the loss of 6.3 ha of the overall 54.5 ha significant woodland (11.5% decrease). Although forest cover in the planning area is low, the woodland loss does not represent a significant reduction of the size of the overall woodland, especially when the additional woodlands north of Boyne Road are considered. The proposed expansion will occur at the western edge of the forest and immediately south of the existing landfill, so no fragmentation or impacts to the core of the woodland patch will result. It is not expected that the proposed expansion will affect the function of the woodland for provision of wildlife habitat.

The proposed expansion will result in the loss of 7.2 ha of evaluated non-PSW and unevaluated wetlands. This represents approximately 8% of the approximately 85.4 ha of contiguous wetland on and off-site, south of Boyne Road. Additional wetlands are also present north of Boyne Road. Based on field observations, the wetlands did not support significant numbers of wetland-obligate species, such as amphibians. The proposed expansion is not expected to have a significant impact on the remaining portions of the wetlands or their functions.

The proposed expansion will result in the loss of 6.3 ha of significant wildlife habitat for wood thrush and eastern wood-pewee. Although forest cover in the planning area is low, the proposed expansion is not expected to reduce the ability of either species to continue to use the remaining 48.2 ha of forest adjacent to the proposed expansion for breeding.

The proposed expansion will result in the loss of 1.3 ha of the approximately 6.0 ha of significant wildlife habitat in the form of interior forest habitat. The proposed expansion will occur at the western edge of the forest and immediately south of the existing landfill, so no fragmentation or impacts to the core of the interior forest habitat will result. The proposed expansion will not significantly reduce the area of interior forest habitat available in the woodland, and the remaining portions will continue to provide this habitat type for area-sensitive species.

In addition to the features discussed above, the proposed expansion has the potential to cause direct mortality to wildlife during construction. To avoid contravention of the *Migratory Birds Convention Act*, clearing of vegetation should take place outside of the breeding bird nesting period (April 1 – August 31) to protect birds, their nests and young. If clearing must occur during this time, a nest survey must be performed by a qualified biologist within 24 hours prior to the proposed works. If a nest is located, it must be buffered and protected until it is no longer active. Other wildlife have the potential for direct mortality during construction, such as snakes and mammals. A Wildlife Encounter Protocol should be developed for use during construction, and all staff should be trained on the contents of the protocol. The protocol should include steps to take if wildlife are observed in the work area, if wildlife are injured, and contact information for appropriate individuals who can offer advice or assistance. Any specific mitigation measures identified by MECP for little brown myotis as a result of consultation, following submission of the Information Gathering Form, must also be implemented.

13.4.1.2.2 Potential Indirect Impacts

Potential indirect impacts of the construction phase include typical construction-related impacts. These potential indirect impacts are not considered significant and are mitigable with standard construction best management practices. These potential indirect impacts and the corresponding best management mitigation practices are as follows:

- Accidental spills or sedimentation in adjacent vegetation communities
  - Best Management Practices: Regular equipment maintenance to minimize the potential for fluid leaks/releases; Spill Prevention & Response Plan; Sediment & Erosion Control Plan to isolate work areas from adjacent vegetation communities
- Dust deposition on vegetation in adjacent vegetation communities
  - Best Management Practices: provide dust control measures as required (water spray is preferred)
- Noise related impacts to wildlife in adjacent habitats
  - Best Management Practices: maintenance of equipment, controls on equipment use including site speed limits
- Introduction of invasive plant species via construction equipment
  - Best Management Practices: clean equipment prior to mobilizing it to the site

13.4.2 Operations Stage

13.4.2.1 Aquatic Ecosystems

13.4.2.1.1 Potential Direct Impacts

Once the proposed expansion is constructed, potential impacts related to the landfill during the Operations Stage on surface water features are expected to be limited to effects related to the use of site operations equipment (Table 13-27). These impacts can be avoided through the implementation of standard operational measures, the continuation of measures implemented during the Construction Stage (Table 13-26), routine environmental monitoring for potential releases from the landfill and, if required, investigation and mitigation measures before adverse effects occur off-site.

Table 13-27: Summary of Potential Pathway of Effects and Measures to Protect Fish Habitat Related to the Landfill Expansion Operation Stage

Stressor	Expected Mitigation Measures to Protect Fish and Fish Habitat	Residual Effect
Direct Impacts		
Habitat Loss and Alteration • Change in habitat structure and cover • Change in food supply • Change in access to habitat/migration	• Minimize footprint associated with landfill expansion. • Minimize riparian and aquatic vegetation clearing and use proper clearing techniques. • Minimize duration of any in-water mitigation measures. • Apply DFO's Measures to Protect Fish and Fish Habitat (DFO, 2019b). • Complete any in-water works from 29 June to 14 March, which is outside the restricted activity timing window to avoid spawning and egg/larval development periods. • Minimize organic debris (e.g., woody debris) clearing and use proper clearing techniques. • Revegetate cleared areas using native species. • Remove all material or structures (e.g., isolation dams, silt curtains) placed in the watercourse and perimeter ditch. • If required for maintenance, construct in isolation and complete a fish rescue to remove and relocate fish from the isolated work area.	The relocation of the perimeter ditch and removal of watercourse (i.e., Reach 2) will result in approximately 1621 m (10,011 m^2) of "supporting" fish habitat loss based on current plans. However, this habitat is unlikely to be used directly by fish and the existing ditch contributes flows downstream to fish bearing waters. Flows downstream will be maintained and improved through a new ditch and SWMP.

Stressor	Expected Mitigation Measures to Protect Fish and Fish Habitat	Residual Effect
Potential mortality of fish/eggs/ova from equipment	• Minimize footprint associated with landfill expansion. • Apply DFO's Measures to Protect Fish and Fish Habitat (DFO, 2019b). • Operate machinery from above the high watermark to minimize the disturbance of the bed, riparian area, and shoreline. • Minimize duration of in-water works. • Complete any in-water mitigation measures from 16 July to 14 March, which is outside the restricted activity timing window to avoid spawning and egg/larval development periods.	No negative residual effects anticipated if mitigation measures are properly applied and maintained.
Displacement or stranding of fish or incubating eggs	• Minimize footprint associated with landfill expansion. • Maintain 100% downstream flow during construction. • If required for maintenance, construct an isolation area and perform a fish rescue to remove and relocate all fish from the isolated work area. • Apply DFO's Measures to Protect Fish and Fish Habitat (DFO, 2019b). • Operate machinery from above the high watermark to minimize the disturbance of the bed, riparian area, and shoreline. • Minimize duration of in-water works. • Complete any in-water mitigation measures from 29 June to 14 March, which is outside the restricted activity timing window to avoid spawning and egg/larval development periods.	

Stressor	Expected Mitigation Measures to Protect Fish and Fish Habitat	Residual Effect
	• If applicable, follow the DFO interim code of practice for end-of-pipe fish protection screens for small water intakes in freshwater (DFO, 2020e) to prevent entrainment or impingement of fish. • If applicable, ensure in-water activities do not interfere with fish passage, constrict the channel width, or reduce flows, or result in the stranding or death of a fish. • If applicable, ensure the pumping system is sized to accommodate expected high flows/high water events during the construction period. Pumps should always be monitored, and back-up pumps should be readily available on-site in case of pump failure. • If applicable, protect pump discharge area(s) to prevent erosion and the release of suspended sediments and remove this material when the works have been completed.	
Incidental entrainment, impingements or mortality of resident species	• Minimize footprint associated with landfill expansion. • Maintain 100% downstream flow during construction. • If required for maintenance, construct an isolation area and perform a fish rescue to remove and relocate all fish from the isolated work area. • Apply DFO's Measures to Protect Fish and Fish Habitat (DFO, 2019b). • Operate machinery from above the high watermark to minimize the disturbance of the bed, riparian area, and shoreline. • Minimize duration of in-water works.	No negative residual effects anticipated if mitigation measures are properly applied and maintained.

Stressor	Expected Mitigation Measures to Protect Fish and Fish Habitat	Residual Effect
	• Complete any in-water mitigation measures from 29 June to 14 March, which is outside the restricted activity timing window to avoid spawning and egg/larval development periods. • If applicable, follow the DFO interim code of practice for end-of-pipe fish protection screens for small water intakes in freshwater (DFO, 2020e) to prevent entrainment or impingement of fish. • If applicable, ensure in-water activities do not interfere with fish passage, constrict the channel width, or reduce flows, or result in the stranding or death of a fish. • If applicable, ensure the pumping system is sized to accommodate expected high flows/high water events during the construction period. Pumps should always be monitored, and back-up pumps should be readily available on-site in case of pump failure. • If applicable, protect pump discharge area(s) to prevent erosion and the release of suspended sediments and remove this material when the works have been completed.	
Direct mortality of fish	• Minimize footprint associated with landfill expansion. • Maintain 100% downstream flow during construction. • If required for maintenance, construct an isolation area and perform a fish rescue to remove and relocate all fish from the isolated work area. • Apply DFO's Measures to Protect Fish and Fish Habitat (DFO, 2019b).	

Stressor	Expected Mitigation Measures to Protect Fish and Fish Habitat	Residual Effect
	• Operate machinery from above the high watermark to minimize the disturbance of the bed, riparian area, and shoreline. • Minimize duration of in-water works. • Complete any in-water mitigation measures from 29 June to 14 March, which is outside the restricted activity timing window to avoid spawning and egg/larval development periods. • If applicable, follow the DFO interim code of practice for end-of-pipe fish protection screens for small water intakes in freshwater (DFO, 2020e) to prevent entrainment or impingement of fish. • If applicable, ensure in-water activities do not interfere with fish passage, constrict the channel width, or reduce flows, or result in the stranding or death of a fish. • If applicable, ensure the pumping system is sized to accommodate expected high flows/high water events during the construction period. Pumps should always be monitored, and back-up pumps should be readily available on-site in case of pump failure. If applicable, protect pump discharge area(s) to prevent erosion and the release of suspended sediments and remove this material when the works have been completed.	

Stressor	Expected Mitigation Measures to Protect Fish and Fish Habitat	Residual Effect
Indirect Impacts		
Change in water quality including a change in: • contaminant concentrations • nutrient concentrations • water temperature • dissolved oxygen concentrations	• Follow the mitigation measures outlined under the “change in sediment concentrations” stressor. • Develop and implement a site-specific Spill Management Plan and have all components of the Plan on-site at all times in event of a spill. • Maintain equipment in clean condition and free of fluid leaks, invasive species, or noxious weeds. • Wash, refuel, and service equipment away from watercourse and perimeter ditch (i.e., greater than 30 m). • Plan activities near water such that chemicals do not enter watercourse and perimeter ditch. • Ensure that material used in a watercourse has been handled and treated in a manner to prevent the release or leaching of substances into the water that may be deleterious to fish. • Minimize aquatic and terrestrial vegetation clearing and use proper clearing techniques. • Revegetate cleared terrestrial areas to minimize exposed soils and therefore erosion potential. • Revegetate cleared terrestrial areas with native species. • Remove all material or structures (e.g., isolation dams, silt curtains) placed in the waterbody. • Minimize organic debris (e.g., woody debris) clearing and use proper clearing techniques.	No negative residual effects anticipated if mitigation measures are properly applied and maintained.

Stressor	Expected Mitigation Measures to Protect Fish and Fish Habitat	Residual Effect
	• If appliable, follow the DFO interim code of practice for routine maintenance and dredging (DFO, 2020b) and temporary cofferdams and diversion channels (DFO, 2020c).	
Change in base flow	• Minimize footprint associated with the landfill expansion. • Undertake all in-water activities in isolation of open or flowing water to maintain the natural flow of water. • Follow the DFO interim code of practice for culvert maintenance (DFO, 2020d) and temporary cofferdams and diversion channels (DFO, 2020c).	No negative residual effects anticipated if mitigation measures are properly applied and maintained.

Change in sediment concentrations	• Apply DFO's Measures to Protect Fish and Fish Habitat (DFO, 2019b).
	• Obtain and work in compliance with regulatory permits and approvals.
	• Develop and implement a site-specific Erosion and Sediment Control Plan or equivalent that minimizes risk of sedimentation in the watercourse and perimeter ditch during all phases of the landfill expansion.
	• Install, monitor, and maintain effective erosion and sediment control measures (e.g., silt fence, cofferdam) before starting work to prevent sediment from entering the watercourse and perimeter ditch.
	• Temporary erosion control measures must be:
	    • Properly installed.
	    • Installed before or immediately after disturbance.
		No negative residual effects anticipated if mitigation measures are properly applied and maintained.

Stressor	Expected Mitigation Measures to Protect Fish and Fish Habitat	Residual Effect
	• Inspected and properly maintained (e.g., repaired, replaced, or supplemented with functional materials) throughout construction until permanent erosion control is established, or reclamation is complete. • Manage water flowing onto the site, as well as water being pumped/diverted from the site, such that sediment is filtered out prior to the water entering the watercourse and perimeter ditch. • Conduct in-water work during a period of low flow and avoid wet, windy, and rainy periods. • Minimize duration of in-water work. • Revegetate disturbed areas and exposed soils on shoreline banks. • Revegetate cleared areas to minimize exposed soils and, therefore, erosion potential. • Revegetate cleared areas with native species. • Undertake all instream activities in isolation of open or flowing water to avoid introducing sediment into the watercourse and perimeter ditch. • If appliable, follow the DFO interim code of practice for routine maintenance and dredging (DFO, 2020b) and temporary cofferdams and diversion channels (DFO, 2020c).	

Notes: DFO = Fisheries and Oceans Canada.

13.4.2.1.2 Potential Indirect Impacts

During the Operations Stage, potential indirect impacts to aquatic ecosystems are likely to be limited to the following:

- Site runoff, accidental spills, or sedimentation of fish habitat
- Dust and airborne waste deposition into fish habitat

Given the presence of the existing landfill, some of these potential impacts (i.e., site runoff, accidental spills, dust and airborne waste) are already present to some degree. These potential impacts will be mitigated by a site-specific Erosion and Sediment Control Plan and Spill Contingency Plan or equivalent, as well as maintaining regulated air quality parameters. Monitoring of groundwater and surface water quality and quantity will be carried out to meet relevant provincial permitting and approvals.

The proposed SWMP at the northeast corner area of the landfill site on the south side of Boyne Road will be designed so that it provides enhanced (80%) TSS removal and control peak flows off-site. The modifications to Volks Municipal Drain will be designed to prevent potential seepage of leachate-impacted groundwater into the surface water in the ditch. Therefore, with the addition of the SWMP and modifications to Volks Municipal Drain and implementation of appropriate mitigation measures (i.e., erosion and sediment control; Table 13-27), existing standard operational measures, and groundwater and surface water quality/quantity monitoring, potential indirect impacts to fish and fish habitat during the Operations Stage are considered minor.

13.4.2.2 Terrestrial Ecosystems

13.4.2.2.1 Potential Direct Impacts

Once the proposed expansion is constructed, impacts related to the Operations Stage of the landfill are expected to be limited to potential, occasional mortality of wildlife. These occurrences can be avoided through the implementation of standard operational measures, the continuation of measures implemented during the Construction Stage, and compensation for the loss of habitat of endangered species (as described in Section 13.4.1.2.1).

13.4.2.2.2 Potential Indirect Impacts

During the Operations Stage of the proposed expansion, potential indirect impacts to terrestrial ecosystems are likely to be limited to the following types of impacts:

- Accidental spills or sedimentation in adjacent vegetation communities
- Dust and airborne waste deposition in natural habitats
- Noise related impacts on wildlife in adjacent habitats
- Introduction of invasive plant species via equipment or yard waste

Given the presence of the existing landfill, some of these impacts may be or already are present to some degree. The existing standard operational measures will continue to mitigate these potential impacts to the extent feasible, and the proposed buffer around the proposed limit of waste will provide a buffer to adjacent natural areas and the associated habitats they represent.

13.4.3 Closure and Post-closure Stage

13.4.3.1 Aquatic Ecosystems

13.4.3.1.1 Potential Direct Impacts

Activities associated with landfill closure include the addition of final cover soil, organic material capable of supporting vegetation growth (such as topsoil) and revegetation; as such, potential direct impacts to aquatic systems are anticipated to include:

- Planting terrestrial vegetation adjacent to a watercourse
- Using mechanical equipment for the addition of topsoil and plantings

The use of mechanical equipment near the watercourse, above the highwater mark, may cause accidental release of deleterious substances and sedimentation of fish habitat. These impacts can be avoided through the mitigation measures to protect fish and fish habitat outlined in Section 13.4.4.1.1 (Table 13-27).

Riparian planting and addition of topsoil may influence fish habitat through changes in water quality (i.e., temperature, dissolved oxygen, nutrient concentrations), habitat structure and cover, and food supply. The addition of riparian plantings of native vegetation are expected to improve fish habitat through increased cover for fish, water quality, and prevent sedimentation or runoff of deleterious substances into fish habitat.

13.4.3.1.2 Potential Indirect Impacts

Potential indirect impacts associated with closure and post-closure activities are limited to effects from site runoff to the reinstated perimeter ditch (e.g., contamination, sedimentation). With the continued operation of the proposed SWMP, indirect impacts to fish habitat as a result of landfill closure are not anticipated.

13.4.3.2 Terrestrial Ecosystems

13.4.3.2.1 Potential Direct Impacts

Activities associated with landfill closure include the addition of final cover soil, organic material capable of supporting vegetation growth (such as topsoil) and plantings of native vegetation; as such, the landfill closure will result in some compensation for natural communities lost during construction and operations. No negative direct impacts are anticipated.

13.4.3.2.2 Potential Indirect Impacts

Potential indirect impacts associated with closure and post-closure activities are limited to stormwater management on the landfill site, and possible importation of invasive species with the landfill cover seed mix, topsoil or via the equipment used to implement the capping. Care must be taken to ensure the materials imported to the landfill site for capping of the landfill are free of invasive species through careful preparation of the seed mix and sourcing of the topsoil, and making sure equipment is clean and free of invasive species. With these measures, indirect impacts as a result of landfill closure are not anticipated.

13.4.3.3 Construction Stage

13.4.3.3.1 Aquatic Ecosystems

The Pathways of Effects were used to identify and evaluate potential effects, and applicable mitigation measures were identified for the Landfill Expansion Construction Stage (Table 13-26). Residual effects, if any, are identified for activities that cannot be eliminated through implementation of mitigation measures to protect fish and fish habitat (DFO, 2019b), and DFO standards and interim codes of practice (e.g., DFO, 2020b,c).

Approvals Requirements for Potential Impacts to Fish and Fish Habitat

As the likelihood of the HADD of fish habitat cannot be avoided for the proposed expansion (based on current preliminary design options), the landfill expansion will likely require review by DFO through a Request for Review submission during the detailed design process. DFO will provide a determination regarding approvals requirements. If required, consultation with DFO will need to occur to determine if habitat compensation measures are required. These measures may include incorporating design elements or habitat features that further improve fish habitat (e.g., riparian plantings, instream features, varied substrates), creating additional fish habitat on/off-site, or a combination of these measures. If required, a DFO application for Authorization will include a comprehensive impact assessment that will incorporate the landfill expansion detailed design

13.4.3.3.2 Terrestrial Ecosystems

Mitigation of Direct Impacts to Species at Risk and Wildlife

Natural heritage features and habitat are most susceptible to being altered during the construction stage. Therefore, construction activities need to be mitigated and controlled to avoid significant adverse effects.

To avoid contravention of the *Migratory Birds Convention Act*, clearing of vegetation should take place outside of the breeding bird nesting period (April 1 – August 31) to protect birds, their nests and young. If clearing must occur during this time, a nest survey must be performed by a qualified biologist within 24 hours prior to the proposed works. If a nest is located, it must be buffered and protected until it is no longer active.

Based on the proposed expansion and its proximity to natural heritage features and significant species, the preparation and implementation of a Wildlife Encounter Protocol will be required. This protocol will outline the steps to take in the event of an encounter with wildlife, including SAR, during the construction stage, including steps to take if wildlife are injured. Detailed information and specific requirements related to wildlife and SAR encounters will be incorporated in the protocol including proper species identification, taxa- or species-specific handling methods, contact information if support is needed, and reporting of wildlife and SAR as required by provincial legislation.

Along with the Wildlife Encounter Protocol, further mitigation related to potential wildlife and SAR encounters during the construction stage will include the following items:

- Species Fact Sheets for SAR that may be encountered on-site during the construction stage will be posted on-site in the site office or trailer where it is visible to workers for review. These fact sheets will outline SAR identification and species-specific protocols in the event they are encountered.
- To ensure compliance with policy and the Wildlife Encounter Protocol, all persons entering the Site will receive staff training outlining the proper identification, handling methods, any associated reporting of wildlife and/or SAR encounters, and steps to take to ensure compliance with the in the event of wildlife and SAR encounters.

Wildlife exclusionary fencing around the landfill expansion area, or portions of the area should be considered at Detailed Design to mitigate wildlife encounters on site during construction.

In addition, typical construction mitigation measures such as erosion and sediment control, work area delineation, noise reduction, dust suppression, etc. must be implemented. All heavy machinery should be carefully cleaned prior to entering the work area to reduce the potential for spread of invasive species to the Site.

Compensation for Potential Impacts to SAR and Wildlife

As habitat for SAR bats (little brown myotis) cannot be avoided within the proposed expansion, a permit under the ESA (*O. Reg.* 242/08) will be required, and conditions of such a permit will likely include compensation measures. Consultation with the MECP will be required to determine appropriate compensation measures. These measures may include planting additional forest habitat nearby, providing alternative roost structures (e.g., bat boxes), funding research studies, or a combination of these measures.

No compensation for the loss of other features, such as interior forest habitat and wetlands, is warranted as the remaining natural areas will continue to function as wildlife habitat.

13.4.3.4 Operations Stage

During the Operations Stage, standard mitigation measures for erosion and sediment control, accidental spills, dust suppression, reduction of airborne waste, timing of operations and maintenance of the SWMS and facilities will be required.

As heavy machinery activity will continue throughout the operations phase, implementation of the Wildlife Encounter Protocol developed for the Construction Stage should continue. Equipment for containing spills should be available on-site. The following should be implemented: provide spill response kits in fuel and hazardous materials storage and handling facilities at temporary work areas, in on-site work areas and/or in vehicles and equipment, and train personnel in spill response practices and procedures; contain and clean up spills and leaks as soon as possible following incidents; maintain equipment in clean condition and free of fluid leaks, invasive species, or noxious weeds; and wash, refuel, and service equipment away from the watercourse and perimeter ditch (i.e., greater than 30 m).

Mitigations during the Operations Stage associated with SAR, if any, will be contained in the conditions of the permit issued under the ESA (*O. Reg.* 242/08). Best management practices and environmental approval conditions, permits, authorizations, or plans issued for the landfill expansion would be followed.

13.4.3.5 Closure and Post-Closure Stage

The Closure and Post-closure stage of the landfill is self-mitigating, as the site will be vegetated as landfilling is completed in the proposed expansion. Plantings should include native, non-invasive species that are known to occur within the region. The riparian edges should be revegetated using the same species that were removed to the extent possible. As well, revegetate disturbed areas and install appropriate erosion control measures over exposed soils on banks. Care must be taken to ensure the materials imported to the Site are free of invasive species through careful preparation of the seed mix and sourcing of the topsoil, and making sure equipment is clean and free of invasive species.

Mitigation during the Closure and Post-closure Stage associated with SAR, if any, will be contained in the conditions of the permit issued under the ESA (*O. Reg.* 242/08).

13.5 Land Use Planning

This section provides the assessment of impacts from the proposed expansion of the Boyne Road Landfill on land use.

The preferred expansion for the landfill site is primarily a horizontal expansion to the south of the existing landfill and a vertical expansion above the southern portion of the approved top of landfill contours. The expansion will add an additional 3.8 ha to the landfill footprint, as well as 16.21 ha of Township-owned property to the east and southeast of the overall landfill property. These Township-owned lands are not currently zoned for landfill use and will remain zoned as Rural.

The following data sources were utilized for this assessment:

- Provincial Policy Statement, 2020
- United Counties of Stormont, Dundas, and Glengarry Official Plan (2018)
- Township of Winchester Zoning By-law No. 12-93

- MECP Guideline D-4, Land Use On or Near Landfills and Dumps
- MECP Guideline D-6, Compatibility between Industrial Facilities
- Digital sources to supplement the characterization of existing conditions.

13.5.1 Policy Overview

Following is an overview of the policy and guidelines described above that were used to discern the existing Site Area and Site-vicinity Study Area characteristics in terms of land use composition.

13.5.1.1 Provincial Policy Statement, 2020

The PPS defines *waste management systems* as sites and facilities designed to accommodate solid waste from one or more municipalities and may include recycling facilities, transfer stations, processing and disposal sites.

Given the nature and scale of the expansion and the surrounding land use context, the following policies contained with Section 1.0 of the PPS have specific relevance to the landfill expansion:

Policy 1.1.1 states that healthy, liveable and safe communities are sustained by:

a) promoting efficient development and land use patterns which sustain the financial well-being of the Province and municipalities over the long term;

c) avoiding development and land use patterns which may cause environmental or public health and safety concerns.

Opinion regarding PPS2020:

The landfill expansion will help to promote an efficient land use pattern to help sustain the financial well-being of the Province and Township over the long term. In this regard, the landfill expansion is expected to increase the available capacity of the landfill to the year 2048, which will allow the Township to continue to use these lands as designated for waste to be disposed of locally.

The lands for the expansion are Class O (Organic) soils. These are not considered as being lands that would normally be considered for protection as Prime Agricultural Lands nor included within a Prime Agricultural Area for long-term protection for agriculture.

The landfill expansion is to take place within the existing landfill property, avoiding the need to use additional undeveloped lands. According to the OP schedule, the existing landfill is designated as Rural by the Official Plan and is surrounded by Agricultural and Rural land uses. It is not anticipated that the expansion of the landfill will have any direct negative effects on these existing land uses. The designation of the landfill site on the Official Plan uses symbology, an “A” to show the area as a landfill use. This symbology denotates usage, not spatial usage, and as such does not define the size of the landfill site. Therefore, no Official Plan Amendment is required as there are no spatial limitations to change.

Based upon analysis of the existing context, there does not appear to be any existing development that would be adversely affected in terms of PPS2020 policy.

13.5.1.2 United Counties of Stormont, Dundas, and Glengarry Official Plan

The County Official Plan directs development for the next 20 years in the municipality. The Plan designates the Landfill Site within the Rural Zone, and as having an Active Landfill. The intent of this designation is to promote agricultural land uses and a limited amount of residential development so residential development will not impede existing agriculture and non-agriculture uses. The landfill is also considered as an appropriate rural land use.

There are also policies that require study for any development that is proposed within proximity of the landfill (see below).

Permitted uses within this designation include:

- agricultural uses, forestry and conservation, and natural resource management
- residential uses of existing lots of record and new lots created by severance as provided for by this Plan
- Animal boarding, breeding, and training facilities, including stables
- Bed and breakfast establishments
- Open space
- Cemeteries

Relevant sections of the OP to waste management systems, and the proposed expansion include:

3.5.2.2.9. Land use compatibility shall be considered in the design and development or redevelopment of residential areas. This includes establishing or respecting building setbacks, separation distances, and influence areas from incompatible land uses (e.g., sewage treatment facilities, waste management facilities, industrial uses, mineral extraction operations etc.). Such uses should be located to avoid existing and future residential areas.

4.3.5.5 Local Municipalities will use a 500 m radius, or such other distance recommended by the Ministry of the Environment, as a guideline for triggering the assessment of the impact(s) of waste management systems on surrounding lands. Development proposals near sensitive land uses within the influence study area must include, but are not limited to, landfill generated gases, ground and surface water contamination by leachate, odour, litter, vehicular traffic, dust, noise, vectors and vermin and visual impact (see Section 3.5.1.5). Development within 500 m of the lands zoned for waste disposal shall generally be discouraged unless supported by an appropriate study or studies which confirm that there will be no negative impacts on the proposed development related to current uses/activities associated with the normal operation of the waste management system. Furthermore, the study(ies) shall confirm, to the satisfaction of the County, that the proposed development will not impact future expansions of the uses/activities associated with the existing waste management system.

Opinion regarding Official Plan Policy:

As previously mentioned, as the denotation of the landfill site on the Official Plan Schedule is a symbol, and does not designate spatial usage, an Official Plan Amendment will not be required to expand the landfill site.

According to the OP schedule, the existing landfill is surrounded by Agricultural and Rural land uses. Through the land use analysis, agricultural fields were identified surrounding the landfill site. It is considered that the expansion of the landfill, as described above, will not have any direct negative effects on these existing land uses.

13.5.1.3 Township of Winchester Zoning By-law No. 12-93

The current active Boyne Road Landfill site is zoned SRD under the Township of Winchester Zoning By-law No. 12-93. The balance of the Township owned lands are zoned as Rural. It is noted that the Township still uses the By-laws that existed at the time of amalgamation, hence the reference is still to the former municipality and not North Dundas.

Waste disposal site is defined as (Section 2.103) a site which is licensed or approved by the Ministry of the Environment and/or its agents where garbage, refuse, domestic or industrial waste is disposed of or dumped, excluding radioactive or toxic chemical wastes, and shall include a sludge disposal area.

Permitted uses within the SRD zone (Section 11.5) include:

- agricultural uses
- conservation use
- forestry use
- waste disposal site

The expansion is to take place within the existing lands designated by the Official Plan as a Waste Disposal Site. The separation distance between SRD uses and dwelling units must be 500 m as stated in the Official Plan, and as found in Section 3.19 of the Zoning By-law.

The lands to the south and east, designated for addition to the existing Landfill Site, are designated Rural. Permitted uses within the Rural designation include:

- accessory dwelling
- agricultural use
- apartment, accessory

- apiary
- conservation use
- farm produce outlet
- forestry use
- golf course
- group home
- market and nursery gardening
- riding stable
- rural home occupation
- riding stable
- rural home occupation
- single dwelling
- sod farming
- trail system
- wayside pit or wayside quarry

The zoning By-law, in Section 3.19, identifies the restrictions on uses within 500 m of the SRD Zone. This is the only tool used by most people when making choices on land purchases and requests for land development. Thus, while there is no requirement for a zoning change for the expansion, it is best practice to amend the zoning should the EA be approved to ensure transparency with the public.

Opinion regarding Zoning:

Waste disposal sites are not a permitted use within the Rural designation. However, the area proposed for the expansion is already owned by the Township and is simply being added to the designated part of the lands as an additional buffer to accommodate the landfill expansion and will not be used for waste management services. Therefore, a re-zoning of this property is not required to accommodate the proposed landfill expansion. However, it is recommended that once the EA has been approved confirming that this additional land is to be reserved as part of the landfill site property for buffer area, the Township rezone the lands to ensure that the 500 m study area is correctly identified when using the land use schedule to the Zoning By-law, as this is the only tool available to the general public in regard to potential development within the 500 m restricted zone around the landfill site.

13.5.1.4 MECP Guideline D-4, Land Use On or Near Landfills and Dumps

This guideline identifies restrictions and controls on land use in the vicinity of landfills and dumps to protect the health, safety, convenience and welfare of residents near such facilities. The direction provided in this document is a compliment to existing Ministry abatement programs for landfills and is a direct application of Guideline D-1, Land Use Compatibility.

Application of the D-4 Guideline extends to all proposals for land use on, or near, operating and non-operating landfills, that contain municipal solid waste, industrial solid waste and/or sewage sludges.

The guide states that no land use shall take place with 30 m of an active landfill site and that the landfill shall have a buffer of no less than 30 m. The typical buffer is between 30 and 100 m with a 500 m study area for anticipated impacts.

The addition of Township-owned lands as an additional buffer, while satisfying the 30 to 100 m buffer requirement, will require that the 500 m study area be adjusted to start from the new landfill site property line.

Opinion regarding D-4:

Based on the analysis, the landfill expansion is consistent with the D-4 Guideline.

13.5.1.5 MECP Guideline D-6, Compatibility between Industrial Facilities

The *MECP Guideline D-6 Compatibility between Industrial Facilities* defines category designations for industrial uses and provides recommended distances between these uses and sensitive land uses.

There are no anticipated impacts in relation to the D-6 Guideline as the County and Township define minimum buffers of 30 m between the landfill and adjacent land uses, and 500 m between the landfill and sensitive land uses.

Opinion regarding D-6:

The landfill expansion is consistent with the D-6 Guideline.

13.6 Agriculture

This section provides the assessment of impacts from the proposed expansion of the Boyne Road Landfill on agriculture and agricultural land use.

In the United Counties of Stormont, Dundas and Glengarry Official Plan, the majority of the Township of North Dundas is designated as Agricultural Resource Lands outside of the Urban Settlement Area. The County Official Plan defines Agricultural Resource Lands as lands predominated by prime agricultural lands and other large tracts of land characterized by viable farming activity.

In the Township of North Dundas, subject lands that are in the former Township of Winchester immediately surrounding the Boyne Road Landfill site are designated as Rural, where agricultural use is a permitted use. Lands on the perimeter of these Rural lands are designated Agricultural Zone.

Both the County OP and Township Zoning By-law require a minimum separation distance of 500 m between the lands zoned for waste disposal (SRD) and sensitive land uses, and no land use may take place within 30 m of the fill area.

The addition of the Township-owned lands will create a larger buffer on the east and south side of the landfill and no land use will be allowed on this property.

13.6.1 Soil

The Ministry of Agriculture, Food and Rural Affairs Agricultural Maps shows the Landfill Site within a Muck soil area. Muck soil, as defined in the Soil Survey of Dundas County (Ontario Agricultural College, 1952), is soil 0 to 450 mm deep of organic layer consisting of semi-decomposed vegetative material, usually neutral to alkaline on the surface. This soil is generally not suitable for agriculture and has traditionally not been included in an Agricultural designation, as it requires a great deal of work to prepare for crops and the rate of return is low.

The landfill expansion is to take place within this Muck soil area and it is not anticipated that the expansion will overtly affect neighbouring soils.

13.6.2 Agricultural Impact Assessment

An Agricultural Impact Assessment (AIA) is a study that evaluates the potential impacts of non-agricultural development on agricultural operations and the Agricultural System and recommends ways to avoid or, if avoidance is not possible, minimize and mitigate adverse impacts. This assessment of effects on agricultural land use, while not an AIA is an AIA-based summary of the potential effects from the proposed landfill expansion and has considered requirements described in the Draft Agricultural Impact Assessment Guidance Document (Ontario Ministry of Agriculture, Food and Rural Affairs, March 2018).

There are five active farming operations in proximity to the landfill site. The Township engages in regular discussions with the owners of these farms, and they are aware of the expansion and the expansion process.

It is expected that neighbouring agricultural operations will continue to implement normal farm practices. Based on the noise and odour assessments completed during this EA it is not anticipated that agricultural operations will complain about these potential nuisance effects. It is anticipated that any nuisance effects associated with the landfill expansion will be at worst occasional and of low magnitude. As identified in studies completed for the EA, elevated dust levels can pose a potential impact to nearby crops. Mitigation measures will be implemented to minimize the amount of airborne dust such as enforcing on-site speed limits and applying site fugitive dust best management practices, as necessary and appropriate (e.g., watering or applying dust suppressant to on-site road surfaces).

The expansion is not expected to cause issues with farm vehicles in the area. The volume of farm vehicles and observations during a September 2021 traffic counting period did not identify any major impacts at intersections or along the roadways due to the equipment.

No active agricultural operations will be affected with the proposed landfill expansion. Lands adjacent to the landfill site and used as agricultural fields will continue to be used for this purpose.

13.7 Cultural Heritage Resources

13.7.1 Archaeological Resources

In support of this EASR, a Stage 1 archaeological assessment was carried out in the Site Study Area (Volume 2 Appendix G-2) and submitted to MHSTCI.

Although the Site Study Area was identified as having archaeological potential within 100 m of Boyne Road, this archaeological potential has been impacted by the existing Boyne Road Landfill. The landfill has resulted in disturbance below grade in the northern half of the Site Study Area and significant landscape alteration as seen by the presence of large berms around its boundaries. A previous Stage 1 archaeological assessment conducted by CARF (1992) that covers a portion of the present Stage 1 Site Study Area along Boyne Road also indicated that this area had low potential for archaeological resources.

The southern portion of the Site Study Area is not associated with any features indicating archaeological potential and is thus considered to have low potential for archaeological resources. The drainage ditches located within the Site Study Area reflect 20th century alterations to the landscape and background research shows they do not correspond to any historical water sources located within 300 m. As such, the Site Study Area does not meet the requirements for further archaeological assessment based on the MHSTCI Standards and Guidelines for Consultant Archaeologists (MHSTCI, 2011) and no further archaeological assessments are recommended for the Stage 1 Site Study Area.

The Stage 1 archaeological assessment resulted in the following recommendations:

1. No further archaeological assessments are required for the Site Study Area as shown on Figure 8-1.
2. Should archaeological resources be identified during the landfill expansion in the areas identified as having low archaeological potential on Figure 8-1, a licensed archaeologist should be contacted and additional archaeological assessment may be required.
3. Should landscape disturbance extend beyond the present Stage 1 Site Study Area, additional archaeological assessment may be required.

13.7.2 Cultural Heritage Landscapes and Cultural Heritage Resources

The Counties' *Official Plan* identifies the study area as an active landfill site within a Rural District and across from Crown Land located on part of Lot 8, Concession 7. The Counties' Land Use Schedules B1 and B2 indicate that the Site-vicinity Study Area is surrounded by wood lots, organic soils and non-significant wetlands but no identified built heritage resources or cultural heritage landscapes.

While review of 19th and 20th century mapping suggest there are structures 40 or more years old and potential built heritage resources within the EA-defined Wider Study Area, none are located within or crossed by the designation of 500 m from the Site Study Area. There is also no evidence that any part of the Site-vicinity Study Area is considered to be a cultural heritage landscape.

13.8 Socio-economic

The socio-economic environment is evaluated in a number of different ways and looks at both direct and indirect effects and the level of change that may result to the baseline environment described in Section 9.8.

Direct effects – These are effects to the socio-economic environment that occur as a direct result of a change to a socio-economic feature such as population change, employment effects or visual effects.

Indirect effects – these are effects to the socio-economic environment that occur indirectly as a result of landfill expansion related changes on other aspects of the environment (e.g., increased noise, dust or odour creating nuisance effects).

This assessment was completed in collaboration with data collection and analyses undertaken by other disciplines (including noise and air quality). These data and analyses were used to determine the effects (both beneficial and adverse) associated with the measurable changes in the socio-economic environment resulting from the proposed landfill expansion and identify mitigation measures that are technically and economically feasible to prevent, reduce or otherwise ameliorate the adverse environmental effects.

13.8.1 Local Economy

The following indicators were evaluated to assess effects to the local economy:

- Expected effect on local employment
- Expected effects on local businesses and commercial activity
- Expected effects on municipal finances

13.8.1.1 Potential Effects

The following criteria were used to evaluate potential effects on the local economy:

- Employment opportunities during landfill expansion construction and operation
- Potential effects to local commercial businesses in the Site-area (excludes agriculture)
- Capital costs associated with construction and operation

The local economy can be affected through the potential for the creation of new employment opportunities at the site. Effects to local businesses could occur through increased usage of services during construction or effects on operations that may change patronage. Increased capital costs associated with construction and operation may affect municipal finances, e.g., maintenance, equipment replacement, etc. These are evaluated using relevant figures and information provided by the Township of North Dundas and findings from applicable discipline studies.

13.8.1.2 Evaluation of Effects on the Local Economy

The proposed landfill expansion is not expected to create any new jobs in the community, the existing landfill workforce is deemed sufficient. The annual operating cost are expected to remain the same at approximately $55,000. No significant changes to local traffic around the landfill as a result of the landfill expansion are predicted. Other businesses (excluding farms) in the Site-vicinity Study Area are not anticipated to be affected negatively or positively as a result of the landfill expansion.

Revenue to the landfill is expected to remain generally the same with mild increases related to inflation and the modest population increase forecast.

13.8.2 Residents and Community

The following factors were evaluated to assess effects to the local economy:

- Displacement of residents
- Expected interference with use and enjoyment of residential properties (nuisance effects)

13.8.2.1 Potential Effects

The following criteria were used to evaluate potential effects on residents and communities in the Site-vicinity Study Area.

- Proximity to nearby residences
- Biophysical and social interactions with nearby residential and community receptors (i.e., noise, dust, odour, and nuisance wildlife/pests)

The effect of landfill operations on the local population and on the use and enjoyment of residences are typical public concerns. The proximity of the expanded landfill to residences may cause out-migration of local residents or discourage new residents from moving in. The extent to which local residents can use and enjoy their properties and outdoor spaces can be affected by landfill-related activity that results in, for example, litter, noise, odour, dust and/or vermin or change the visual aspect in an objectionable way. These are evaluated using findings from the respective studies for these components of the environment, as well as qualitative findings from engagement and professional judgement.

13.8.2.2 Evaluation of Effects on Local Residences and Community Features

The physical landfill expansion does not require any displacement of residences. There are no properties with existing homes within the 500 m Site-vicinity Study Area. There are no community features (church, school, etc.) within the 500 m Site-vicinity Study Area. To date, the Township has never received a complaint from neighbours about the operation of the landfill related to noise, traffic, dust, odours or visual. Current noise, dust and odour sources within the Site-vicinity Study Area will primarily be agricultural and traffic as well as potential noise, dust and odour from the existing site.

Air quality studies identified anticipated measurable air emissions and evaluated them to determine effects. The residual effects were evaluated and concluded that they do not result in adverse effects in terms of air quality, dust or odour for the neighbouring existing residences as they meet appropriate provincial regulatory limits. As such, interference with use and enjoyment of property and other outdoor spaces from air quality, dust or odour are not expected. Best practice measures will control air quality, dust and odour levels such that they do not exceed acceptable levels.

Potential noise impacts were evaluated using existing information and predictive modelling. Ancillary equipment and emergency equipment are expected to operate below provincial sound level limits. The change in traffic noise levels between the existing landfill and the landfill expansion is insignificant to noticeable using the provincial scale to quantify this change; this is considered an acceptable change. On-site noise from the landfill expansion itself is predicted to operate below provincial sound level limits.

Concerns relating to traffic may include changes to access/egress to the site for trucks, increased truck traffic and noise from vehicles during construction and operations. No changes to access and egress are anticipated from the expanded site. As noted above, the anticipated increase in traffic as a result of increasing population is not forecast to cause any issues with traffic movement along the haul routes. Applicable by-laws will be adhered to for truck traffic and operational hours, and good housekeeping practices will be maintained such that noise and emissions are not above acceptable levels.

Vermin such as rats and gulls are concerns associated with landfill sites. No complaints regarding vermin have been noted and continued good site maintenance practices (e.g., application of daily cover, litter control program) will continue.

13.8.2.3 Mitigation

Adherence to applicable municipal and provincial guidelines and best management practices (BMP) for effects such as litter, noise, dust or odour will assist in reducing potential effects to local residents. Examples include:

- In design air (odour and dust) mitigation
- Noise Best Management Practices
- Best practice measures and good housekeeping practices such as vehicle and equipment maintenance, use of mufflers, minimal idling, etc.
- Prepare Complaints Response Protocol

13.8.3 Visual

13.8.3.1 Proposed Development Character

The proposed expansion to somewhat higher than the currently approved top of waste contours is limited to the southern half of the current footprint. For the horizontal expansion area, trees and vegetation will be removed to prepare for the expansion. A row of trees and bushes along the western and southern boundaries will remain in place and grow over time to further screen the view from potential off-site receptors. Piles of soil will be levelled off and blended into the top of cover that will be planted with native grass species.

Visual receptors with visibility of the proposed expansion will mostly see the side slopes with 4H:1V, 25 % or flatter and will see less of the top area slopes that are not flatter than 20H:1V (5 %) as they slope from the property boundary of the landfill site (Figure 9-32) towards the proposed top of cover peak.

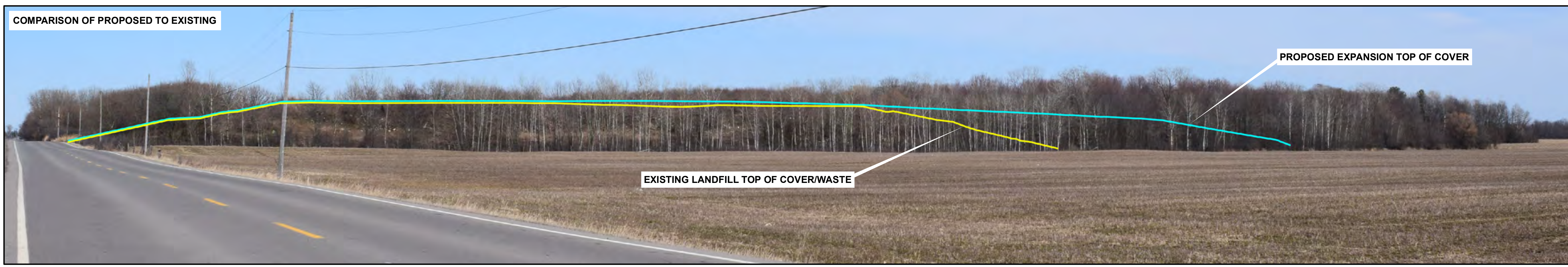
Portions of the existing landfill have already reached the approved top of cover or waste along the northern area and a portion of the western area as shown in the 'comparison of proposed to existing' lines in Figures 13-10 to 13-13. The existing landfill top of cover will tie into the expansion area top of cover and rise to a maximum peak elevation of 90.5 masl.

During operations, the landfill will continue to make use of the existing infrastructure, including buildings on site and the entrance, exit and haul route.

EXISTING CONDITIONS

PROPOSED EXPANSION

COMPARISON OF PROPOSED TO EXISTING



LEGEND

- VIEWPOINT LOCATION AND DIRECTION
- INTERMITTENT WATERCOURSE
- PROPOSED LIMIT OF WASTE FOR THE LANDFILL EXPANSION AREA
- APPROXIMATE PROPERTY BOUNDARY OF LANDFILL SITE
- SITE STUDY AREA
- EXISTING LANDFILL FILL AREA
- TOWNSHIP OWNED PROPERTY

DRAFT

KEY MAP

SCALE 1:20,000

PHOTOGRAPH VIEWPOINT TECHNICAL DATA

CAMERA COORDINATES (MTM NAD 83): 397028.6 E 4996463.9 N
CAMERA ELEVATION (CGVD28): 77.2 m
APPROXIMATE DISTANCE TO PROPOSED EXPANSION: 346 m
VISIBILITY OF PROPOSED EXPANSION IN SIMULATION: YES
DATE AND TIME PHOTOGRAPH WAS TAKEN: APRIL 7, 2020, 3:16 PM
APPROXIMATE DIRECTION: 113 DEGREES T.N.
FOCAL LENGTH: 24 mm
APPROXIMATE HORIZONTAL FIELD OF VIEW : 51.9 DEGREES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2020
2. SERVICE LAYER CREDITS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY
3. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: MTM ZONE 9, VERTICAL DATUM: CGVD28

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
VIEWPOINT 1 - BOYNE ROAD
PROPOSED EXPANSION PHOTOGRAPHIC SIMULATION

CONSULTANT
GOLDER MEMBER OF WSP

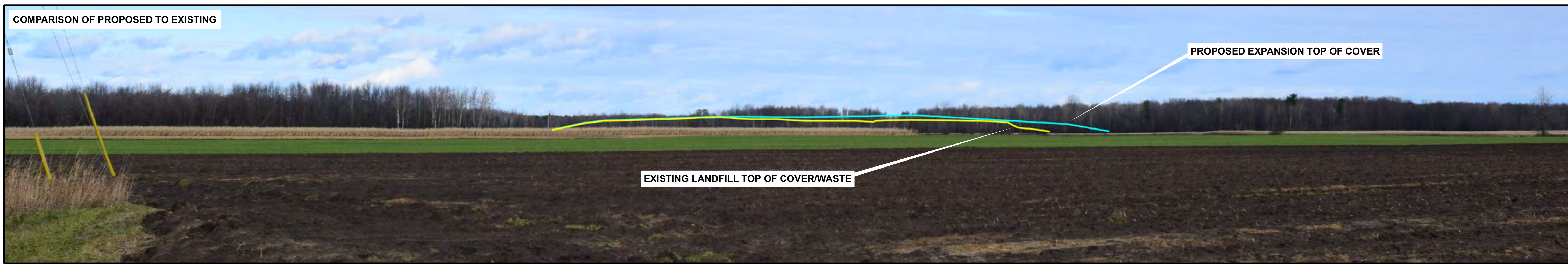
YYYY-MM-DD	2022-02-04
DESIGNED	PJM
PREPARED	JEM
REVIEWED	PAS
APPROVED	----

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	A	13-10

EXISTING CONDITIONS

PROPOSED EXPANSION

COMPARISON OF PROPOSED TO EXISTING

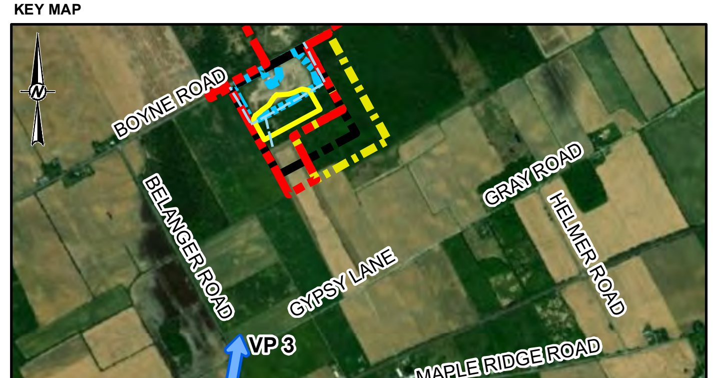


LEGEND

- VIEWPOINT LOCATION AND DIRECTION
- INTERMITTENT WATERCOURSE
- PROPOSED LIMIT OF WASTE FOR THE LANDFILL EXPANSION AREA
- APPROXIMATE PROPERTY BOUNDARY OF LANDFILL SITE
- SITE STUDY AREA
- EXISTING LANDFILL FILL AREA
- TOWNSHIP OWNED PROPERTY

DRAFT

KEY MAP



SCALE 1:40,000

PHOTOGRAPH VIEWPOINT TECHNICAL DATA

CAMERA COORDINATES (MTM NAD 83): 397359.1 E 4995179.4 N
CAMERA ELEVATION (CGVD28): 77.6 m
APPROXIMATE DISTANCE TO PROPOSED EXPANSION: 995 m
VISIBILITY OF PROPOSED EXPANSION IN SIMULATION: YES
DATE AND TIME PHOTOGRAPH WAS TAKEN: NOV 6, 2019, 11:30 AM
APPROXIMATE DIRECTION: 22.5 DEGREES T.N.
FOCAL LENGTH: 24 mm
APPROXIMATE HORIZONTAL FIELD OF VIEW : 51.9 DEGREES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2020
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3. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: MTM ZONE 9, VERTICAL DATUM: CGVD28

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
VIEWPOINT 3 - BELANGER ROAD AT GYPSY LANE PROPOSED EXPANSION PHOTOGRAPHIC SIMULATION

CONSULTANT
GOLDER MEMBER OF WSP

YYYY-MM-DD	2022-02-04
DESIGNED	PJM
PREPARED	JEM
REVIEWED	PAS
APPROVED	----

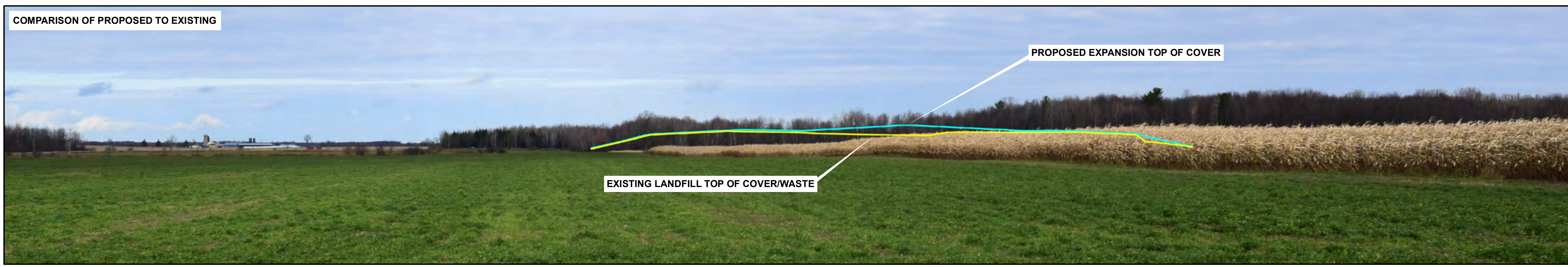
PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	A	13-11

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM

EXISTING CONDITIONS

PROPOSED EXPANSION

COMPARISON OF PROPOSED TO EXISTING

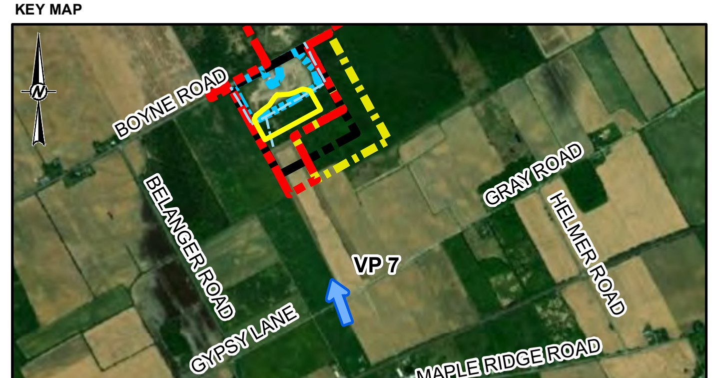


LEGEND

- VIEWPOINT LOCATION AND DIRECTION
- INTERMITTENT WATERCOURSE
- PROPOSED LIMIT OF WASTE FOR THE LANDFILL EXPANSION AREA
- APPROXIMATE PROPERTY BOUNDARY OF LANDFILL SITE
- SITE STUDY AREA
- EXISTING LANDFILL FILL AREA
- TOWNSHIP OWNED PROPERTY

DRAFT

KEY MAP



SCALE 1:40,000

PHOTOGRAPH VIEWPOINT TECHNICAL DATA

CAMERA COORDINATES (MTM NAD 83): 397904.2 E 4995476.1 N
CAMERA ELEVATION (CGVD28): 79.9 m
APPROXIMATE DISTANCE TO PROPOSED EXPANSION: 744 m
VISIBILITY OF PROPOSED EXPANSION IN SIMULATION: YES
DATE AND TIME PHOTOGRAPH WAS TAKEN: NOV 6, 2019, 10:37 AM
APPROXIMATE DIRECTION: 336.5 DEGREES T.N.
FOCAL LENGTH: 24 mm
APPROXIMATE HORIZONTAL FIELD OF VIEW : 51.9 DEGREES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2020
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3. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: MTM ZONE 9, VERTICAL DATUM: CGVD28

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
VIEWPOINT 7 - GYPSY LANE (SNOWMOBILE TRAIL) PROPOSED EXPANSION PHOTOGRAPHIC SIMULATION

CONSULTANT
GOLDER MEMBER OF WSP

YYYY-MM-DD	2022-02-04
DESIGNED	PJM
PREPARED	JEM
REVIEWED	PAS
APPROVED	----

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	A	13-12

Path: N:\Active\Spatial_IM\Township_of_North_Dundas\BoyneRoadLandfill\99_PROJ\1648253\40_PROD\Phase_2.0_Tack_2.1.11 Visual\1648253-2111-XV-13-12.mxd

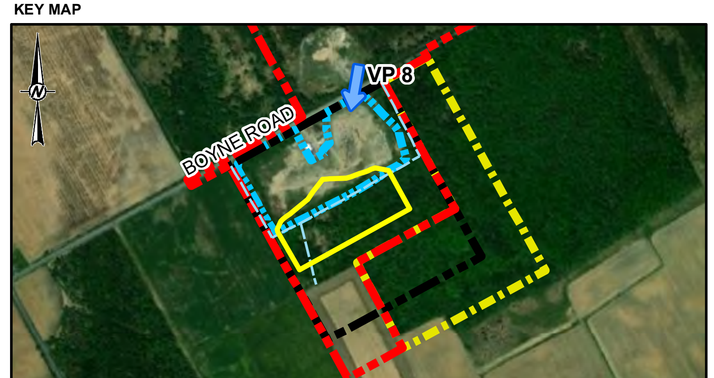
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 25mm 0

LEGEND

- VIEWPOINT LOCATION AND DIRECTION
- INTERMITTENT WATERCOURSE
- PROPOSED LIMIT OF WASTE FOR THE LANDFILL EXPANSION AREA
- APPROXIMATE PROPERTY BOUNDARY OF LANDFILL SITE
- SITE STUDY AREA
- EXISTING LANDFILL FILL AREA
- TOWNSHIP OWNED PROPERTY

DRAFT

KEY MAP



SCALE 1:20,000

PHOTOGRAPH VIEWPOINT TECHNICAL DATA

CAMERA COORDINATES (MTM NAD 83): 397656.5 E 4996814.3 N
CAMERA ELEVATION (CGVD28): 77.1 m
APPROXIMATE DISTANCE TO PROPOSED EXPANSION: 219 m
VISIBILITY OF PROPOSED EXPANSION IN SIMULATION: NO
DATE AND TIME PHOTOGRAPH WAS TAKEN: NOV 6, 2019, 9:10 AM
APPROXIMATE DIRECTION: 190 DEGREES T.N.
FOCAL LENGTH: 24 mm
APPROXIMATE HORIZONTAL FIELD OF VIEW : 95 DEGREES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2020
2. SERVICE LAYER CREDITS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY
3. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: MTM ZONE 9, VERTICAL DATUM: CGVD28

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
VIEWPOINT 8 - BOYNE ROAD AT ENTRANCE TO SNOW STORAGE FACILITY
PROPOSED EXPANSION PHOTOGRAPHIC SIMULATION

CONSULTANT

GOLDER
MEMBER OF WSP

YYYY-MM-DD	2022-02-04
DESIGNED	PJM
PREPARED	JEM
REVIEWED	PAS
APPROVED	----

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	A	13-13

13.8.3.2 Landscape Modelling

A computer generated 3D landscape model was developed in a geographic information system (GIS) with a 2 m resolution digital elevation model, available land cover information to account for potential vegetation screening, and 3D modelling of the proposed expansion design. The 3D model was used to conduct visibility analysis and determine potential key representative public locations for viewing the landfill site within a 1 km site-vicinity study area[2] (9-32). This model also allowed for the rendering of simulated images of the proposed expansion from key viewpoints. These simulated images were combined with field survey photographs to produce photo-composite images to portray the relative scale and extent of the proposed expansion within the existing viewing conditions and to support the assessment of potential visible effects.

13.8.3.3 Visual Assessment

The qualitative visual assessment was established by desktop studies to identify and describe the physical elements of the landscape within the site-vicinity study area. Landscape character evaluation is a process of gathering the landscape into distinct patterns of physical elements that distinguish areas from one another. The description of landscape character focuses on the nature of these elements and their combination to express visual aesthetic assets, including scenic quality. The assessment methodology used in this study is based on components of the Guidelines for Landscape and Visual Impact Assessment (IEMA, 2013) and the USDI Visual Resource Management System (USDI, 1986), as well as professional judgment and experience from conducting previous visual impact assessments. An assessment and characterization of potential visual effects of the proposed expansion was conducted using the following elements of visual change to existing viewing conditions from representative key viewpoints.

- **Visibility of the proposed expansion** - the visible extent of the proposed expansion area and vertical/horizontal limits within the available field of view.
- **Visual contrast of the proposed expansion** - the visual character of the visible proposed expansion and the level of visual contrast between the proposed expansion components and the existing landscape.

Visibility was assessed based on the results of the desktop visibility analysis and the prominence of the visible portion of the proposed expansion. Visually referencing the photo-composite simulations and qualitative analysis of the proposed expansion visual character was used to determine the contrast created between the expansion and the existing viewing conditions. The degree of contrast was determined based on the following definitions:

- **None** - The element is not visible or perceived
- **Weak** - The element contrast can be seen but does not attract attention

[2] 1 km represents a foreground viewing distances that which provides for a discernible level of visual detail to be perceived (USDI BLM, 1986a).

- **Moderate** - The element contrast begins to attract attention and begins to dominate the characteristic landscape
- **Strong** - The element contrast demands attention, will not be overlooked, and is dominant in the landscape.

13.8.3.4 Assessment Results

A total of nine viewpoints (Figure 9-32) were identified during the visibility analysis and baseline field photo reconnaissance. Viewpoints 4, 5 and 6 are outside the one km visual study area and the proposed expansion is not discernible with any level of visual detail from these locations. Viewpoint 9 has no visibility due to the wood lots southeast of the proposed expansion screening the view. Viewpoint 2 at the main gate on Boyne Road is mostly blocked by buildings and trees on-site and only offers a very brief glimpse to motorists passing by. Four key viewpoint locations were identified to conduct visual simulations and an effects assessment based on the visibility analysis and baseline field visits as described in Table 13-28.

Table 13-28: Key Viewpoints

Key Viewpoints	Description	Coordinates	Viewing Direction
Viewpoint 1	Boyne Road	397028.6 m E, 4996463.9 m N	East (113°)
Viewpoint 3	Belanger Road at Gypsy Lane	397359.1 m E, 4995179.4 m N	North (22.5°)
Viewpoint 7	Gypsy Lane (snowmobile trail)	397904.2 m E, 4995476.1 m N	North (336.5 °)
Viewpoint 8	Boyne Road at entrance to snow storage facility	397656.5 m E, 4996814.3 m N	South (190°)

Notes: Coordinates are in NAD 83 MTM Zone 17 projection; 0 = degrees

Viewpoints 1, 3, 7 and 8 were selected to produce simulations of the proposed expansion that represent the visual character and assess the overall level of contrast with the existing viewing conditions. The simulations for viewpoints 1, 3, 7 and 8 are displayed in Figures 13-10 to 13-13. Each simulation is accompanied by the following assessments of the visual contrast and related rationale for determining the level of visual effect.

Viewpoint 1 - Boyne Road, Proposed Expansion Photographic Simulation (refer to Figure 13-10)

Receptors: motorists and pedestrians travelling along Boyne Road.

Visibility: partial visibility of the proposed expansion through trees and vegetation, minimal scale of the proposed expansion within the available field of view.

Visual Contrast: the predominantly horizontally-oriented landscape is maintained with the addition of the linear expansion that is partially visible through the existing treeline. The view of the existing horizon will slightly change and become more disconnected with the removal of trees within the expansion area. The natural brown and yellow hues of the native vegetation growing on the proposed expansion are similar to the surrounding agricultural fields, grass, shrubs and trees in the study area. The colour and texture of the proposed expansion reduce the contrast within the setting and integrate effectively within the landscape. The expansion creates an overall degree of contrast that is **weak** and will not attract attention.

Visual Effect: partial alteration to the existing landscape based on the introduction of an earth form feature (the landfill expansion) with a low level of discernable visual detail due to vegetation screening. The **weak** level of contrast does not change the overall rural landscape character of the Study area.

Viewpoint 3 - Belanger Road at Gypsy Lane, Proposed Expansion Photographic Simulation (refer to Figure 13-11)

Receptors: motorists and pedestrians travelling along Belanger Road. Recreational users or pedestrians travelling along Gypsy Lane.

Visibility: partial visibility of the proposed expansion through trees and vegetation, minimal scale of the proposed expansion within the available field of view.

Visual Contrast: the predominantly horizontally-oriented landscape is maintained with the addition of the linear expansion that is partially visible through the existing treeline. The view of the existing horizon will slightly change and become more disconnected with the removal of trees within the expansion area. The natural brown and yellow hues of the native vegetation growing on the proposed expansion are similar to the surrounding agricultural fields, grass, shrubs and trees in the study area. The colour and texture of the proposed expansion reduce the contrast within the setting and integrate effectively within the landscape. The expansion creates an overall degree of contrast that is **weak** and will not attract attention.

Visual Effect: partial alteration to the existing landscape based on the introduction of an earth form feature (the landfill expansion) with a low level of discernable visual detail due to vegetation screening. The **weak** level of contrast does not change the overall rural landscape character of the Study area.

Viewpoint 7 - Gypsy Lane (Snowmobile Trail), Proposed Expansion Photographic Simulation, (refer to Figure 13-12)

Receptors: Recreational users or pedestrians travelling along Gypsy Lane.

Visibility: partial visibility of the proposed expansion through trees and vegetation, minimal scale of the proposed expansion within the available field of view. An intermittent watercourse that flows through the trees and vegetation will provide an opening through which the proposed expansion may be more visible.

Visual Contrast: the predominantly horizontally-oriented landscape is maintained with the addition of the linear expansion that is partially visible through the existing treeline. The view of the existing horizon will slightly change and become more disconnected with the removal of trees within the expansion area. The natural brown and yellow hues of the native vegetation growing on the proposed expansion are similar to the surrounding agricultural fields, grass, shrubs and trees in the study area. The colour and texture of the proposed expansion reduce the contrast within the setting and integrate effectively within the landscape. The expansion creates an overall degree of contrast that is **weak** and will not attract attention.

Visual Effect: partial alteration to the existing landscape based on the introduction of an earth form feature (the landfill expansion) with a low level of discernable visual detail due to vegetation screening. The **weak** level of contrast does not change the overall rural landscape character of the Study area.

Viewpoint 8 - Boyne Road at Entrance to Snow Storage Facility, Proposed Expansion Photographic Simulation (refer to Figure 13-13)

Receptors: motorists and pedestrians travelling along Boyne Road.

Visibility: no visibility of the proposed expansion from this viewpoint.

Visual Contrast: no visible contrast.

Visual Effect: no visual effect.

13.8.3.5 Summary and Recommendations

To further mitigate visibility and reduce contrast with the surrounding landscape, it is recommended that additional trees be planted within the tree line between the proposed expansion and the southwestern property boundaries.

Considering the partial visibility and **weak** degree of contrast with the surrounding landscape, along with the minimal scale of the proposed expansion within the available field of view, the overall visual effect of the proposed expansion can be seen but does not attract attention and would not alter the prevailing rural character of the landscape setting.

13.9 Transportation

The existing traffic related to landfill site operations was described in Section 9.9. The traffic impact study evaluated the operation of the Access/Boyne, St. Lawrence/Main and County Road (CR) 7/Boyne intersections, and examined the lane configuration and left turn lane warrants. The analysis was conducted for the traffic using the 2021 traffic counts, and the expected 2048 traffic, which represents the end of the 25 year planning period for the landfill expansion. The time period selected for the analysis was the weekday peak a.m. and p.m. hours, which are expected to be the peak traffic periods for both the landfill facility and the background traffic.

13.9.1 Traffic Analysis

13.9.1.1 Trip Generation

The site generated trips were calculated for two scenarios, to determine the most representative a.m. and p.m. peak hour trips for use in the study.

The landfill facility will continue to be open weekdays from 8:00 a.m. to 4:00 p.m., and on Saturdays from 8:00 a.m. to 12:00 p.m. May through November and only one Saturday a month from 8:00 a.m. to 12:00 p.m. November through May. The facility will continue to receive waste and recyclable materials, as well as brush and wood. Trips will originate mainly from the two main municipalities of Winchester to the west along Boyne Road, and Chesterville to the east along Boyne Road then south along CR 7. The site will have the one access point onto Boyne Road.

13.9.1.1.1 Scenario 1 - Average Trips

The first scenario utilized the number of monthly trips to/from the facility, averaged the trips to hourly trips, and then applied a peaking factor (PF) which converted the average hour trips to peak hour trips by applying a conservative PF of 2.0. Traffic counts have determined a PF of 1.5 as being typical in converting average hour traffic to peak hour traffic. The trips were then increased by 5.5 percent, which is the expected increase in landfill traffic over the 25 year planning period.

Traffic counts of vehicles entering and exiting the landfill facility were obtained from the Township on a vehicles per month basis. The average counts were taken for two time periods, with the traffic analysis using the greater number of trips which occurred between April 1st and October 31st:

April 1st to October 31st -	460 vehicles/month	35% Heavy vehicle
November 1st to March 31st -	285 vehicles/month	42% Heavy vehicle

For the April 1st to October 31st time period and a 5½ day week (44 hr):

Average vehicle trips per hour
460 veh per month / (44 hr per week x 4 weeks per month) = 2.61 or 3 veh/hr

Peak vehicle trips per hour
3 veh/hr x 2.0 peaking factor x 1.055 (landfill expansion) = 6.33 or 7 veh/hr

	Entering	Exiting	Total
AM/PM Peak Hour Vehicle Trips	7	7	14

13.9.1.1.2 Scenario 2 – Site Trips Determined from Traffic Counts

The second scenario used the existing site trip counts entering and exiting the facility, which were taken on September 9, 2021 between 8:00 a.m. and 10:00 a.m. and between 2:00 p.m. and 4:00 p.m. Observations and counts showed that peak periods occurred when the landfill facility just opened and trucks were leaving and waste was dropped off from the previous day, and when waste was dropped off at the end of the work day.

September 9, 2021 traffic count - 2 hour peak a.m. and p.m. time period

	Entering		Exiting	
	EB right	WB left	NB left	NB right
2 hr a.m. Vehicle Trips	8	1	6	2
2 hr p.m. Vehicle Trips	14	5	15	3

The trips from the 2 hour a.m. and p.m. time period were increased by 5.5 percent at each approach, which is the expected increase in traffic due to the landfill expansion over the 25 year planning period to the year 2048. The 2 hour trip period was then averaged to get a peak a.m. and pm. hour, and a peaking factor (PF) of 2.0 was applied.

The traffic counts would form the base for the calculation of the expected trips during the April 1st to October 31st time period. The expected 2048 trips were calculated using the above adjustment factors with the peak a.m. and p.m. hour trips shown below.

	Entering	Exiting	Total
a.m. Peak Hour Vehicle Trips	11	10	21
p.m. Peak Hour Vehicle Trips	21	20	41

13.9.2 Trip Distribution

The traffic impact assessment study has utilized the trips for Scenario 2, which were calculated from the counts as discussed in Section 9.9.1. The higher number of trips would reflect the trip pattern of waste being dropped off at the facility at the beginning and end of the workday.

The distribution of expected site generated trips entering and exiting the landfill facility was determined from the examination of the peak a.m. and p.m. hour traffic movements along Boyne Road past the site, and at the St. Lawrence/Main and CR 7/Boyne intersections. Site generated trips were distributed onto the adjacent roads in the proportions shown on Figure 13-14.

Figure 13-15 shows the expected weekday peak a.m. and p.m. hour site generated trips for the proposed expansion using the expected trips calculated from the existing traffic counts (Scenario 2).

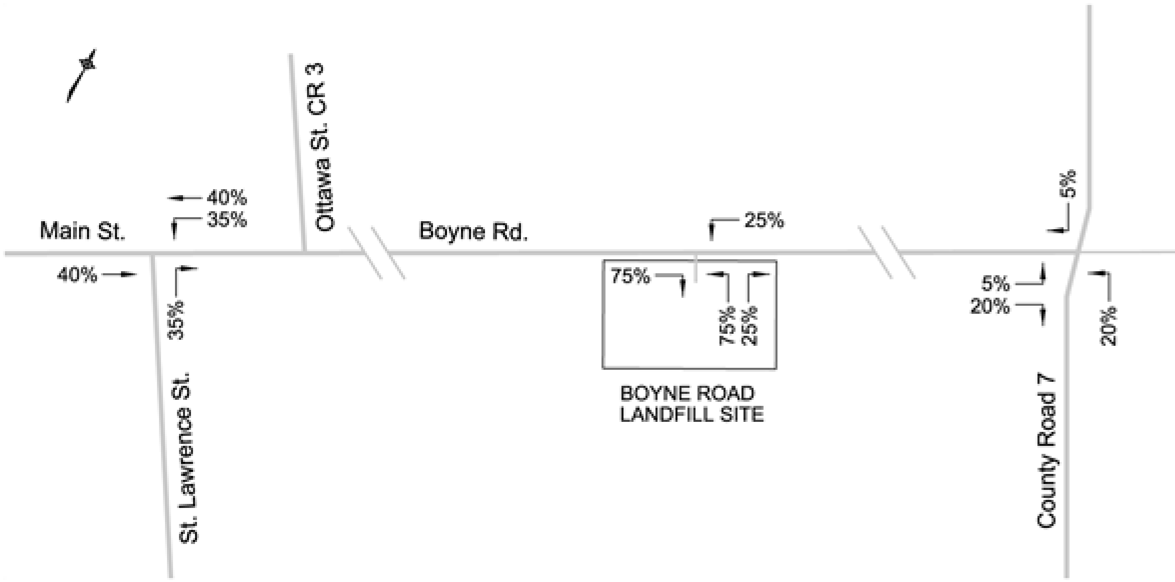


Figure 13-14: Trip Distribution on the Road Network

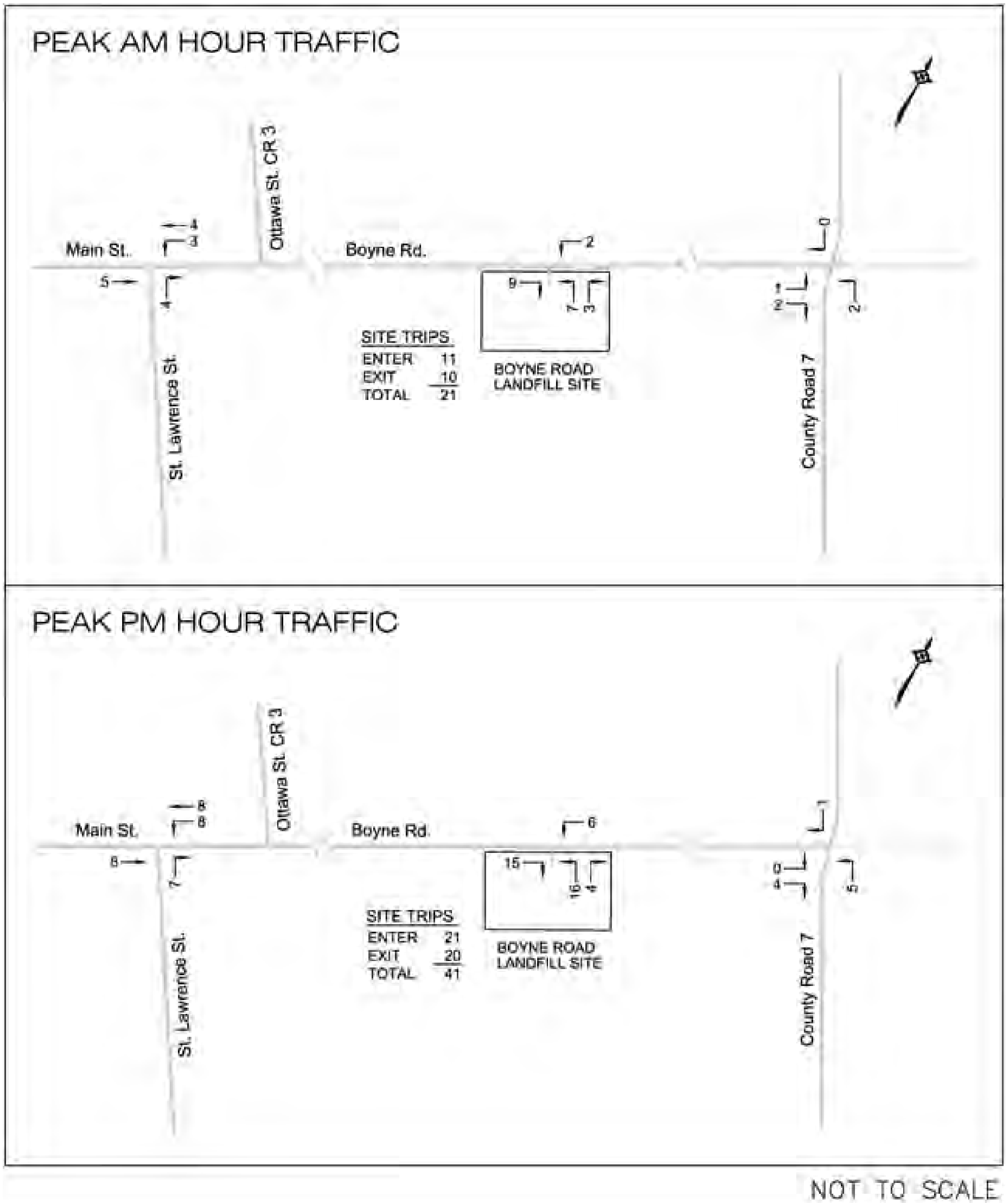


Figure 13-15: Peak AM and PM Site Generated Trips

13.9.3 Traffic Impact Assessment

The following sections provide the assessment of impacts of traffic associated with the proposed landfill expansion.

13.9.3.1 2048 Background and Total Traffic Volumes

The 2048 background traffic would consist of the future traffic, which would include future development, but would not include the expected trips from the landfill facility. The 2021 traffic counts taken at the Access/Boyne, St. Lawrence/Main and CR 7/Boyne intersections were projected to the year 2048, which represents the horizon year of the 25 year planning period.

The future background traffic was determined by applying the following two factors, which would increase the September 2021 traffic counts to the peak a.m. and p.m. hour pre-COVID-19 traffic (normalize to typical peak hour traffic), and the traffic resulting from future development in the Township (2048 background traffic). Trips to/from the landfill facility were not adjusted for COVID-19 as it was assumed that there would be little change in household or construction waste due to home improvements or contractors. The following are the two factors:

13.9.3.1.1 Typical Peak Hour Traffic (pre-COVID-19)

The September 2021 traffic counts would need to be increased to account for the decreased traffic due to the COVID-19 outbreak, which resulted from both the temporary job loss of some of the work force and allowing some workers to work remotely from home. To convert the 2021 counts to the expected pre-COVID-19 traffic volumes, a conversion factor was applied to the counts. Traffic counts were obtained from the United Counties of Prescott and Russell, which were taken along Russell Road 1.5 km east of the Drouin/Russell intersection. The location is approximately 2.5 km east of the east city limit of the City of Ottawa and would be influenced by federal government employees working remotely. The July 2018 peak hour counts were compared to the September 2020 counts at the east approach to the Drouin/Russell intersection. The counts showed that the 2020 counts were 11 percent lower during the peak a.m. hour and 15 percent lower during the peak p.m. hour. The counts are shown below:

Count Date	AM	PM
July 2018	491	524
September 2020	441	457
	-11%	**-15%**

The study has therefore assumed a 15 percent COVID-19 adjustment factor, which was applied to the 2021 through traffic along Boyne Road to increase traffic at the site access, and at all approaches to the St. Lawrence/Main and CR 7/Boyne intersections, which converted the 2021 counts to pre-COVID-19 traffic volumes.

13.9.3.1.2 Future 2048 Background Traffic

The second factor represents the increase in traffic due to future development unrelated to the landfill operations/expansion. The study has examined the growth in population determined from projections obtained from the Township's Municipal Department, which were completed as part of the Township's Official Plan. The projections have shown the population to increase from 12,107 in 2021 to 13,236 in 2036. This would translate to an annual average compounded increase of 0.596 percent. Considering the growth projections discussed above, the study has assumed an annual average compounded growth of 1.0 percent, which was applied to the 2021 pre-COVID-19 through traffic along Boyne Road at the site access, and at all approaches to the St. Lawrence/Main and CR 7/Boyne intersections. The growth rate translates to the factor below, which was applied to the typical traffic (pre-COVID-19).

1.0% Annual Increase

2021 → 2048 1.308

Figure 13-16 shows the expected 2048 peak a.m. and p.m. hour background traffic utilizing the COVID-19 and future background traffic projections discussed above.

The total traffic volumes are the addition of the 2048 background traffic (Figure 13-16) and the expected site generated trips (Figure 13-15). Figure 13-17 shows the 2048 total volume of traffic at the landfill facility access and the critical intersections within the Haul Route Study Area.

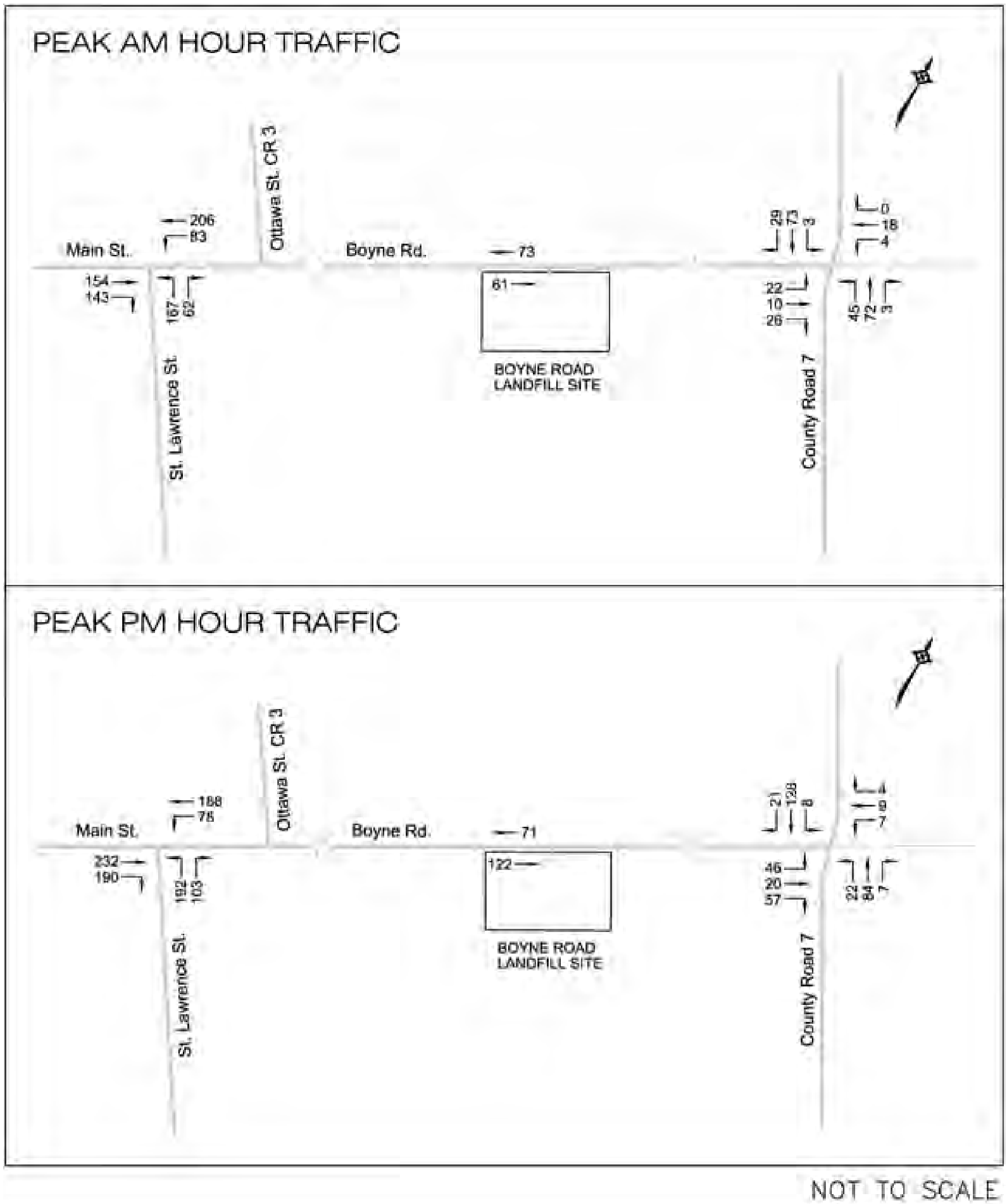


Figure 13-16: 2048 Peak AM and PM Hour Background Traffic

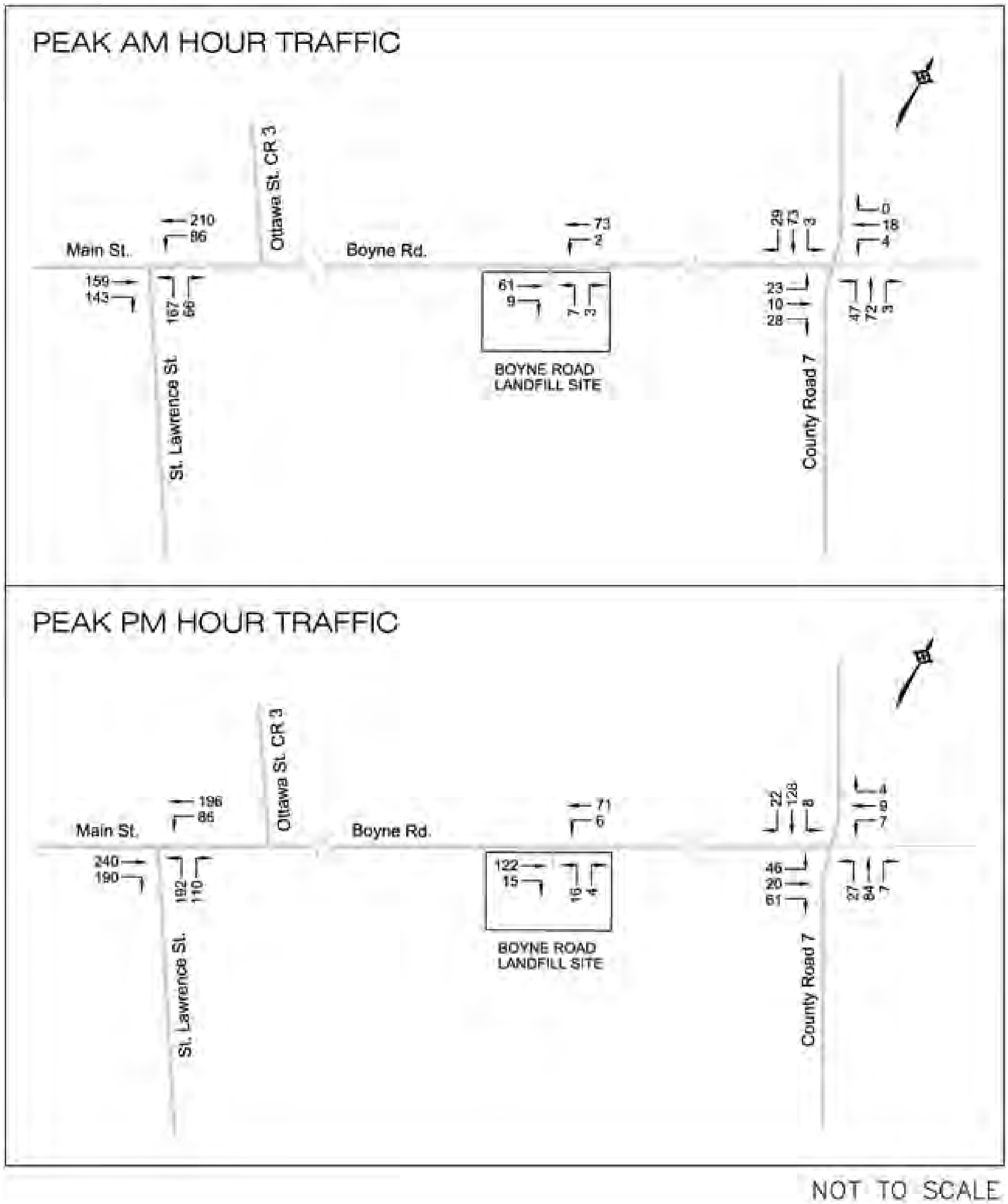


Figure 13-17: 2048 Peak AM and PM Hour Total Traffic

13.9.3.2 Intersection Performance Analysis

The traffic impact study examined the operation of the intersections of Access/Boyne, St. Lawrence/Main and CR 7/Boyne. The analysis periods were the peak a.m. and p.m. hour for the existing traffic counts, and 2048 projected traffic (which represents the horizon year of the expanded landfill facility's planning period). The analysis used the *Highway Capacity Software, Version 7.9.5,* which utilizes the analysis procedure as documented in the Transportation Research Board publication, *Highway Capacity Manual (HCM) 2010 and HCM 6th Edition*.

For unsignalized intersections, the level of service of each lane movement and approach is determined as a function of the delay of vehicles at the approach. The following relates the level of service (LOS) of each lane movement with the expected control delay at the approach.

LEVEL OF SERVICE	CONTROL DELAY	
Level of Service A	0-10 sec./vehicle	Little or No Delay
Level of Service B	>10-15 sec./vehicle	Short Traffic Delays
Level of Service C	>15-25 sec./vehicle	Average Traffic Delays
Level of Service D	>25-35 sec./vehicle	Long Traffic Delays
Level of Service E	>35-50 sec./vehicle	Very Long Traffic Delays
Level of Service F	>50 sec./vehicle	Extreme Delays – Demand Exceeds Capacity

The expected length of queue at the critical lane movements for an unsignalized stop-controlled intersection was determined by the calculation of the 95th percentile queue at each lane approach. The 95th percentile queue length is the calculated 95th greatest queue length out of 100 occurrences at a movement during a 15-minute peak period. The 95th percentile queue length is a function of the capacity of a movement and the total expected traffic, with the calculated value determining the magnitude of the queue by representing the queue length as fractions of vehicles.

The results of the analysis are discussed in the following sections.

13.9.3.2.1 Access and Boyne Road Intersection

The site access to the Boyne Road Landfill facility is a single access point shared by the municipal waste management vehicles, contractors and private homeowners in the Township. The landfill facility will be operational from 8:00 a.m. to 4:00 p.m. weekdays, and 8:00 a.m. to 12:00 p.m. Saturdays from May through November. The traffic study has examined the operation of the site access and adjacent roads during the peak trip period of the facility when vehicles are entering/exiting at the beginning of the day and at the end of the day.

The existing configuration of the Access/Boyne intersection is a "T" intersection with Boyne Road forming the eastbound and westbound approaches and the site access the northbound approach. All approaches are a single lane with no exclusive turn lanes as discussed in Section 9.9.1 of this report. The northbound site exit approach would have an implied stop sign.

An operational analysis of the intersection was performed using the weekday 2021 traffic counts taken on September 9, 2021 and shown in Figure 9-39. The analysis determined that the westbound Boyne Road left/through movement and northbound left/right access movement both functioned at a Level of Service (LOS) "A" during the peak a.m. hour (8:30 to

9:30 a.m.) and during the peak p.m. hour (2:45 to 3:45 p.m.). The results are summarized in Table 13-29 with the summary sheets provided in Volume 2 Appendix H as Exhibit 4 for the 2021 peak a.m. hour and Exhibit 5 for the peak p.m. hour.

Table 13-29: Site Access and Boyne Road Intersection – LOS and Delay

	PEAK AM HOUR 2021 Count **2048** Total	**PEAK AM HOUR** 2021 Count **2048** Total	**PEAK PM HOUR** 2021 Count **2048** Total	**PEAK PM HOUR** 2021 Count **2048** Total
Intersection Approach	**LOS**	**Delay (sec.)**	**LOS**	**Delay (sec.)**
WB Left/Through – Boyne Road	A **A**	7.7 **7.7**	A **A**	7.8 **7.9**
NB Left/Right - Site Access	A **A**	9.3 **9.6**	A **B**	9.7 **10.3**

The expected 2048 traffic was determined as shown in Figure 13-17, which included the future site generated trips and background traffic along Boyne Road. A left turn lane warrant analysis was performed for the 2048 total peak AM and PM hour volume of traffic at the westbound Boyne Road approach. The analysis utilized the left turn lane warrant graphs from the Ministry of Transportation Ontario (MTO) publication, *Geometric Design Standards for Ontario Highways*. The analysis determined that the westbound Boyne Road approach did not trigger the warrant for an exclusive westbound left turn lane into the site. The 2048 traffic analysis will be conducted using the existing intersection geometry. The left turn lane warrant analysis is provided in Volume 2 Appendix H as Exhibit 6.

The operation analysis using the expected 2048 total traffic and the existing intersection geometry determined that all approaches functioned at a LOS “A” during the peak a.m. hour. During the peak p.m. hour, the westbound Boyne Road approach functioned at a LOS “A” and northbound site Access approach at a LOS “B”. Table 13-29 summarizes the operation of the intersection with the analysis sheets provided in Volume 2 Appendix H as Exhibit 7 for the peak a.m. hour and Exhibit 8 for the peak p.m. hour. The peak p.m. hour 95th percentile queue was determined to be 0.0 vehicles for the westbound Boyne Road approach and 0.1 vehicles for the northbound site access.

The intersection would operate at an acceptable level of service, resulting in no requirement for modifications triggered by the expansion of the landfill facility.

13.9.3.2.2 Main Street and St. Lawrence Street Intersection

The St. Lawrence/Main intersection is an all-way stop-controlled intersection in the village core and is located 2.8 km west of the site. The intersection is a “T” intersection with St. Lawrence Street forming the northbound approach, and Main Street the eastbound and westbound approaches. Main Street is the extension of Boyne Road within the village limits. The peak hour traffic during the operational hours of the landfill facility occurred between 9:00 and 10:00 a.m., and 3:00 and 4:00 p.m.

The existing traffic counts were taken on September 14, 2021. The operational analysis determined that all approaches functioned at a LOS “A” during the peak AM hour. During the peak p.m. hour, the eastbound and northbound approaches functioned at a LOS “B”, and westbound approach at a LOS “A”. The analysis work sheets are provided in Volume 2 Appendix H as Exhibit 9 for the peak a.m. hour and Exhibit 10 for the peak p.m. hour. The intersection operation is summarized in Table 13-30.

Table 13-30: Main Street and St. Lawrence Street Intersection – LOS and Delay

	PEAK AM HOUR 2021 Count (2048) Background **2048** Total	**PEAK AM HOUR** 2021 Count (2048) Background **2048** Total	**PEAK PM HOUR** 2021 Count (2048) Background **2048** Total	**PEAK PM HOUR** 2021 Count (2048) Background **2048** Total
Intersection Approach	**LOS**	**Delay (sec.)**	**LOS**	**Delay (sec.)**
EB Through/Right – Main St.	A (B) **B**	9.0 (11.7) **12.0**	B (C) **C**	10.3 (17.4) **18.6**
WB Left/Through – Main St.	A (B) **B**	9.5 (12.5) **12.8**	A (B) **B**	9.9 (13.6) **14.4**
NB Left/Right - St. Lawrence St.	A (B) **B**	9.4 (11.9) **12.1**	B (B) **C**	10.3 (14.9) **15.5**

The 2048 background traffic is the expected volume of traffic derived from the traffic counts and increased using a COVID-19 adjustment factor and an annual average compounded growth factor. The background traffic analysis does not include existing or future trips generated by the landfill facility. The 2048 analysis determined that all approaches functioned at a LOS “B” during the peak a.m. hour. During the peak p.m. hour the westbound and northbound approaches functioned at a LOS “B”, and the eastbound approach at a LOS ”C”. Table 13-30 summarizes the operation of the intersection with the analysis sheets provided in Volume 2 Appendix H as Exhibit 11 and Exhibit 12.

Following the expansion of the site, all approaches functioned at a LOS “B” during the 2048 peak a.m. total traffic. During the peak p.m. hour the eastbound and northbound approaches functioned at a LOS “C” and westbound at a LOS “B”. The analysis sheets are provided as Exhibits 13 and 14, with Table 13-30 summarizing the operation of the intersection. The 95th percentile queue during the peak p.m. hour was determined to be 5.3 vehicles at the eastbound approach, 2.7 vehicles at the westbound approach, and 3.2 vehicles at the northbound approach.

The intersection would operate at an acceptable level of service, resulting in no requirement for modifications triggered by the expansion of the landfill facility.

13.9.3.2.3 County Road 7 and Boyne Road (Connaught Road) Intersection

The intersection of CR 7/Boyne is located 6.6 km east of the site with CR 7 forming the northbound and southbound approaches, Boyne Road the eastbound approach, and Connaught Road the westbound approach. The intersection is a two-way stop-controlled intersection with stop signs installed at the Boyne Road and Connaught Road approaches. All approaches consist of a single lane with shared turning movements. Traffic counts taken on September 14, 2021 determined that the peak a.m. hour occurred between 9:00 and 10:00 a.m., and peak p.m. hour between 2:45 and 3:45 p.m.

The existing 2021 traffic counts determined that the approaches to the intersection functioned at a LOS “A” or “B” during both the peak a.m. and p.m. hours. Table 13-31 summarizes the operation of the intersection with the analysis sheets provided in Volume 2 Appendix H as Exhibit 15 for the peak a.m. hour and Exhibit 16 for the peak p.m. hour.

Table 13-31: Boyne Rd and County Road 7 Intersection – LOS and Delay

	PEAK AM HOUR 2021 Count (2048) Background **2048** Total	**PEAK AM HOUR** 2021 Count (2048) Background **2048** Total	**PEAK PM HOUR** 2021 Count (2048) Background **2048** Total	**PEAK PM HOUR** 2021 Count (2048) Background **2048** Total
Intersection Approach	**LOS**	**Delay (sec.)**	**LOS**	**Delay (sec.)**
EB Left/Through/Right – Boyne Rd.	A (B) **B**	9.6 (10.3) **10.4**	B (B) **B**	10.1 (11.3) **11.4**
WB Left/Through/Right – Connaught	B (B) **B**	10.3 (11.3) **11.3**	B (B) **B**	10.1 (11.2) **11.3**
NB Left/Through/Right – CR 7	A (A) **A**	7.4 (7.6) **7.6**	A (A) **A**	7.5 (7.6) **7.6**
SB Left/Through/Right – CR 7	A (A) **A**	7.3 (7.4) **7.4**	A (A) **A**	7.4 (7.4) **7.4**

The operational analysis using the 2048 background traffic (excluding site trips) determined that the eastbound and westbound approaches functioned at a LOS “B” and northbound and southbound CR 7 approaches at a LOS “A” during both the peak AM and PM hours. The operational analysis worksheets are provided in Volume 2 Appendix H as Exhibits 17 and 18, respectively, with Table 13-31 summarizing the analysis.

The analysis of the total traffic at the year 2048 determined that the intersection would continue to operate at the same level of service as the 2048 background traffic, with the eastbound and westbound approaches functioning at a LOS “B” and northbound and southbound approaches at a LOS “A” during both the peak a.m. and p.m. hour. Table 13-31 summarizes the results with the analysis sheets provided in Volume 2 Appendix H as Exhibit 19 and Exhibit 20. The 95th percentile queue at the approaches for the 2048 peak PM hour traffic was 0.7 vehicles at the eastbound Boyne Road approach and 0.1 vehicles at the northbound CR 7 approach.

The intersection would operate at an acceptable level of service, resulting in no requirement for modifications triggered by the expansion of the landfill facility.

13.9.3.3 Agricultural Equipment on the Public Roads

A large portion of the Township of North Dundas contains agricultural land. Farm equipment constantly travels between fields and the main farming compound along public roads. The equipment is usually large and travels at a low speed. Traffic Counts taken in September 2021 during the two hour a.m. and two hour p.m. peak periods recorded the following farm vehicles and movements at the intersections:

	AM	PM
Access/Boyne	No vehicles	No vehicles
St. Lawrence/Main	1 EB Through (8:45-9:00)	1 NB Right (2:15-2:30) 1 EB Right (3:45-4:00)
CR 7/Boyne	1 SB Through (8:15-8:30) 2 SB Through (8:30-8:45) 1 EB Through (9:00-9:15)	1 SB Through (3:15-3:30)

The volume of farm vehicles and observations during the counting period did not identify any major impacts at intersections or along the roadways due to the equipment.

13.9.4 Summary of Traffic Assessment

The Traffic Impact Study examined the impact of the additional traffic generated by the proposed landfill expansion at the site access onto Boyne Road, and the St. Lawrence/Main and CR 7/Boyne intersections. The analysis considered the weekday peak a.m. and p.m. hours for the expected traffic at the year 2048. The following summarizes the findings of the study:

- The trip generation analysis determined that following the expansion of the Boyne Road Landfill site, the facility would generate 11 trips entering and 10 trips exiting the site during the weekday peak a.m. hour for a total of 21 vehicle trips, and 21 trips entering and 20 trips exiting during the peak p.m. hour for a total of 41 vehicle trips.

- The traffic analysis adjusted the 2021 traffic counts to the expected year 2021 pre-COVID-19 volume of traffic by utilizing a factor that was determined from the comparison of pre-COVID-19 and COVID-19 counts taken along a county road at the east limit of the City of Ottawa in the United Counties of Prescott and Russell. The examination of counts determined that the 2021 counts should be increased by 15 percent to represent pre-COVID-19 traffic volumes. The peak hour background traffic counts were further increased by an annual average compounded rate of 1.0 percent to the year 2048 to account for future development in the Township.

- The landfill site is currently operating with one access onto Boyne Road. The access is a single lane entering and one lane exiting the site. An analysis of the expected 2048 traffic determined that there would be no roadway modifications required to the site access and Boyne Road intersection due to the expansion of the landfill facility. The traffic analysis further examined the St. Lawrence/Main intersection in the Village of Winchester, and CR 7/Boyne intersection located 6.6 km east of the landfill site. The expected site trips at both intersections would have a minor impact on the operation of the intersections with no modifications required.

13.10 Design and Operations

This section provides the assessment of impacts associated with the design and operations of the proposed expansion of the Boyne Road Landfill site as described in Section 12 of this EASR.

13.10.1 Landfill Expansion Development

The landfill expansion involves a limited vertical expansion on the south portion of the existing landfill and a new 3.8 ha horizontal expansion footprint area. The horizontal expansion area will have a constructed base consisting of a pad of imported permeable fill. It is proposed that the expansion area would be constructed and filled in three or four phases; final cover would be placed progressively as the landfilling in a phase is completed. It is anticipated that the development would proceed from east to west, since the proposed SWM pond is located along the east side of the site and this would allow drainage from the first phase of the landfill cover into the pond. A detailed phasing plan for the expansion will be prepared as part of the Development and Operations plan in support of the ECA amendment application.

It is also noted that the expansion is located south of the existing landfill and is of similar height to the existing landfill. As described in the visual impact assessment in Section 13.8.3, the combination of the existing landfill and forested areas will be quite effective at screening the view of the expansion operations from Boyne Road and other off-site vantage points.

13.10.2 Leachate Management

As described in Section 12.2, the proposed expansion will continue to reply on natural attenuation to control potential adverse effects on off-site groundwater quality. The results of the hydrogeological impact assessment in Section 13.2 are that the expanded landfill site requires some additional CAZ lands to the south to remain in compliance with the MECP Reasonable Use Guideline. It is noted that the Township is already in discussion with the landowners to secure a groundwater easement on this land. With the addition of more CAZ lands to the south, adverse impacts to off-site groundwater quality are not expected. In addition, the development and operation of the landfill do not involve lowering of the groundwater level or taking of groundwater; as such, no effects on off-site groundwater availability are expected.

In addition, the expansion design includes the replacement of the section of existing open ditch on the north side of Boyne Road opposite the landfill with a culvert or a lined ditch. This is intended to avoid the potential effects of leachate-impacted groundwater from discharging into the ditch and adversely affecting surface water quality. In addition, the proposed perimeter ditch around the expansion area and the proposed SWM pond will be elevated to minimize the potential for leachate-impacted groundwater from coming into contact with runoff from the landfill cover and non-landfill areas of the site. As such, adverse effects from landfill operations on surface water quality are not anticipated.

13.10.3 Landfill Gas

As described in Section 12.4, it is neither required by regulation nor proposed to install a landfill gas collection system at the Boyne Road Landfill site. The air quality assessment reported in Section 13.1 demonstrates that air emissions from the expanded landfill (air quality, odour, dust) are expected to comply with provincial requirements. Also, the estimated GHG generation from the expanded landfill is indicated to negligibly contribute to provincial GHG release.

As described in Section 12.4, off-site lateral migration of landfill gas through the subsurface is not expected. Rather, the landfill gas generated at the site is expected to vent to atmosphere through the landfill cover soils. It is also noted that there are no existing structures within 500 m of the landfill site other than the landfill building. As such, there is no potential for off-site lateral migration of landfill gas from the existing landfill or the expansion area to cause adverse effects.

13.10.4 Soil Requirements/Balance

As is the case for the existing landfill operations, there are no potential sources of earth borrow materials on the landfill site property for use in construction of the expansion or future site operations. The construction of the landfill expansion will require the importation of approximately 38,000 m^3 of permeable sandy soil for the landfill base; additional imported soil will be required for construction of the stormwater pond berms.

As is done for the current landfill operations, daily cover for the expansion waste will consist of imported soil materials as well some alternative daily cover materials. The daily cover materials will consist of a combination of surplus soils from construction projects within the Township as well as material from licensed pit sources. For the proposed expansion, if soil is used for all the daily cover, using a 4 waste : 1 daily cover ratio, an estimated 84,000 m^3 of soils would be required.

The proposed final landfill cover is proposed to consist of a general soil final cover meeting the requirements of *O.Reg.* 232/98. Again, imported soil (suitable soils that are surplus from construction projects and/or from licensed pits) and topsoil will be required. It is noted that the final cover is to be placed progressively as waste placement is completed in each phase of the expansion, so not all the final cover material will be required at one time.

13.10.5 Capital and Operational Costs

As described in Section 12.0 of this EASR, the proposed expansion involves the construction of new site infrastructure components as part of the expansion design. An estimate of capital costs for implementation of the expansion was prepared. It is considered appropriate to consider a contingency allowance to account for the final engineering design and potential variations in both construction materials and contractor costs over time. There will also be costs associated with the approvals process and engineering services during design and construction.

An estimate of possible costs for the main components of the capital costs (in 2021 dollars) can be broken down as follows, including what are considered appropriate contingencies and ranges above and below the estimate costs at this EA stage of planning and design:

- Clearing, excavation and fill placement to construct the expansion base pad: approximately $1,300,000 to $1,500,000.
- Construction of the SWM wetland facility and north side landfill ditching: approximately $171,500 to $365,000.
- Construction of the mitigation measure in the north side Boyne Road ditch (Volks Drain): approximately $615,000 to $950,000 for the culvert option, which is expected to be the more expensive option.

As described previously, these capital costs will be phased with progressive construction and filling of the expansion. Initially the clearing and base for the first expansion cell will be constructed, along with the stormwater management wetland and ditch on the north side of the existing landfill. The mitigation measures in the Volks Drain opposite the north side of the landfill could be constructed during the first few years of the expansion. As such, the capital costs associated with the expansion can be planned within the Township's annual capital expenditures budgeting process. The operating costs are expected to be comparable to the current operating costs. These cost components are not expected to adversely impact municipal finances.

13.10.6 Summary

In summary, there are no significant impacts expected as related to site design and operations.

13.11 Comparison to Do- Nothing

For the Township, the Do-Nothing alternative would be to allow the Boyne Road Landfill to reach its approved capacity and not pursue any other solution for residual waste management for the Township. The predicted effects of the preferred alternative were compared to the Do-Nothing scenario to better understand and appreciate the magnitude of any predicted effects of the proposed expansion design. Considering the natural, social, economic, cultural and technical components and indicators, a discussion of this comparison is provided in Table 13-32.

Not all effects of landfill expansion noted below in Table 13-32 were negative, a few were positive, and some effects were similar whether considering Do-Nothing or landfill expansion. However, when considering the identified preferred undertaking and the discussion in Table 13-32, it is shown that all negative effects are mitigatable to within regulatory limits, as landfill expansion is a well-known and well understood type of approach in terms of landfill development, operations and performance.

One of the Township's basic requirements as a municipality is to provide municipal services and infrastructure for its ratepayers including waste management. As such, the Do-Nothing Alterative would not be practical to implement. If the Township actually did nothing, individual residents would be responsible for finding their own solution to waste management such as hiring a private waste management company or disposing of waste on their own property. The comparison of the Do-Nothing alternative does not include the potential actual impacts of the Do-Nothing alternative.

Table 13-32: Comparison of Do-Nothing to the Preferred Undertaking

Component	Sub-component	Indicator(s)	Do-Nothing Versus Preferred Undertaking
Atmosphere	Air quality (including dust, odour, GHG)	Expected concentrations of air quality indicator compounds (selected regulated air contaminants to represent this type of project), including dust, at the property boundary and nearby sensitive receptors. Expected site-related odour at off-site sensitive receptors. Expected GHG emissions	Under Do-Nothing conditions, the landfill would close and air quality indicators, odour and GHG would reduce over time from current conditions as the site would not be operational. The site will still have the potential for air quality, odour and GHG impacts, just at lower thresholds. The proposed landfill expansion design would see continued air quality indicators, odour and GHG from the operational site at levels greater than Do-Nothing, but in compliance with regulatory limits. There is the possibility of air quality, odour and GHG impacts if unorganized waste disposal occurred as a result of the Do-Nothing condition.
	Noise	Noise Levels at neighbouring noise sensitive existing receptors or vacant lots (with appropriate zoning that may accommodate the future construction of sensitive noise receptors).	The closure of the existing landfill under the Do-Nothing scenario would see noise from the site activities reduce to zero. There would still be noise in the area due to other activities, as well as the recycling activities. The landfill expansion proposed is predicted to have noise effects in compliance with regulatory limits.
Geology and Hydrogeology	Groundwater quality	Expected effect on groundwater quality at the landfill site property boundary and/or compliance boundaries.	The existing landfill, if closed in a Do-Nothing scenario, would continue to have impacts to groundwater quality at the property boundary for 100s of years, at concentrations below regulatory limits. The proposed expansion of the landfill will increase the potential impacts to groundwater quality at the property boundary beyond the Do-Nothing scenario, but with concentrations below regulatory limits. There is the possibility of groundwater quality impacts if unorganized waste disposal occurred as a result of the Do-Nothing condition.
Surface Water	Surface water quality	Expected effect on surface water quality in the drainage ditch along Boyne Road and within the Site-vicinity Study Area.	The closure of the existing landfill will still allow for potential leachate-impacted groundwater to discharge to the municipal drain along Boyne Road. With the proposed expansion of the landfill as designed, the possibility of impacts to the SWMS and other water bodies is very limited as a result of operational practices. Therefore, the proposed expansion of the landfill will decrease the potential impacts to surface water quality compared to Do-Nothing. There is the possibility of surface water quality impacts if unorganized waste disposal occurred as a result of the Do-Nothing condition.
	Surface water quantity	Expected change in runoff to and peak flows in drainage features. Expected degree of off-site effects on surface water quantity within the Site-vicinity Study Area.	Surface water quantity peak flows are based on landfill final design parameters (e.g., slope steepness, length, etc.). Under the Do-Nothing scenario a pre-existing peak flow is anticipated for the closed landfill. The regulatory requirements for landfill expansion require the matching of peak flow by using stormwater management tools (e.g., ponds, orifices, etc.). As such, the peak flow in Do-Nothing and landfill expansion scenarios is the same. The only difference is the peak flow may be sustained for a longer duration with the landfill expansion in some drainage areas, and for a shorter duration in other areas, compared to the Do-Nothing scenario.

Component	Sub-component	Indicator(s)	Do-Nothing Versus Preferred Undertaking
Biology	Aquatic ecosystems	Expected change in surface water quality and/or quantity within the Site Study Area and the Site-vicinity Study Area. Expected impact on aquatic habitat and biota, including rare, threatened, or endangered species within the Site Study Area and the Site-vicinity Study Area.	As noted for surface water, there is no anticipated difference between the Do-Nothing scenario and the landfill expansion as related to surface water quality or peak flow on or off-site. As noted, under landfill expansion conditions there may be a longer or shorter duration of peak flow that could impact aquatic habit (although there are no rare, threatened or endangered species). The works associated with landfill expansion are expected to result in a loss of aquatic habitat, which may require compensation. Conversely, the proposed expansion will also result in improvement to some components of the aquatic habitat. There is the possibility of aquatic habitat impacts if unorganized waste disposal occurred as a result of the Do-Nothing condition.
	Terrestrial ecosystems	Expected impact on terrestrial vegetation communities, wildlife habitat, and wildlife, including rare, threatened or endangered species within the Site and Site-vicinity Study Areas.	The closure of the landfill under the Do-Nothing scenario is not likely to affect habitat for SAR bats (little brown myotis). The landfill expansion will directly negatively impact the habitat of little brown myotis through the construction process. Compensation for habitat loss will be developed in consultation with the MECP for little brown myotis. There is the possibility of terrestrial habitat impacts if unorganized waste disposal occurred as a result of the Do-Nothing condition.
Land Use	Current and planned future land uses	Expected incompatibility with existing or known future land use.	The landfill expansion is consistent with the Provincial Policy Statement and conforms with the Official Plan. There is the possibility of land use policy issues if unorganized waste disposal occurred as a result of the Do-Nothing condition.
Agriculture	Agriculture	Expected effect on agricultural land base and agricultural operations within the Site and Site-vicinity Study Areas.	The Do-Nothing scenario would see no change or effect regarding agricultural operations in the area. The landfill expansion design requires some land to the south of the existing landfill that will reduce some existing agricultural operations on Township-owned lands. There is the possibility of agricultural land loss if unorganized waste disposal occurred as a result of the Do-Nothing condition.
Cultural Heritage Resources	Archaeology	Expected archaeological resources potentially affected on-site.	There is the possibility of archaeological resource disturbance/loss if unorganized waste disposal occurred as a result of the Do-Nothing condition. The landfill expansion lands required to the South will have no effect on expected archaeological resources.
	Built Heritage Resources	Expected impact on identified cultural heritage landscapes within the Site-vicinity Study Area.	The landfill expansion will not impact built heritage resources and neither will the Do-Nothing scenario.
	Cultural Heritage Landscapes	Expected impact on the heritage attributes of identified built heritage resources within the Site-vicinity Study Area.	The landfill expansion will not impact cultural heritage landscapes and neither will the Do-Nothing scenario.

Component	Sub-component	Indicator(s)	Do-Nothing Versus Preferred Undertaking
Socio-economic	Local Economic	Expected effect on local employment. Expected effects on local businesses and commercial activity. Expected effects on municipal finances.	The Do-Nothing scenario causes a negative effect with regard to local employment while the landfill expansion should have a positive effect on local employment during construction and continued operation. Neither the Do-Nothing nor the landfill expansion are expected to cause effects to local businesses or commercial activity. The Do-Nothing scenario will cost the Township less than expanding the site.
	Residents and Community	Displacement of residents. Expected interference with use and enjoyment of residential properties (nuisance effects).	Under Do-Nothing conditions there is no expected displacement of residents. As noted from other components (noise, air quality, visual and traffic), the expectation is that neither the landfill expansion nor the Do-Nothing scenario will interfere with the use and enjoyment of residential properties.
	Visual	Expected changes in landscape views from off-site.	The closure of the existing landfill under the Do-Nothing scenario will continue to have areas where the landfill is visible from off-site. With the proposed landfill expansion, it is expected that the landfill will have slightly greater visibility from off-site locations to the South, although mitigation could be effective. There is the possibility of visual impacts if unorganized waste disposal occurred as a result of the Do-Nothing condition.
Design and Operations	Financial	Expected effect on traffic along haul routes.	The costs for the Do-Nothing scenario are not zero as on-going monitoring and maintenance will be required for decades post-closure of the existing landfill. To expand the landfill will incur some capital costs, although these will be relatively lower because a natural attenuation expansion design is proposed, and affordable for the Township as they are spread over time as the expansion is progressively developed. During operation of the landfill and post-closure, on-going monitoring will be required. There is the possibility of clean up costs if unorganized waste disposal occurred as a result of the Do-Nothing condition.
Transportation	Traffic	Estimated costs associated with implementation of expansion alternatives.	The proposed expansion is predicted to have no impact to traffic that will require the upgrade of any intersection over the life of the landfill. If the landfill were to close (Do-Nothing), this would also have no impact to traffic requiring upgrades to any intersections.

14.0 Climate Change Considerations

The document entitled “Considering Climate Change in the Environmental Assessment Process” (MECP, 2019) was used as a guide for incorporating measures in the landfill expansion design that reduce both the potential impact of climate change on the landfill (i.e., climate change adaptation) and its potential impact on climate change (i.e., climate change mitigation).

14.1 Potential Impacts of Climate Change on the Landfill Expansion

It is expected that the planned 25 year operational period of the landfill expansion, i.e., through 2048, will be too short to be significantly affected by impacts from climate change. However, during the post-closure period, longer term changes in precipitation and temperature could possibly affect the vegetative cover growth on the closed landfill and/or runoff of surface water from the landfill final cover and the performance of the components that comprise the SWMS. For example, an increase in precipitation and/or an increase in storm intensity or duration compared to historical design storms would increase the amount of runoff, potentially resulting in surface erosion of the vegetated landfill final cover surface and exceedance of the capacity of the SWMS.

As described in Sections 12.5 and 13.3, climate change adaptation was incorporated into the design of the landfill expansion as follows:

- The SWM pond has been designed to provide 80% total suspended solids removal (Enhanced level of treatment). In the event that larger storms result in an increased amount of surface erosion and a corresponding increased amount of suspended solids in the runoff, the pond will be better able to remove suspended solids and thereby reduce potential effects on the off-site downstream receiving municipal drainage ditch system.

- In addition to the design of the SWMS components, i.e., ditches and SWM pond, to accommodate the runoff associated with the storm events corresponding to the 1:5 and 1:100 year return period storm intensities and durations (as required by *O. Reg.* 232/98), to evaluate potential climate change effects the 1:100 year design storm intensity-duration-frequency values were increased by 20 percent to check/confirm that the stormwater runoff conveyance and storage systems could still be expected to manage the increased flows. This approach follows the climate change guidelines for stormwater management system design and assessment in the adjacent City of Ottawa. The evaluation indicates that under expansion conditions, the proposed stormwater management facilities are indicated to be capable of acceptably controlling discharge from the site, including consideration of increased precipitation associated with climate change as described above.

Landfill operations may also have to adapt to climate change effects. For example:

- Changing climate patterns may result in extremes of heat or cold for extended periods of time. This will require site operations staff working outdoors to use applicable operational procedures that are reviewed and periodically updated to reflect these changing conditions. Landfill vehicles and equipment will continue to have heaters and air conditioners to provide climate-controlled conditions for the operators.
- If there are stronger winds for extended periods of time that reduce the effectiveness of current methods to control litter, consideration can be given to the use of properly anchored litter control fences whose dimensions around the working area are sufficient to control litter. Additional resources to pick up litter from strong wind events, both on and off the site, may also be required.

The expanded landfill footprint will result in an increased area of landfill through which precipitation will infiltrate and generate leachate. A gradual increase in annual precipitation associated with climate change in future could result in a gradual increase in the annual infiltration through the landfill final cover and an increase in leachate generation. However, it is noted that not all the increase in precipitation would infiltrate, i.e., the runoff and evapotranspiration components of the site water balance would also increase. This would result in a larger volume of leachate entering the groundwater flow system to be naturally attenuated within the on-site buffers and Contaminant Attenuation Zone lands. The groundwater modelling results reported in Section 13.2 indicates that with the CAZ lands as proposed, the expanded landfill is expected to perform in accordance with the Reasonable Use Guideline. However, if ongoing monitoring indicates that the site is expected to not remain in compliance in terms of effects on off-site groundwater quality, whether due to increased precipitation or other reasons, then the mitigation measure would be to increase the size of the Contaminant Attenuation Zone in the required direction(s) and by the required dimensions.

In summary, the potential impacts from climate change related to precipitation have been considered in terms of design of the stormwater management system for the expanded landfill. Adjustments to landfill operations can be made, as required, in future to mitigate potential effects from climate change.

14.2 Impacts of the Landfill Expansion on Climate Change

The potential effects of the landfill expansion on climate change have been assessed to quantify potential climate change effects. Ways that the landfill expansion could reduce GHG emissions or remove GHGs from the atmosphere have also been considered. The detailed assessment of GHGs associated with the proposed expansion is provided in Section 13.1.1.8 and summarized below.

The two main ways that a landfill expansion could affect climate change are the generation of GHG that enters the atmosphere, and reduction of GHG sequestration by removal of forested areas.

The activities at the landfill expansion that will produce GHGs include the following:

- landfill gas
- on-site transportation fuel combustion emissions
- stationary combustion emissions from propane used for comfort heating in the buildings
- land clearing as part of the expansion

The GHG emission estimates, where applicable, followed quantification guidelines for both provincial and federal reporting:

- Federal reporting under Section 46 of the *Canadian Environmental Protection Act*, (CEPA), SC 1999: Greenhouse Gas Emissions Reporting Program (GHGRP).
- Provincial reporting under Ontario's Greenhouse Gas Emissions: Quantification, Reporting, and Verification Regulation, Ontario Regulation 390/18 (*O. Reg.* 390/18).

GHG emissions from on-Site transportation and stationary combustion were estimated using emission factors from Tables 2-2 and 2-6 of Canada's ECCC Document "2020 Canada's Greenhouse Gas Quantification Requirements" dated December 2020 (GHGRP Guidance Document) (ECCC, 2020b). Fuel consumption for the on-Site transportation equipment was estimated using methods in the document titled Exhaust and Crankcase Emission Factors for Non-road Compression-Ignition Engines in MOVES' (US EPA, 2018). Stationary combustion emissions from propane used for comfort heating were estimated. There is no prescribed method in the 2020 GHGRP Guidance Document for estimating fugitive methane emitted through the landfill cap and therefore GHG emissions from these sources were estimated using engineering calculations. Fugitive methane that is oxidized in the atmosphere once emitted through the cap has not been taken into consideration for this assessment; however, it is commonly assumed that approximately 10% of the methane from landfill gas oxidizes.

Table 14-1 summarizes the estimated annual GHG emission rates in tonnes per year for each activity at the proposed expanded landfill.

Table 14-1: Summary of Estimated GHG Annual Emissions from the Proposed Expansion of the Boyne Road Landfill in Year 2049

Source	CO_2 Estimated Annual Emissions [tonnes/yr]	CH_4 Estimated Annual Emissions [tonnes/yr]	N_2O Estimated Annual Emissions [tonnes/yr]	CO_2e Annual Total [tonnes/yr][1]
Landfill	1831	664	0	18,438
Mobile Combustion Emissions (road and non-road vehicles)	1566	0.055	0.13	1607
Comfort Heating	22	0.000	0.002	23
Land Clearing[2]	117	—	—	121

Notes:
1. CO_2e equals carbon dioxide equivalence, which is the summation of multiplying the emissions of CO_2, CH_4, N_2O by their respective global warming potential of 1, 25, and 298, respectively (IPCC, 2012).
2. Emissions represent the combination of the loss of CO_2 storage and the one-time land clearing emissions averaged over the life of the proposed landfill expansion (estimated at 25 years).

The peak annual GHG emissions were predicted to occur in 2049.

Table 14-2 presents a comparison of the Boyne Road Landfill site's proposed expansion GHG emissions to the provincial and Canadian totals. As indicated, the increase in emissions from the existing landfill to the proposed expansion would have a negligible contribution of less than 0.003% to the Ontario emissions and less than 0.0006% to the Canadian emissions; therefore, the proposed landfill expansion will have a negligible effect on climate change.

Table 14-2: Comparison of GHG Emissions from the Boyne Road Landfill Expansion to Ontario and Canadian Emission Totals

Ontario GHG Emissions (2019)		**163,200**	**163,200**
Canada-wide GHG Emissions (2019)		**730,000**	**730,000**
Source	**Existing Emissions [kt/year CO_2e]**	**Expansion Emissions [kt/year CO_2e]**	**Increase in Emissions [kt/year CO_2e]**
Landfill Expansion GHG Emissions	15.64	20.18	4.54
Comparison to Ontario Total	0.01%	0.01%	0.003%
Comparison to Canada-wide Total	0.002%	0.003%	0.0006%

15.0 Cumulative Impact Assessment

15.1 Approach

In the approved ToR, the Township committed to undertake a cumulative impact assessment of the preferred alternative, which is expansion of the Boyne Road Landfill site as described in Section 12.0. The cumulative impact assessment combines the potential effects of the proposed landfill expansion in combination with past, present and reasonably foreseeable future activities, where possible, as briefly outlined in the Code of Practice for Preparing and Reviewing Environmental Assessments in Ontario (MOECC, 2014). To carry out this assessment, a framework often used in federal EA processes was considered (Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, March 2018, Version 2 (Government of Canada (2012)), noting that the Canadian Environmental Assessment Act has been replaced by the Impact Assessment Act (2019). Cumulative effects guidance documents under the new act have not been prepared.

An assessment of cumulative effects provides a more complete understanding of what might happen to natural, social, economic, cultural and technical components beyond the influence of the proposed landfill expansion alone. This is useful for regulatory decision-makers and authorities as they review and plan future developments.

15.1.1 General

This analysis considers the residual, negative effects of the proposed Boyne Road Landfill expansion and the potential for these residual effects to interact with other projects or activities, which when combined may result in a greater and in particular adverse effect to a natural, social economic, cultural or technical component.

15.1.2 Assessment Methodology

The cumulative effects analysis involved a scoping phase and an analysis of effects phase. For the scoping phase, the components that had residual negative effects (after mitigation) from the proposed landfill expansion were identified. After this, other projects or activities in the area that may affect the same components were identified.

During the analysis of effects phase, the other projects or activities were evaluated to assess if their effects would overlap in timing or spatial extent with the effects of the proposed landfill expansion, accounting for and including the proposed landfill expansion mitigation measures. The nature and extent of the possible cumulative effects were then identified along with any possible mitigation and/or monitoring strategies.

15.2 Scope

15.2.1 Identified Components

Of the natural, social economic, cultural and technical components for which impact assessments associated with the proposed landfill expansion were carried out, the only identified components with potential residual negative off-site effects after proposed mitigation measures are in effect were related to those components shown in Table 15-1 below.

Table 15-1 summarizes the predicted potential residual effects of the Boyne Road Landfill expansion on the selected components where the proposed mitigation measures may not be sufficient to completely eliminate any potential effects, even though the assessments indicate it is expected that site compliance with the regulatory standards and guidelines can be achieved in all regards.

Table 15-1: Summary of Landfill Expansion Potential Residual Effects

Component/ Sub-component	Potential Effects of Boyne Road Landfill Expansion	Location of Residual Effect from Boyne Road Landfill Expansion
Atmosphere*	Odour	Site, Site-vicinity
	Dust emissions	Site, Site-vicinity
	Air quality	Site, Site-vicinity
	Noise emissions	Site, Site-vicinity (including haul routes)
	GHG	Site, Site-vicinity (including haul routes)
Hydrogeology	Groundwater quality impacts	Site
Surface Water	Surface water quantity or quality impacts	Site-vicinity
Biology	Change in habitat as a result of alteration of flows (aquatic biological resources)	Site-vicinity
	Removal of vegetation and disruption to wildlife (terrestrial biological resources)	Site
Transportation	Traffic along the haul route	Site-vicinity (including haul route)
Socio-economic/Visual	Change in views of the expansion from the south	Site-vicinity

Notes:
* A quantitative cumulative impact assessment is a component of the air quality assessment described in Section 13.1.1 whereby the background air quality expected for the area obtained from a combination of background air quality for the region and the modelled air quality resulting from the emissions of currently approved sources at the existing Boyne Road Landfill site is added to the predicted impact from the landfill expansion. This is a different qualitative cumulative impact assessment from that following the framework often used in federal EA processes. These are different cumulative impact assessments.

15.2.2 Spatial Boundaries

All predicted negative, residual effects of the Boyne Road Landfill expansion are located on the Site and in the Site-vicinity (including along the haul route); therefore, this is the area for primary consideration in the cumulative impact assessment.

15.2.3 Temporal Boundaries

The residual effects of the Boyne Road Landfill expansion will arise primarily during the construction and operations phases.

15.2.4 Other Projects and Activities

The existing zoning and land use in the vicinity of the landfill was considered in determining the other projects and activities to include in this cumulative assessment. The lands in the Site-vicinity are zoned as rural and the current land uses consist of undeveloped lands and forested areas, with agricultural uses (crop lands) to the south. There are also individual residences, with the closest being approximately 700 m to the west.

There are no known new future planned land uses in the Site-vicinity.

As such, the only expected activity in the Site-vicinity whose effects could possibly overlap with those from the landfill expansion is farming operations

15.2.5 Potential Impacts Due to Other Projects and Activities

A residual effects interaction matrix shown in Table 15-2 was completed to identify potential overlaps in terms of types of effect between negative, residual effects of the Boyne Road Landfill expansion and potential residual effects of other projects and activities on each component.

Table 15-2: Interactions Matrix – Type of Effect

Component/ Sub-component[1]	Potential Effects of Boyne Road Landfill Expansion	Farming Operations
Atmosphere	Odour	yes
	Dust emissions	yes
	Air quality	yes
	Noise emissions	yes
	GHG	yes
Hydrogeology	Groundwater quality impacts	no
Surface Water	Surface water quantity or quality impacts	no
Biology	Change in habitat as a result of alteration of flows (aquatic biological resources)	no
	Removal of vegetation and disruption to wildlife (terrestrial biological resources)	no

Component/ Sub-component[1]	Potential Effects of Boyne Road Landfill Expansion	Farming Operations
Transportation	Traffic along the haul routes	no
Socio-economic/Visual	Change in views of the landfill from the south	no

Notes: [1] Only those components with potential negative, residual effects are listed.

15.3 Analysis of Effects

Overlaps in terms of components in timing or space of effect between the negative, residual effects of the Boyne Road Landfill expansion and the potential residual effects of the other existing activities in the vicinity of the landfill were identified in Table 15-2.

Table 15-3 below provides a further discussion of the identified overlaps of potential cumulative effects results from the proposed Boyne Road Landfill expansion and other projects and activities in the area. Additional mitigation and/or monitoring strategies are identified where applicable and possible.

Table 15-3: Potential Cumulative Effects

Component / Indicators[1]	Potential Effects of the Boyne Road Landfill Expansion	Existing or Proposed Activities that Overlap in Time or Space	Proposed Mitigation or Monitoring	Potential Remaining Cumulative Effects
Atmosphere • Expected concentrations of air quality indicator compounds (selected regulated air contaminants to represent this type of project), including dust, at the property boundary and nearby sensitive receptors. • Expected site-related odour at off-site sensitive receptors. • Expected GHG emissions.	Expansion is expected to result in a variable increase in concentrations of most air quality indicator compounds, odour and GHG. Air quality and odour associated with the expansion are predicted to meet relevant Ontario Regulations at the property boundary or sensitive receptors.	Continued active farming, has the potential to contribute to reduced air quality. Farming operations can contribute to odours and GHG emissions.	General best management practices and operations as part of the design are anticipated to mitigate the Boyne Road Landfill expansion air quality and odour effects to within regulatory limits.	The air quality assessment completed concludes the effects will be within the compliance limits.

Component / Indicators[1]	Potential Effects of the Boyne Road Landfill Expansion	Existing or Proposed Activities that Overlap in Time or Space	Proposed Mitigation or Monitoring	Potential Remaining Cumulative Effects
Atmosphere • Noise levels at off-site PORs, or vacant lots that accommodate the future construction of PORs.	Site operations and ancillary equipment are expected to operate below the applicable sound level limits. Change in traffic noise levels between the existing landfill and proposed landfill expansion is insignificant to noticeable; this is considered an acceptable change.	Continued farming operations can have potential noise effects.	General best management practices and operations as part of the landfill expansion design and operations will mitigate potential noise effects.	The noise assessment completed concludes the effects will be within acceptable limits.

Note: [1] Only those components with negative, residual effects for the landfill expansion and negative effects for other projects and activities are listed.

16.0 Monitoring and Contingency

The following sections present the proposed monitoring programs for the landfill expansion (Section 16.1), followed by contingency plans (Section 16.2). Efforts have been made to conservatively estimate potential impacts associated with the proposed Boyne Road Landfill expansion; however, there is always some potential for variability between predicted and actual conditions. Effective monitoring and contingency measures are intended to address this potential variability and confirm the assumptions used in this assessment.

16.1 Monitoring

Groundwater and surface water monitoring programs have been ongoing at the Boyne Road Landfill site for approximately 30 years. These programs have evolved over time as additional hydrogeological investigations have been carried out, new monitoring wells have been installed, and the annual reports have been reviewed and commented on by MECP. As such, there is long, continuous history of monitoring data available at this site. The site-specific data obtained; the hydrogeological setting and understanding of groundwater flow; the limited surface water in the vicinity of the site; the location of the proposed expansion relative to the relative to the existing landfill footprint; and the proposed expansion design and mitigation measures, provide the justification for departures from the generic monitoring programs set out in *O.Reg.* 232/98. For the proposed expansion, it is proposed that the groundwater and surface water monitoring programs that are ongoing as part of the site operations continue, modified as appropriate for the expansion.

The proposed groundwater and surface water monitoring programs for the landfill expansion are summarized below and will be finalized and confirmed during the ECA amendment application for the expansion. The existing groundwater and surface water trigger mechanisms will also be reviewed and modified as appropriate at that time.

In view of the site setting and the findings of the impact assessments for the proposed expansion, there are no other monitoring programs recommended for the other disciplines as ECA conditions. It is note that there may be monitoring requirements associated with DFO authorization/approval requirements related to surface water works and/or in association with Species at Risk as part of a permit issued under the *Endangered Species Act* (*O.Reg.* 242/08).

16.1.1 Groundwater Monitoring

For the proposed landfill expansion, the continued objectives of the groundwater monitoring program are to monitor the quality of leachate and groundwater to determine the extent and degree of leachate effects on groundwater quality and assess site compliance with the MECP Reasonable Use Guideline as required by O.Reg. 232/98. The proposed groundwater monitoring program is summarized below.

For the proposed landfill expansion, the continued objectives of the groundwater monitoring program are to monitor the quality of leachate and groundwater to determine the extent and degree of leachate effects on groundwater quality and assess site compliance with the MECP

Reasonable Use Guideline as required by *O.Reg.* 232/98. The proposed groundwater monitoring program for the expansion is summarized below and shown on Figure 16-1.

Existing monitoring wells MW7, MW12, BRW3, MW15-1 and 15-2 are within or immediately adjacent to the proposed expansion. These monitoring wells will need to be decommissioned.

Monitoring Locations: MW1, MW4, MW5, MW9, MW13, MW14, MW16, MW17, MW18, MW19, BRW1-A, BRW1-B, BRW1-C, BRW2, MW06-20, MW06-21, MW06-22R, MW07-23, MW07-24, MW07-25, BRW07-26, BRW15-3, BRW16-1A, MW16-1B, MW16-2, BRW16-3A, MW16-3B, MW16-3C, BRW22-A, MW22-B

Monitoring Frequency: Spring, Late Summer

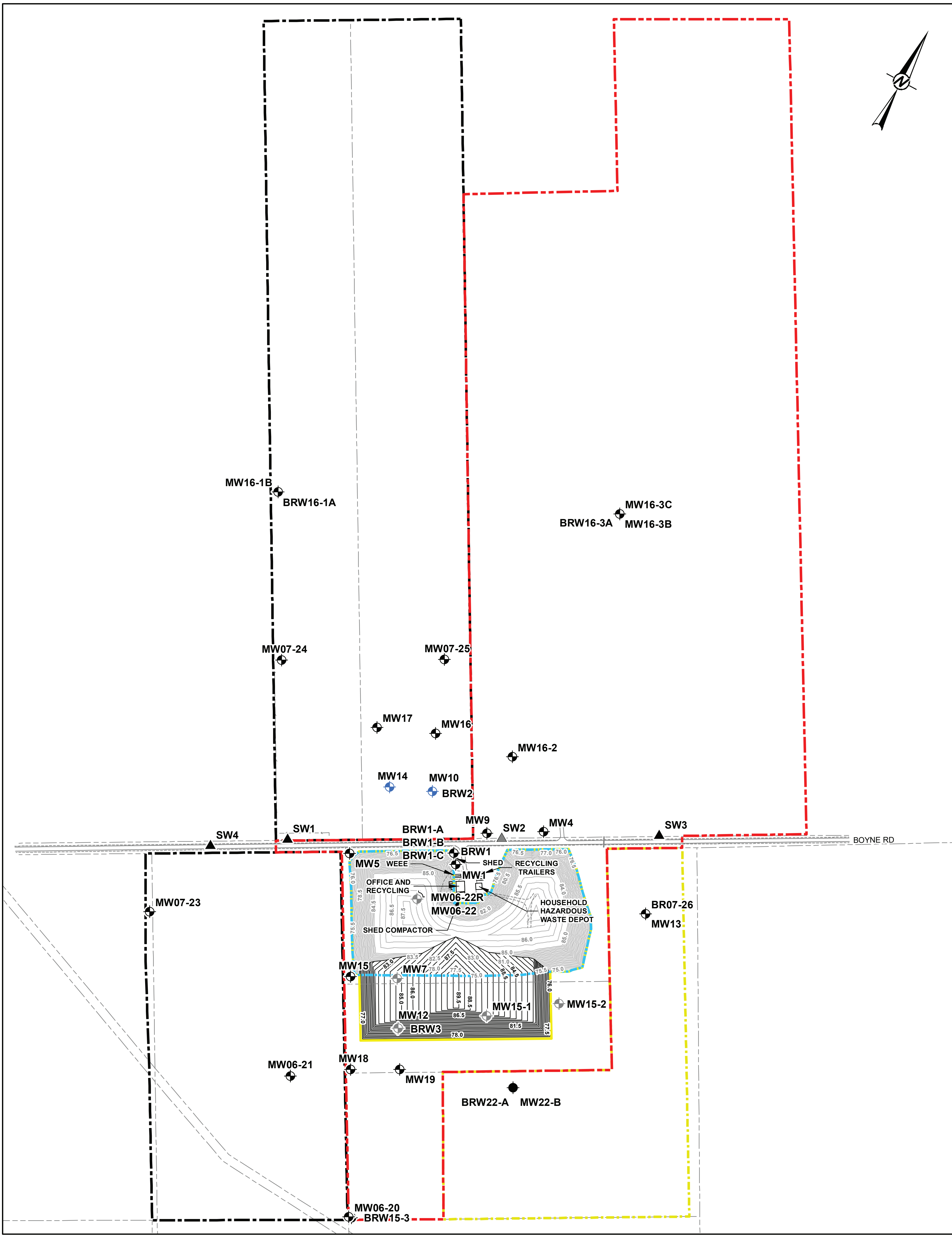
Field Measured Parameters: groundwater levels at all accessible monitoring wells, temperature, conductivity, pH

Laboratory Analytical Parameters: potassium, boron, iron, manganese, barium, aluminum, cadmium, chromium, cobalt, lead, zinc, TDS, alkalinity, sulphate, sodium, nitrate, chloride, BOD, DOC, ammonia, dissolved reactive phosphorous (DRP), phenols, hardness (calculated from laboratory calcium and magnesium analysis), copper, nickel; VOCs (at MW06-22R, MW1, MW4, MW5, and MW16 only)

16.1.2 Surface Water Monitoring

16.1.2.1 Surface Water Program

There are currently four surface water monitoring stations located within the drainage ditch (Volks Drain) along the north side of Boyne Road (on the opposite side of the road from the disposal area). SW1 and SW4 are located upstream of the landfill site, SW2 is located opposite the disposal area, and SW3 is located downstream of the landfill site. The locations of the four existing surface water monitoring stations are indicated on Figure 9-9. The sampling locations are proposed to remain with the exception of SW2, which will be removed from the monitoring program when the current open section of Volks Drain opposite the disposal area is converted to either a closed pipe or a lined ditch as part of the landfill expansion design. The proposed surface water monitoring program is summarized below.



LEGEND

- EXISTING LANDFILL FILL AREA
- PROPOSED LIMIT OF WASTE FOR THE LANDFILL EXPANSION AREA
- APPROXIMATE BOUNDARY OF CONTAMINATION ATTENUATION ZONE
- PROPOSED NEW LANDFILL PROPERTY BOUNDARY TO BE ADDED THROUGH AN ECA AMENDMENT
- APPROXIMATE LANDFILL SITE PROPERTY BOUNDARY
- GROUND SURFACE CONTOURS (mASL), BASED ON RESULTS OF THE SURVEYS CONDUCTED IN 2008, 2010, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019 AND 2020
- PROPOSED EXPANSION TOP OF WASTE ELEVATION CONTOURS (mASL)
- APPROXIMATE SURFACE WATER MONITORING LOCATION
- HISTORIC SURFACE WATER MONITORING LOCATION
- APPROXIMATE GROUNDWATER MONITORING LOCATION
- HISTORIC GROUNDWATER MONITORING LOCATION
- NEW PROPOSED GROUNDWATER MONITORING LOCATION
- WATER LEVEL ONLY MONITORING LOCATION

REFERENCES
1. BASE PLAN SUPPLIED IN ELECTRONIC FORMAT BY STANTEC CONSULTING LTD.
2. COORDINATE SYSTEM: MTM ZONE 9 NAD83.

DRAFT

0 60 120 180 240 300

1:6,500 METRES

CLIENT
TOWNSHIP OF NORTH DUNDAS

CONSULTANT
GOLDER MEMBER OF WSP

YYYY-MM-DD	2022-01-27
PREPARED	JEM/MG
DESIGN	PLE
REVIEW	----
APPROVED	----

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS RESIDUAL WASTE MANAGEMENT PLAN

TITLE
PROPOSED LANDFILL EXPANSION GROUNDWATER AND SURFACE WATER MONITORING PROGRAM LOCATIONS

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	0	16-1

Monitoring Locations: SW1, SW3, SW4 – refer to Figure 16-1

Monitoring Frequency: Spring, Late Summer, Late Fall

Field Measured Parameters: temperature, conductivity, pH, dissolved oxygen, approximate flow rate

Field Observations at Sampling Locations: aquatic plants, algae growth, litter/debris

Laboratory Analytical Parameters: boron, iron (total and dissolved), manganese, barium, aluminum, cadmium, chromium, cobalt, lead, zinc, alkalinity, nitrate, nitrite, chloride, BOD, ammonia, total phosphorous, phenols, potassium, copper, nickel, sodium, sulfate, TDS, TSS, chemical oxygen demand, DOC, total kjeldahl nitrogen, hardness (calculated from laboratory calcium and magnesium analysis), unionized ammonia (calculated from ammonia and field temperature analysis)

16.1.2.2 Stormwater Program

There is no existing stormwater management infrastructure at the site. It is proposed for the expansion that a sampling location be added at the outfall for the stormwater management pond, and it be sampled four times per year after significant rainfall events, once in spring and fall and two other sampling events. The samples collected will be analyzed for the same field measured parameters and laboratory parameters as listed above for surface water.

16.2 Contingency Measures

The following contingency measures are proposed and will be finalized and confirmed during the ECA amendment application for the expansion.

16.2.1 Groundwater

Both the existing landfill and the proposed expansion are intended to operate in compliance with the Reasonable Use Guideline B-7 as a natural attenuation landfill using adequate CAZ lands to provide the required attenuation of leachate effects on groundwater quality at the CAZ boundaries. The approved contingency plan for the existing landfill is considered appropriate for the proposed expansion as described in the following.

Should the ongoing groundwater monitoring program at any of the Compliance Evaluation Monitoring Wells define the existence of, or potential for, unacceptable impacts on groundwater quality beyond the CAZ boundaries, the Township will prepare and present a mitigation plan for the approval of the MECP Director and/or the District Manager. Contingency actions to be taken by the Township to prevent or remediate the off-property impacts could consist of:

- Delineation of the extent of the leachate impact on groundwater, and acquisition of additional CAZ land to bring the site into compliance with MECP Guideline B-7.
- Gaining control over the contaminated groundwater to bring the site into compliance.

- Developing and implementing groundwater control/treatment measures (for example, a groundwater interceptor trench in overburden or purge wells in bedrock) to bring the site into compliance with Guideline B-7.

16.2.2 Surface Water

During normal site operations, the valve on the stormwater management pond will be open. The results of the stormwater pond discharge quality sampling will be compared to proposed trigger values, which will be developed as part of the ECA application and approval process for the landfill expansion.

In the event of an exceedance of a trigger, additional stormwater sampling and analysis would be conducted at the wetland pond to confirm the result. If the second sample results in an exceedance, then the stormwater management pond would be operated in batch discharge mode with the gate valve closed.

During batch discharge mode operation, surface sampling would occur prior to the discharge of any surface water. When the concentration for each trigger parameter is less than the corresponding trigger concentration, the surface water would be released to the downstream receiver (Volks Drain). If the impounded stormwater quality does not meet the trigger concentrations, it could be slowly infiltrated back into the landfill or possibly pumped into a tanker and hauled to the municipality’s sewage lagoons.

17.0 Other Approvals

The following describes the additional approvals that will or may be required for the expansion of the Boyne Road Landfill site, in addition to the EA approval process.

17.1 Environmental Compliance Approvals

The *EPA*, Section 27 stipulates that "…no person shall use, operate, establish, alter, enlarge or extend a waste management system or a waste disposal site except under and in accordance with an environmental compliance approval [ECA]." The application to MECP for an amendment to the waste ECA under Part 5 of the *EPA* must be supported by a detailed report that complies with *O. Reg.* 232/98 Landfilling Standards and describes the proposed design and operations of the expanded Boyne Road Landfill site.

The *Ontario Water Resources Act (OWRA)*, Section 53 states "…no person shall use, operate, establish, alter, extend or replace new or existing sewage works except under and in accordance with an environmental compliance approval" (Ontario, 1990e). Sewage works in this context refer to collecting, transmitting, treating and/or discharging of stormwater. An ECA amendment from the MECP for 'sewage works' will be required for the proposed stormwater management system associated with the expanded landfill. The application must be supported by a stormwater management system design brief and ECA-level drawing for the proposed system.

17.2 Fisheries Act

Preparation and submission of a DFO Request for Review will be required to determine any additional mitigation and potential compensation in consultation with DFO.

17.3 Endangered Species Act

As habitat for SAR bats (little brown myotis) cannot be avoided within the proposed expansion, a permit under the *ESA* (*O. Reg.* 242/08) will be required, and conditions of such a permit will likely include compensation measures. Consultation with the MECP will be required to determine appropriate compensation measures.

17.4 Drainage Act

It is expected that an approval will be required under the provincial *Drainage Act* for the alternations/improvements in the portion of the Volks Drain on the north side of Boyne Road opposite the landfill site to construct the proposed mitigation measures.

17.5 Planning Act

Re-zoning of the landfill is not required to accommodate the proposed landfill expansion. However, it is recommended that once the EA has been approved confirming that the additional land to the south and east is to be reserved as part of the landfill site property for buffer area, the Township rezone the lands to ensure that the 500 m study area is correctly identified when using the land use schedule to the Zoning By-law, as this is the only tool available to the general public in regard to potential development within the 500 m restricted zone around the landfill site.

17.6 South Nation Conservation

A work permit from the Conservation Authority is expected to be required to undertake the site work associated with the expansion, i.e., since the expansion is within an area with a wetland land classification and/or because of the work to be carried out in the Volks Drain or associated with the perimeter drain.

18.0 Summary of Commitments

Compliance monitoring of the proposed Boyne Road Landfill expansion will be carried out to confirm that it has been constructed, implemented and operated in accordance with the commitments made by the Township during the preparation of the EA and any conditions of EA approval. This section lists the commitments made by the Township of North Dundas during the ToR (Table 18-1) and during the EA study process (Table 18-2). This list does not include items that will be legally required according to existing provincial regulations.

The following table (Table 18-1) summarizes the commitments made by the Township during the development of the ToR and during consultation for the ToR, and the status of fulfilling each of the commitments.

Table 18-1: List of ToR Commitments

ID	ToR Commitment	Status and How Commitment was Fulfilled
1	The EA will be prepared in accordance with subsections 6(2)(a) and 6.1(2) of the *EA Act*.	<u>Completed</u> Described in Section 2.3.1 of this EASR.
2	The Township will contact Indigenous groups to discuss their consultation needs and their involvement in the EA.	<u>Completed</u> Contact and consultation with Indigenous groups is provided in Sections 4.4.2 and 4.7 of this EASR and associated portions of Volume 4 Consultation Record.
3	The Township will consider the stated purpose of the EA during the EA process and will refine the purpose statement, if required. The final purpose statement will be provided in the EA Study report.	<u>Completed</u> As described and provided in Section 2.1 of this EASR.
4	Additional information on waste disposal and diversion projections will be provided during the EA to further support the need for the equivalent of 400,000 m^3 of additional waste disposal capacity (excluding final cover).	<u>Completed</u> A diversion study was completed, and proposed diversion activities and diversion predictions are summarized in Sections 6.3.5 and 7.0 of this EASR, with details provided in Volume 3 Appendix J. Revised residual waste disposal projections over the 25 year expansion operating period considering the predicted diversion are provided in Section 7.0 of this EASR.

ID	ToR Commitment	Status and How Commitment was Fulfilled
5	The Township commits to completing a Waste Diversion Study to assess further opportunities for at-source residential diversion in the Township.	Completed A study of further diversion opportunities for residential waste in the Township was completed and is summarized in Sections 6.3.5 and 7.0 of this EASR, with details provided in Volume 3 Appendix J.
6	The Township commits to updating the consultation plan to align with the Code of Practice: Consultation in Ontario's Environmental Assessment Process (2014).	Completed The consultation plan was updated in alignment with the Code of Practice (MOECC, 2014a) as described in Sections 4.1 through 4.3 of this EASR.
7	During the EA, the Township will develop evaluation criteria and indicators to be used to compare 'Alternative Methods', in consultation with the MECP, GRT, Indigenous communities and the public.	Completed Evaluation criteria for comparison of 'Alternative Methods' of landfill expansion were developed as described in Section 8.0 of this EASR. Input received from consultation on the proposed criteria is described in Section 11.3 of this EASR.
8	During the EA, the appropriate Study Areas for assessment of impacts from 'Alternatives To' and 'Alternative Methods' will be determined and described in the EA Study report.	Completed Appropriate Study Areas for the 'Alternatives To' and 'Alternative Methods" were determined and are described in Sections 5.1 and 8.1, respectively, of this EASR.
9	During the EA, detailed technical work plans for each of the environmental components will be developed in consultation with the agencies, Indigenous communities and the public. Where relevant, the Township will provide the detailed work plans to the appropriate regulatory agency for review and concurrence prior to undertaking the work.	Completed The development of detailed work plans and consultation on and agency review of the proposed work plans are as described in Section 8.2 of this EASR, and in Volume 4 Consultation Record – Appendix G1.
10	During the EA, a more detailed description of the existing conditions relevant to the preferred 'Alternative To' and 'Alternative Methods' will be prepared using a combination of sources of existing information and site-specific studies and will be provided in the EA Study report.	Completed A more detailed description of existing conditions for the 'Alternatives To' and 'Alternative Methods" was prepared and is described in Sections 5.2 - 5.9 and 9.0, respectively, of this EASR.

ID	ToR Commitment	Status and How Commitment was Fulfilled
11	The Township will provide in the EA Study report a final detailed description of the proposed undertaking once the preferred 'Alternative Method' has been identified.	Completed A final description of the preferred 'Alternative Method', which is the proposed Boyne Road Landfill expansion, is provided in Section 12.0 of this EASR.
12	The preferred alternative will be assessed from the perspective of climate change.	Completed An assessment of the proposed landfill expansion in terms of climate change is provided in Section 14.0 of this EASR.
13	A cumulative impact assessment of the preferred alternative will be completed and provided in the EA Study report.	Completed A cumulative impact assessment considering the proposed landfill expansion is provided in Section 15.0 of this EASR.
14	The Township commits to developing a monitoring framework during the preparation of the EA.	Completed A monitoring program framework is provided in Section 16.0 of this EASR.
15	The Township commits to circulating a draft EA Study report prior to submission of the final EA Study report.	Completed The Township circulated a Draft EASR on May 27, 2022 for a 4 week comment period.
16	The Township commits to determining and describing the other regulatory approvals required to proceed with the preferred alternative and including this in the EA Study report.	Completed Other regulatory approvals required to proceed with the proposed landfill expansion are provided in Section 17.0 of this EASR.
17	The list of ToR commitments will be provided in the EA Study report together with the way in which these commitments were addressed during the EA and the location of the information within the EA documents. The EA Study report will also include a list of commitments made by the Township during the preparation of the EA studies and during consultation throughout the EA process.	Completed The list of ToR commitments and how they were fulfilled during the EA, as well as a list of EA commitments by the Township, are provided in Section 18.0 of this EASR.

The following table (Table 18-2) summarizes the commitments made by the Township of North Dundas during the EA.

Table 18-2: List of Commitments made by the Township during the EA

ID	Component/Sub-component (if applicable)	Commitment (Location of Where Commitment was Made in the EA Document Package)	Project Phase
A	-	Implementation of all required Site effects monitoring and reporting programs. (EASR – Section 16)	Construction, operations and post-closure
B	-	The Township commits to implement the practices set out in the Waste Diversion Study. (EASR – Volume 3 Appendix J)	Operations
C	Atmosphere/Air Quality	The Township will operate the active disposal area with approx. 200 m^2 maximum working face and will apply daily cover of the waste. (EASR – Section 13.1.1.7)	Operations
D	Atmosphere/Air Quality	Landfill areas will be capped progressively as cells are completed (EASR – Section 13.1.1.7)	Operations and post-closure
E	Atmosphere/Air Quality	Township will implement dust mitigation measures related to vehicles. (EASR – Section 13.1.1.7)	Operations and post-closure
F	Atmosphere/Noise	The Township will implement best management practices to control potential off-site noise effects. (EASR - Section 13.1.2.4)	Operations
G	Geology and Hydrogeology	The Township commits, in future, to obtain control over an additional 400 m of groundwater travel distance towards the south as CAZ through either property acquisition or groundwater easement below this land area. (EASR – Section 13.2)	Operations and post-closure
H	Surface Water/Quantity	Design stormwater management system to match post-expansion outlet of surface water flows to corresponding pre-expansion flows to convey design storm flows. (EASR – Sections 12.5 and 13.3)	Pre-construction

ID	Component/Sub-component (if applicable)	Commitment (Location of Where Commitment was Made in the EA Document Package)	Project Phase
I	Surface Water/Quality	Design stormwater management controls to provide Enhanced Level Protection (80% TSS removal) as defined by the MECP SWM Planning and Design Manual (MECP, 2003). (EASR – Sections 12.5 and 13.3)	Pre-construction
J	Surface Water/Quality	Design stormwater management controls to provide water quality storage requirements based on Table 3.2 of the Ontario Stormwater Management Planning and Design Manual (MECP, 2003). (EASR – Sections 12.5 and 13.3)	Pre-construction
K	Surface Water/Quality	Surface drainage from potentially contaminated areas, i.e., originating from active landfilling areas, will be contained locally within berms and will discharge into the waste. Surface drainage from non-contaminated areas such as road areas and areas with interim or final landfill cover will be conveyed to the SWM wetland via the internal drainage ditches. (EASR – Sections 12.5 and 13.3)	Pre-construction
L	Biology/Terrestrial Ecosystem	Because the expansion will result in loss of habitat for little brown myotis, which is designated endangered under the ESA, an Information Gathering Form will be prepared and submitted to the MECP prior to any works being undertaken to initiate permitting under the ESA (*O.Reg.* 242/08). (EASR – Section 13.4)	Pre-construction
M	Biology/Terrestrial Ecosystem	Clearing of vegetation should take place outside of the breeding bird nesting period (April 1 – August 31). If clearing must occur during this time, a nest survey must be performed by a qualified biologist within 24 hours prior to the proposed works. (EASR – Section 13.4)	Construction and operations

ID	Component/Sub-component (if applicable)	Commitment (Location of Where Commitment was Made in the EA Document Package)	Project Phase
N	Biology/Terrestrial Ecosystem	Prepare and implement a Wildlife Observation Protocol to outline the steps to take in the event of an encounter with wildlife, including SAR, during the construction stage. All on-site personnel should be trained on the contents of the protocol. (EASR – Section 13.4)	Pre-construction, construction and operations
O	Biology/Aquatic Ecosystem	Prepare Sediment and Erosion Control Plan and Spill Management Plan for construction activities and site operations. (EASR – Section 13.4)	Pre-construction, construction and operations
P	Biology/Aquatic Ecosystem	Prepare and submit a Request for Review application to DFO to determine if habitat compensation measures are required for fish habitat affected by the landfill expansion. Obtain required DFO approvals. (EASR – Section 13.4)	Pre-construction
Q	Biology/Aquatic Ecosystem and Surface Water/Quality	As an alternative to the closed culvert pipe proposed to be installed in the portion of the Volks Drain on the north side of Boyne Road opposite the landfill site frontage, consideration would be given to an open lined ditch alternative at the ECA design and amendment application stage to mitigate both 1) the potential for leachate-impacted groundwater to the north roadside ditch(Volks Drain) and thereby protect surface water quality and 2) reduce the overall amount of impact on fish habitat and potential effects due to the loss of fish habitat in the Volks Drain if a closed pipe is used. (EASR – Sections 13.3 and 13.4)	Pre-construction
R	Biology/Aquatic Ecosystem and Surface Water/Quality	Prepare and submit an application for a work permit to South Nation Conservation to undertake the construction work associated with the expansion. (EASR – Section 17.6)	Pre-construction

ID	Component/Sub-component (if applicable)	Commitment (Location of Where Commitment was Made in the EA Document Package)	Project Phase
S	Biology/Aquatic Ecosystem	Complete in-water work/mitigation measures between June 29 and March 14 to avoid adverse aquatic effects. (EASR – Section 13.4)	Construction and operations
SS	Biology/Aquatic and Terrestrial Ecosystem	Above the wetted surface of the stormwater management pond native species will be considered. (EASR – Section 4.8.7)	Construction and Operations
T	Cultural Heritage Resources/Archaeological Resources	Should archaeological resources be unexpectedly encountered during the landfill expansion, a licensed archaeologist will be contacted to assess the need for additional archaeological assessment. (EASR – Section 13.7.1)	Construction and operations
U	Land Use Planning	Rezone the lands to be added to the landfill site property as Special Rural – Waste Disposal (SRD). (EASR – Section 13.5)	Operations
V	Socio-economic/Residents and Community	Prepare complaints response protocol. (EASR – Section 13.8.2)	Pre-construction and operations
W	Socio-economic/Visual	Plant additional trees within the tree line between the proposed expansion and the southwestern property boundaries. (EASR- Section 13.8.3)	Operations
X	Design and Operations	In the expansion design, provide a minimum separation of 1 m between the high groundwater table and the base of the waste in the expansion area. (EASR – Section 12.2)	Pre-construction
Y	Design and Operations	Preparing a landfill development phasing plan for the expansion. (EASR – Section 13.10)	Pre-construction

18.1 Potential Project Modifications

In accordance with section 4.2.5 of the MECP Code of Practice for Preparing and Reviewing Environmental Assessments in Ontario (MOECC, 2014), and subject to *O. Reg.* 101/07, minor modifications to the undertaking may be made following approval, subject to consultation with the MECP Environmental Assessment Branch to confirm any requirements with respect to such modifications under the *Environmental Assessment Act*.

19.0 References

Alberta Environment and Sustainable Resource Development (2013). Air Quality Model Guideline – Effective October 1st, 2014. ISBN: 978-1-4601-0599-3, Edmonton, Alberta.

Algonquins of Ontario, ND. Our Proud History. http://www.tanakiwin.com/algonquins-of-ontario/our-proud-history/. Accessed April 3, 2017.

Algonquins of Pikwakanagan, ND. History. http://www.algonquinsofpikwakanagan.com/culture_history.php. Accessed July 24, 2017

Armstrong, D.K. and Dodge, J.E.P. 2007. Paleozoic Geology of Sothern Ontario, Ontario Geological Survey, Miscellaneous Release, Data 210.

Bat Conservation International (BCI). 2021. Species Profiles (online). Available:http://www.batcon.org/resources/media-education/species-profiles.

Belden, H. & Co., 1879. Illustrated Historical Atlas of the County of Carleton. Reprinted, 1981, Ross Cumming, Port Elgin.

Bevers, Cameron, ND. Highway 31. http://www.thekingshighway.ca/Highway31.htm

Bing Imagery supplied by ESRI and Microsoft © 2019 Microsoft Corporation © 2019 Digital Globe © CNES (2019) Distribution Airbus DS

Bird Studies Canada. 2003. Marsh Monitoring Program: Training Kit and Instructions for Surveying Marsh Birds, Amphibians and their Habitats. 40 pp.

Bond, Courtney C. J.,1984. Where the Rivers Meet: An Illustrated History of Ottawa. Windsor Publications (Canada) Ltd., Ottawa.

Bookhout T.A., Editor. 1994. Research and management techniques for wildlife and habitats. Fifth ed.
The Wildlife Society, Bethesda M.D. 740 pp.

Brown MB, Brown CR. 2019. Barn Swallow (Hirundo rustica). In The Birds of North America Online (P. G. Rodewald, ed), version 2.0. Ithaca NY: Cornell Lab of Ornithology. Available: https://doi.org/10.2173/bna.barswa.02.

Cadman, M.D., D. A. Sutherland , G. G. Beck , D. Lepage , and A. R. Couturier , editors. 2007. Co-published by Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources, and Ontario Nature, Toronto, xxii + 706 pp. ISBN 978-1-896059-15-0.

Canada, Government of (Canada). 1985. Fisheries Act. R.S.C. 1985, c. F-14. Current to 20 October 2021. Ottawa ON: Minister of Justice. https://laws-lois.justice.gc.ca/eng/acts/f-14/

Canada, Government of (Canada). 1994. Migratory Birds Convention Act. S.C. 1994, c. 22.

Canada, Government of (Canada). 2002. Species at Risk Act. S.C. 2002, c. 29.

Canada, Government of (Canada). 2013. Canada Gazette Vol 147, 21.

Canada, Government of (Canada). 2017. Canada Gazette Vol 151, 43.

Canadian Council of Ministers of the Environment (CCME). 1999. *Canadian National Ambient Air Quality Objectives: Process and Status*. Available from ceqg-rcqe.ccme.ca/download/en/133/

Canadian Council of Ministers of the Environment (CCME). 2014. *Canada-Wide Standards for Particulate Matter and Ozone, 2012 Final Report.*

Canadian Council of Ministers of the Environment (CCME). 2007. Canadian Environmental Quality Guidelines (CEQG) – Water Quality Guidelines (CWQG) for the Protection of Aquatic Life, Summary Table. Available: https://ccme.ca/en/summary-tableCARF, 1992. Phase 1 Study of the Heritage Resources for the Proposed Water Works Project Village of Winchester, Dundas County. Consultant's Report Submitted to the Ministry of Heritage, Sport, Tourism and Culture Industries. Archaeological Licence 92-65.

Cataraqui Archaeological Research Foundation (CARF). 1992. Phase 1 Study of the Heritage Resources for the Proposed Water Works Project Village of Winchester, Dundas County. Consultant's Report Submitted to the Ministry of Heritage, Sport, Tourism and Culture Industries. Archaeological Licence 92-65.

Cataraqui Archaeological Research Foundation (CARF). 1997. Stage 1 Archaeological Assessment of Village of Winchester Sewage System Project, Stormont, Dundas & Glengarry County, Ontario. Consultant's Report Submitted to the Ministry of Heritage, Sport, Tourism and Culture Industries. Archaeological Licence 97-11.

Cataraqui Archaeological Research Foundation (CARF). 2000. Stage 2 Archaeological Assessment of the Township of North Dundas – Winchester Sewage System Project, Stormont, Dundas & Glengarry County, Ontario. Consultant's Report Submitted to the Ministry of Heritage, Sport, Tourism and Culture Industries. Archaeological Licence 99-050.

Chapman, L.S. and D.F. Putnam. 1984. The Physiography of Southern Ontario. Ontario Geological Survey, Special Volume 2. Ontario Ministry of Natural Resources. Toronto.

City of Cornwall. 2020. https://www.cornwall.ca/en/live-here/paramedic.aspx, accessed in 2020.

Crins, W.J., P.A. Gray, P.W.C. Uhlig, and M.C. Wester. 2009. The Ecosystems of Ontario, Part I: Ecozones and Ecoregions. Ontario Ministry of Natural Resources, Inventory, Monitoring and Assessment Section, Science and Information Branch, Peterborough, Ontario.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2011. COSEWIC assessment and status report on the Barn Swallow Hirundo rustica in Canada. Ottawa ON: Committee on the Status of Endangered Wildlife in Canada. Available: https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/cosewic/sr_barn_swallow_0911_eng.pdf. ix + 37 p.

Cummings, D.I. and Russell, H.A.J. 2007. The Vars-Winchester Esker Aquifer, South Nation Watershed, Ontario. CANQUA Fieldtrip Guidebook. Open File 5624.

Di Rocco, R, and R. Gervais. 2021. SPOT: Swim Performance Online Tools. [accessed 14 January 2022]. http://www.fishprotectiontools.ca/

Dobbyn, J.S. 1994. Atlas of the Mammals of Ontario. Federation of Ontario Naturalists, Toronto. 120 pp.

eBird. 2021. eBird: An online database of bird distribution and abundance [web application]. eBird, Cornell Lab of Ornithology, Ithaca, New York. Available: http://www.ebird.org

Environment and Climate Change Canada (ECCC) and Health Canada (2017). *Draft Screening Assessment Hydrogen Sulfide (H_2S), Sodium Sulfide (Na(SH)) and Sodium Sulfide (Na_2S), September 2017.*

Environment and Climate Change Canada (ECCC). 2018a. Recovery Strategy for the Little Brown Myotis (Myotis lucifugus), the Northern Myotis (Myotis septentrionalis), and the Tri-colored Bat (Perimyotis subflavus) in Canada. Species at Risk Act Recovery Strategy Series. Ottawa ON: Environment and Climate Change Canada. Available: https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/plans/Rs-TroisChauveSourisThreeBats-v01-2019Nov-Eng.pdf. ix + 172 p.

Environment and Climate Change Canada (ECCC). 2018b. Recovery Strategy for the American Ginseng (Panax quinquefolius) in Canada. Species at Risk Act Recovery Strategy Series. Ottawa ON: Environment and Climate Change Canada. Available: https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/plans/rs_american_ginseng_e_final.pdf. vii + 32 p.

Environment and Climate Change Canada (ECCC) (2019). National Air Pollution Surveillance Program (NAPS). http://www.ec.gc.ca/rnspa-naps/

Environment and Climate Change Canada (ECCC) (2020a) 1990-2018 Greenhouse Gas Sources and Sinks in Canada.https://publications.gc.ca/collections/collection_2020/eccc/En81-4-1-2018-eng.pdf

Environment and Climate Change Canada (ECCC) (2020b) 2020 Canada's Greenhouse Gas Quantification Requirements.

Ellis, C.J. and Deller, D.B., 1990. Paleo-Indians. In The Archaeology of Southern Ontario to A.D. 1650, eds C.J. Ellis and N. Ferris, Ontario Archaeology Society (Occasional Publication No. 5), London, Ontario, p. 37-74.

Ellis, Chris J., Kenyon, Ian T. and Michael W. Spence, 1990. The Archaic. In The Archaeology of Southern Ontario to A.D. 1650, edited by Chris Ellis and Neal Ferris, pp. 65-124. Occasional Publication of the London Chapter, OAS Number 5.

Farrar JL. 1995. Trees in Canada. Markham, ON: Fitzhenry & Whiteside Limited and Ottawa, ON: Canadian Forest Service, Natural Resources Canada. 502 p.

Fisheries and Oceans Canada (DFO). 2008. Protocol for the Detection and Relocation of Freshwater Mussel Species at Risk in Ontario-Great Lakes Area (OGLA). Canadian Manuscript Report of Fisheries and Aquatic Sciences 2790. [accessed December 2021] https://waves-vagues.dfo-mpo.gc.ca/Library/332071.pdf.

Fisheries and Oceans Canada (DFO). 2013. Ontario Restricted Activity Timing Windows for the Protection of Fish and Fish Habitat. [accessed December 2021] Projects Near Water - Ontario Restricted Activity Timing Windows for the Protection of Fish and Fish Habitat (dfo-mpo.gc.ca).

Fisheries and Oceans Canada (DFO). 2018. Pathways of Effects. [accessed December 2021] https://www.dfo-mpo.gc.ca/pnw-ppe/pathways-sequences/index-eng.html.

Fisheries and Oceans Canada (DFO). 2019a. Fish and Fish Habitat Protection Policy Statement, August 2019. Ecosystem Programs Policy. [accessed December 2021] https://www.dfo-mpo.gc.ca/pnw-ppe/policy-politique-eng.html.

Fisheries and Oceans Canada (DFO). 2019b. Measures to Protect Fish and Fish Habitat. [accessed December 2021] https://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures-eng.html.

Fisheries and Oceans Canada (DFO). 2020a. Projects Near Water. [accessed December 2021] https://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html.

Fisheries and Oceans Canada (DFO). 2020b. Interim code of practice: Routine maintenance dredging. [Accessed December 2021] Interim code of practice: Routine maintenance dredging (dfo-mpo.gc.ca).

Fisheries and Oceans Canada (DFO). 2020c. Interim code of practice: Temporary cofferdams and diversion channels. [Accessed December 2021] Interim code of practice: Routine maintenance dredging (dfo-mpo.gc.ca).

Fisheries and Oceans Canada (DFO). 2020d. Interim code of practice: Culvert maintenance. [Accessed December 2021] Interim code of practice: culvert maintenance (dfo-mpo.gc.ca).

Fisheries and Oceans Canada (DFO). 2020e. Interim code of practice: End-of-pipe fish protection screens for small water intakes in freshwater. [Accessed December 2021] Interim code of practice: End-of-pipe fish protection screens for small water intakes in freshwater (dfo-mpo.gc.ca)

Fisheries and Oceans Canada (DFO). 2021. Aquatic Species at Risk Mapping (Online). Available: http://www.dfo-mpo.gc.ca/species-especes/fpp-ppp/index-eng.htm

Forest Gene Conservation Association (FGCA). 2010. Butternut Health Assessment in Ontario: Finding Retainable Trees. The Government of Canada Habitat Stewardship Program (2007) for Species at Risk.

Freeze, R.A., and J.A. Cherry, 1979. Groundwater. Prentice-Hall, NJ.

Gabhauer MA. 2007. Bobolink, pp. 586-587 in Cadman MD, Sutherland DA, Beck GG, Lepage D, Couturier AT, eds. Atlas of the Breeding Birds of Ontario, 2001-2005. Toronto ON: Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources and Ontario Nature. xxii + 706 p.

Geological Survey of Canada. (1982). Surficial Geology, Winchester, Ontario: Map No. 1491A.

Golder Associates Ltd., 1995. Report on Hydrogeological Evaluation for Communal Water Supply, Provost Cartage Property, Village of Winchester. Submitted to J.L. Richards and Associates Limited.

Golder Associates Ltd., 2003. Report on Evaluation of Potential Capacity for Water Taking, Well Field #7, Communal Wells, Village of Winchester, Ontario. Report No. 021-2859/2000, submitted to the Corporation of the Township of North Dundas, October 2003.

Golder Associates Ltd., 2003a. Hydrogeological Evaluation of Municipal Water Supply (Well 6) Located in the Maple Ridge Glaciofluvial Complex, Village of Chesterville, Ontario, Report No. 021-2859/1070, submitted to the Corporation of the Township of North Dundas, December 2003.

Golder Associates Ltd. and Sauriol Environmental Inc., 2005. Environmental Study Report, Phase I and II Hydrogeological Components, Townships of North Dundas and Russell, Ontario. Report No. 04-1120- 732, submitted to Stantec Consulting Ltd., January 2005.

Golder Associates Ltd., May 2013. Design and Operations Plan, Boyne Road Landfill, Township of North Dundas, Ontario: Report No. 10-1125-0090/5000.

Golder Associates Ltd., 2015. *Waste Management Alternatives Evaluation, Township of North Dundas*. Township of North Dundas, Winchester, Ontario, Report No. 1416664/6000, November 2015.

Golder Associates Ltd., 2017. Stage 2 Archaeological Assessment, Riverside South Phase 12-708 River Road, Part Lot 20 and 21, Broken Front Concession Rideau Front, Geographic Township of Gloucester, Ottawa Ontario. Consultant’s Report Submitted to the Ministry of Heritage, Sport, Tourism and Culture Industries. PIF Number P366-0049-2015.

Golder Associates Ltd., 2021. 2020 Groundwater and Surface Water Monitoring Program and Operations Monitoring, Boyne Road Landfill Site, Township of North Dundas, Ontario: Report No. 20139489/4000.

GoldSim Technology Group. 2010a. GoldSim User’s Guide. Version 10.5.

GoldSim Technology Group. 2010b. GoldSim Contaminant Transport Module. Version 6.0.

Gorenc, S., Stanfield, L. 2017. Ontario Stream Assessment Protocol (OSAP) – Section 4, Module 11: Unconstrained Headwater Sampling.

Harkness, John Graham, 1946. Stormont, Dundas and Glengarry: A History. Mutual Press Limited, Ottawa.

Health Canada (1994). National Ambient Air Quality Objectives for Carbon Monoxide. Executive Summary, Desirable, Acceptable and Tolerable Levels. ISBN 0-662-25642-5.

Heidenreich, Conrad and J.V. Wright,1987. Population and Subsistence. Plate 18, Historical Atlas of Canada, Volume 1: From the Beginning to 1800, edited by R. Cole Harris, University of Toronto Press, Toronto.

Hemson Consulting Ltd. (January 2013). *Population and Growth Projections; United Counties of Stormont, Dundas, and Glengarry.* Toronto, ON. https://www.sdgcounties.ca/sites/default/files/2021-01/hemson_pop_growth_report.pdf

Holmes, Joan & Associates, Inc.,1993. Report on the Algonquins of Golden Lake Claim.

Hull SD, Shaffer JA, Lawrence DI. 2019. The effects of management practices on grassland birds: Eastern Meadowlark (*Sturnella magna*). Jamestown ND: US Geological Survey. Available: https://pubs.usgs.gov/pp/1842/mm/pp1842MM.pdf.

Humphrey C. 2017. Recovery Strategy for the Eastern Small-footed Myotis (*Myotis leibii*) in Ontario. Ontario Recovery Strategy Series. Peterborough ON: Ontario Ministry of Natural Resources. Available: https://files.ontario.ca/mnrf_sar_rs_esfm_final_accessible.pdf vii + 76 p.

Humphrey C. and Fotherby, H. 2019. Recovery Strategy for the Little Brown Myotis (*Myotis lucifugus*), Northern Myotis (*Myotis septentrionalis*) and Tri-colored Bat (*Perimyotis subflavus*) in Ontario. Ontario Recovery Strategy Series. Prepared by the Ministry of the Environment, Conservation and Parks, Peterborough, Ontario. vii + 35 pp. + Appendix. Adoption of the Recovery Strategy for the Little Brown Myotis (*Myotis lucifugus*), the Northern Myotis (*Myotis septentrionalis*), and the Tri-colored Bat (*Perimyotis subflavus*) in Canada (Environment and Climate Change Canada 2018)

Indigenous and Northern Affairs Canada (INAC), 2011. A History of Treaty-Making in Canada. https://www.aadnc-aandc.gc.ca/eng/1314977704533/1314977734895. Accessed April 3, 2017.

Indigenous and Northern Affairs Canada (INAC), 2013. Algonquins of Pikwakanagan. https://www.aadnc-aandc.gc.ca/eng/1357840942028/1360163432152. Accessed February 10, 2020.

Indigenous and Northern Affairs Canada (INAC), 2016. Algonquins of Ontario Land Claim Negotiations: Infographic. https://www.aadnc-aandc.gc.ca/eng/1476707913976/1476707942691. Accessed April 3, 2017.

Intergovernmental Panel on Climate Change (IPCC) (2012) Climate Change 2007: The Physical Science Basis, Working Group 1 contribution to the IPCC Fourth Assessment Report – Errata http://www.ipcc.ch/report/ar4/wg1/.

Jamieson, James B.,1989. An Inventory of the Prehistoric Archaeological Sites of Ottawa-Carleton. Paper submitted to the Ontario Archaeological Society, Ottawa Chapter.

Jones, C., Layberry, R., and MacNaughton, A. 2021. Ontario Butterfly Atlas Online. Toronto Entomologists' Association. Available: http://www.ontarioinsects.org/atlas_online.htm

Lall, R., Kendall., M., Ito, K., Thurston, G.D. 2004. Estimation of Historical Annual $PM_{2.5}$ Exposures for Health Effects Assessment. Atmospheric Environment 38 (2004) 5217 – 5226. Accessed https://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/display.files/fileID/13226.

Landscape Institute / Institute of Environmental Management and Assessment (LI/IEMA). 2013. Guidelines for Landscape and Visual Impact Assessment. 3rd Edition, Routledge

Lee, H.T., W.D. Bakowsky, J. Riley, J. Bowles, M. Puddister, P. Uhlig and S. McMurray. 1998. Ecological Land Classification for Southern Ontario: First Approximation and its Application. Ontario Ministry of Natural Resources, South Central Region, Science Development and Transfer Branch. SCSS Field Guide FG-02.

Land Information Ontario (LIO). 2021. LIO Metadata Management Tool – Ministry of Natural Resources (online). Available: http://www.mnr.gov.on.ca/en/Business/LIO/2ColumnSubPage/STEL02_167955.html. Accessed: June 2017.

Loring, Stephen, 1980. Paleo-Indian Hunters and the Champlain Sea: A Presumed Association. Man in the Northeast 19: 15-42.

McDiarmid, R. W. 2012. Reptile Biodiversity. Standard Methods for Inventory and Monitoring. Mercedes S. Foster, Craig Guyer, J. Whitfield Gibbons, Neil Chernoff (Eds.). University of California Press. 412 pages.

Mika, Nick and Helma Mika,1983. Places in Ontario: Their Name Origins and History. Part III N-Z. Belleville: Mika Publishing Company.

Ministry of Agriculture Food and Rural Affairs. March 2018. *Draft Agricultural Impact Assessment (AIA) Guidance Document.* Toronto, ON. http://www.omafra.gov.on.ca/english/landuse/aiagd.pdf

Ministry of the Environment (MOE). 1994. Guideline B-7: Incorporation of the Reasonable Use Concept into MOEE Groundwater Management Activities. Ontario Ministry of the Environment, Program Development Branch, Ontario.

Ministry of Environment and Energy (MOEE). 1994a. Water Management: Policies, Guidelines, Provincial Water Quality Objectives. Available: https://atrium.lib.uoguelph.ca/xmlui/bitstream/handle/10214/15816/OME_water_qual_object94.pdf?sequence=1&isAllowed=y

Ministry of the Environment (MOE). 1995. Ontario Guideline D-1, Land Use Compatibility. Available: https://www.ontario.ca/page/d-1-land-use-and-compatibility

Ministry of the Environment (MOE). 1995a. Ontario Guideline D-4, Land Use On or Near Landfills and Dumps. Available: https://www.ontario.ca/page/d-4-land-use-or-near-landfills-and-dumps

Ministry of the Environment (MOE). 1995b. Ontario Guideline D-6, Compatibility between Industrial Facilities. Available : https://www.ontario.ca/page/d-6-compatibility-between-industrial-facilities

Ministry of the Environment (MOE). 2012. Landfill Standards: A guideline on the Regulatory and Approval Requirements for New or Expanding Landfilling Sites (*O.Reg. 232/98*). January 2012.

Ministry of the Environment and Climate Change (MOECC). 2014 Consultation in Ontario's Environmental Assessment Process. 2014

Ministry of the Environment and Climate Change (MOECC). (2014a). *Code of Practice for Preparing and Reviewing Environmental Assessments in Ontario.* Queen's Printer for Ontario: Toronto, Ontario.

Ministry of the Environment and Climate Change (MOECC). (2014b). *Code of Practice for Preparing and Reviewing Terms of Reference for Environmental Assessments in Ontario.* Queen's Printer for Ontario: Toronto, Ontario. Ontario Ministry of Municipal Affairs and Housing (MMAH). 2020. Provincial Policy Statement. URL: http://www.mah.gov.on.ca/Page1485.aspx.

Ministry of Environment and Climate Change (MOECC). 2017. Guide: Consideration of Climate Change in Environmental Assessment in Ontario. December 2017.

Ministry of the Environment, Conservation and Parks (MECP). 1998. Noise Guideline for Landfill Sites. October 1998. Queen's Printer for Ontario: Toronto, Ontario.

Ministry of the Environment, Conservation and Parks (MECP). 2003. Stormwater Management Planning and Design Manual. March 2003. Queen's Printer for Ontario. Available: https://www.ontario.ca/document/stormwater-management-planning-and-design-manual-0

Ministry of the Environment, Conservation and Parks (MECP). 2013. Environmental Noise Guideline Stationary and Transportation Sources – Approval and Planning Publication NPC-300. August 2013. Queen's Printer for Ontario: Toronto, Ontario.

Ministry of the Environment, Conservation and Parks (MECP). 2016. Technical Bulletin: Methodology For Modelling Assessments Of Contaminants With 10-Minute Average Standards And Guidelines For Odour Under O. Reg. 419/05. Standards Development Branch.

Ministry of the Environment, Conservation and Parks (MECP). 2017. Air Dispersion Modelling Guideline for Ontario, Version 3 – February 2017.

Ministry of the Environment, Conservation and Parks (MECP). 2018. Food and Organic Waste Policy Statement.

Ministry of the Environment, Conservation and Parks (MECP). 2018a. A Made-in-Ontario Environment Plan.

Ministry of the Environment, Conservation and Parks (MECP. 2018b. *Procedure for Preparing an Emission Summary and Modelling Report Guideline A-10 Version 4.1.* PIBs 3614e04.1.

Ministry of the Environment, Conservation and Parks (MECP). 2018c. Air Quality in Ontario 2018 Report.

Ministry of the Environment, Conservation and Parks (MECP). 2019a. Discussion paper on reducing litter and waste in our communities (updated 2021).

Ministry of the Environment, Conservation and Parks (MECP). 2020a. Strategy for a Waste-Free Ontario: Building the Circular Economy (2017, updated 2020)

Ministry of the Environment, Conservation and Parks (MECP) (2020b). Ambient Air Quality Criteria. Technical Assessment and Standards Development Branch, Human Toxicology and Air Standards Section.

Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI). 2011. Standards and Guidelines for Consultant Archaeologists. Queens Printer, Ontario.

Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI). 2016. Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes: A Checklist for the Non-Specialist. Ministry of Tourism, Culture and Sport, Toronto, ON.

Ministry of Natural Resources (MNRF), 1985. Paleozoic Geology, Winchester Area, Southern Ontario: Map No. P.2721.

Ministry of Natural Resources and Forestry (MNRF). 2000. Significant Wildlife Habitat Technical Guide (SWHTG). 151 pp.

Ministry of Natural Resources and Forestry (MNRF). 2010. Natural Heritage Reference Manual for Natural Heritage Polices of the Provincial Policy Statement, 2005 Second Edition.

Ministry of Natural Resources and Forestry (MNRF). 2011. Bats and Bat Habitats: Guidelines for Wind Power Projects. 32 pp.

Ministry of Natural Resources and Forestry (MNRF). 2013a, May. Reptile and Amphibian Training Workshop Materials. Elbow Lake Environmental Education Centre, Kingston, Ontario.

Ministry of Natural Resources and Forestry (MNRF). 2013b. Butternut Health Assessor Protocol.

Ministry of Natural Resources and Forestry (MNRF). 2014. Ontario Wetland Evaluation System – Southern Manual. 3rd Edition (Version 3.2).

Ministry of Natural Resources and Forestry (MNRF). December 2014a. Butternut Health Assessment Guidelines: Assessment of Butternut Tree Health for the Purposes of the Endangered Species Act, 2007. Species at Risk Branch.

Ministry of Natural Resources and Forestry (MNRF). December 2014b. Draft Survey Protocol for Eastern Whip-poor-will (*Caprimulgus vociferus*) in Ontario. Species at Risk Branch, Peterborough. iii + 10 pp.

Ministry of Natural Resources and Forestry (MNRF), Digital Raster Acquisition Project Eastern Ontario (DRAPE) 2014c. File provided to Golder Associates on request.

Ministry of Natural Resources and Forestry (MNRF). 2014d. Significant Wildlife Habitat Mitigation Support Tool. Version 2014.

Ministry of Natural Resources and Forestry (MNRF). 2015. Significant Wildlife Habitat 6E Criterion Schedule. 39 pp.

Ministry of Natural Resources and Forestry (MNRF). 2017. Wildland Fire Assessment and Mitigation Reference Manual in support of Provincial Policy Statement, 2014. Toronto: Queen's Printer for Ontario.

Ministry of Natural Resources and Forestry (MNRF). 2021. Southern Ontario Land Resource Information System. Available at https://www.javacoeapp.lrc.gov.on.ca/geonetwork?uuid=635529ce-2639-46f8-9fc2-43fbdd68aad 1. Accessed April 2021.

Ministry of Natural Resources and Forestry (MNRF). 2021a. Make-a-Map Natural Heritage Explorer (online). Available: http://www.giscoeapp.lrc.gov.on.ca/Mamnh/Index.html?site=MNR_NHLUPS_NaturalHeritage&viewer=NaturalHeritage&locale=en-US.

Ministry of Natural Resources and Forestry (MNRF). 2021b. Land Information Ontario, Aquatic Resources Area Layer. Fisheries Section, Species Conservation Policy Branch.

Ministry of Northern Development and Mines (MNDM). 2016. OGSEarth – Karst Data in GIS Format (Online). Available: http://www.mndm.gov.on.ca/en/mines-and-minerals/applications/ogsearth

Oliver, Mangione, McCalla & Associates Ltd. (OMM). 1991. Township of Winchester Landfill Site Report on Hydrogeology Site Operation and Development Final Report.

Ontario Agricultural College. April 1952. *Soil Survey of Dundas County*. Guelph, ON. https://sis.agr.gc.ca/cansis/publications/surveys/on/on14/on14_report.pdf

Ontario, Government of (Ontario). 1990a. *Environmental Assessment Act*, R.S.O. 1990, c. E.18. Current to 1 June 2021. https://www.ontario.ca/laws/statute/90e18

Ontario, Government of (Ontario). 1990b. *The Planning Act*,R.S.O. 1990, c. P.13. Current to 19 October 2021. https://www.ontario.ca/laws/statute/90p13?search=planning+act

Ontario, Government of (Ontario). 1990c. *Ontario Heritage Act*, R.S.O. 1990, c. O.18. Current to 7 May 2020. http://www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_90o18_e.htm

Ontario, Government of (Ontario). 1990d. *Environmental Protection Act*, R.S.O. 1990, c.E.19. Current to 1 June 2021. https://www.ontario.ca/laws/statute/90e19

Ontario, Government of (Ontario). 1990e. Ontario Water Resources Act, R.S.O. 1990, c.O.40. Current to 1 June 2021. https://www.ontario.ca/laws/statute/90o40

Ontario, Government of (Ontario). 1998a. *O.Reg. 232/98, Landfilling Sites*. Current to 31 October 2011. https://www.ontario.ca/laws/regulation/980232

Ontario, Government of (Ontario). 1998b. *O.Reg. 524/98, Environmental Compliance Approvals – Exemptions from Seciom Section 9 of the Act.* Current to 1 July, 2021. https://www.ontario.ca/laws/regulation/980524

Ontario, Government of (Ontario). 2005. *O. Reg. 419/05, Air Pollution – Local Air Quality.* Current to 17 September 2021. ontario.ca/laws/regulation/050419

Ontario, Government of (Ontario). 2006. *O. Reg. 170/06, South Nation Conservation Authority: Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses*. Current to 8 February 2013. https://www.ontario.ca/laws/regulation/060170

Ontario, Government of (Ontario). 2006. *O. Reg. 9/06, Criteria for Determining Cultural Heritage Value or Interest*. Current to 7 May 2020. https://www.canlii.org/en/on/laws/regu/o-reg-9-06/latest/o-reg-9-06.html

Ontario, Government of (Ontario). 2007. *Endangered Species Act*. S.O. 2007, c.6. Current to 19 October 2021. https://www.ontario.ca/laws/statute/07e06

Ontario, Government of Ontario (Ontario). 2016. *Resource Recovery and Circular Economy Act.* S.O. 2016, Chapter 12, Schedule 1. Last amended December 2019.

Ontario, Government of (Ontario). 2018. *O.Reg. 390/18, Greenhouse Gas Emissions: Quantification, Reporting and Verification.* Current to 21 October 2021. https://www.ontario.ca/laws/regulation/180390

Ontario Odonata Atlas. 2019. Natural Heritage Information Centre, Ontario Ministry of Natural Resources. http://www.mnr.gov.on.ca/MNR/nhic/odonates/ohs.html.

Ontario Nature. 2021. Ontario Reptile and Amphibian Atlas (online). Available: http://www.ontarionature.org/protect/species/herpetofaunal_atlas.php

Ottawa, City of (Ottawa). 2012. City of Ottawa Sewer Design Guidelines. Second Edition, October 2012.Pendergast, James F., 1999. The Ottawa River Algonquin Bands in a St. Lawrence Iroquoian Context. Canadian Journal of Archaeology 23(1/2): 63-136.

Ottawa, City of (Ottawa). 2016. Environmental Noise Control Guidelines. January 2016.

Pilon, Jean-Luc and Fox, William, 2015. “St. Charles or Dovetail Points in Eastern Ontario” in Arch Notes, Newsletter of the Ontario Archaeological Society, New Series Vol. 20 Issue 1 pp 5-9.

Pilon, Jean-Luc and Young, Janet, 2009. Ottawa Valley Burial Patterns Spanning Six Millennia. In Painting the Past with a Broad Brush: Papers in Honour of James Valliere Wright, edited by David L. Keenlyside and Jean-Luc Pilod, pp. 181-211. Gatineau, QC: Canadian Museum of Civilization.

Poisson, G., and Ursic, M. 2013. Recovery Strategy for the Butternut (Juglans cinerea) in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. v + 12 pp. + Appendix vii + 24 pp. Adoption of the Recovery Strategy for the Butternut (Juglans cinerea) in Canada (Environment Canada 2010).

Pyle R.M. 1984. The Audubon Society Handbook For Butterfly Watchers. New York. Charles Schribner’s Sons.

Renfrew R, Strong AM, Perlut NG, Martin SG, Gavin TA. 2015. Bobolink (Dolichonyx oryzivorus). In The Birds of North America (PG Rodewald, ed.), version 2.0. Ithaca NY: Cornell Lab of Ornithology. Available: https://doi.org/10.2173/bna.176.

Resource Recovery and Productivity Authority, 2017, 2018. Municipal Datacall Reports. Available from: https://rpra.ca/programs/about-the-datacall/. Last accessed May 2020.

Roseberry JL, Klimstra WD. 1970. The nesting ecology and reproductive performance of the Eastern Meadowlark. The Wilson Bulletin 82(3): 243-267.

Rowe, J.S. 1972. Forest Regions of Canada. Publication No. 1300. Ottawa: Canadian Forestry Service, Department of the Environment.

Rowe, R.K., and J.R. Booker. 2005. POLLUTEv7: Pollutant Migration through a nonhomogeneous soil. GAEA Environmental Engineering Ltd., Whitby, Ontario.

Sauer, J. R., J. E. Hines, and J. Fallon. 2008. The North American Breeding Bird Survey, Results and Analysis 1966 – 2007. Version 5.15.2008. USGS Patuxent Wildlife Research Center, Laurel, Maryland, USA.

Soils Landscape of Canada v3.2 available at; http://sis.agr.gc.ca/cansis/nsdb/slc/v3.2/index.html

South Nation Conservation (SNC). 2016. South Nation Conservation 2016 Forest Cover – Overview and Recommendations (Online). Available: https://www.nation.on.ca/sites/default/files/SNCForestCoverAnalysis_DocumentVer22_0.pdf

South Nation Conservation and Raisin Region Conservation, 2016a. Source Protection Plan, RaisinSouth Nation Source Protection Region, Version 1.4.0, September 1, 2016

South Nation Conservation and Raisin Region Conservation, 2016b. Assessment Report, South Nation Source Protection Area, Version 1.1.0, September 1, 2016.

South Nation Conservation (SNC). 2018. State of the Nation: Watershed Report Card 2018 (Online). Available: https://www.nation.on.ca/sites/default/files/SNCA5YR_Watershed_Report-ENG.pdf

Spence, M.W., R.H. Phil and C.R. Murphy, 1990. Cultural Complexes of the Early and Middle Woodland Periods'. In The Archaeology of Southern Ontario to A.D. 1650, Occasional Publications of the London Chapter, Ontario Archaeological Society, No. 5. London, Ontario.

Stanfield L.W. (Ed). 2017. Ontario Stream Assessment Protocol (OSAP). Version 10. Ontario Ministry of Natural Resources and Forestry (MNRF).

Statistics Canada. 2016. Census Profile. https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/index.cfm?Lang=E.

Statistics Canada. 2017. *Winchester [Population centre], Ontario and Stormont, Dundas and Glengarry, UC [Census division], Ontario* (table). *Census Profile.* 2016 Census. Ottawa, ON. https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/index.cfm?Lang=E (accessed November 23, 2021).

Stenge, D.L., and S.R. Peterson. 1989. Chemical Databases for the Multimedia Environmental Pollutant Assessment System (MEPAS): Version 1. Battelle Memorial Institute.

Surtees, Robert J., 1994. Land Cessions, 1763-1830. In Aboriginal Ontario: Historical Perspectives on the First Nations. Edited by Edward S. Rogers and Donald B. Smith, pp 92-121. Toronto: Dundurn Press.

Swayze, Ken, 2004. Stage 1 & 2 Archaeological Assessment of Proposed Central Canada Exhibition, Albion Road Site, Part Lots 24 and 25, Concession 3, Gloucester Township (Geo.), City of Ottawa. Consultant's report submitted to the Ontario Ministry of Heritage, Sport, Tourism and Culture Industries. PIF: P039-034.

Tasker, Paul, 2016. Historic Land Deal with Algonquin Peoples Signed by Federal, Ontario Governments. http://www.cbc.ca/news/politics/ottawa-ontario-algonquin-agreement-in-principle-1.3809876. Accessed April 3, 2017.

Toronto Region Conservation Authority (TRCA) and Credit Valley Conservation (CVC). 2014. Evaluation, Classification and Management of Headwater Drainage Features Guidelines. 25 pp.

Trigger, Bruce G. and Gordon M. Day, 1994. Southern Algonquian Middlemen: Algonquin, Nipissing, and Ottawa, 1550-1780. In Aboriginal Ontario: Historical Perspectives on the First Nations. Edited by Edward S. Rogers and Donald B. Smith, pp 64-77. Toronto: Dundurn Press.

United Counties of Stormont, Dundas and Glengarry (UCSDG). 2018. United Counties of Stormont, Dundas and Glengarry Official Plan.

United States Department of the Interior Bureau of Land Management (USDI BLM). 1986. Visual Resource Contrast Rating. Bureau of Land Management Manual Handbook H-8431-1, Rel. 8-30. Washington, DC.

United States Environmental Protection Agency (US EPA). June 2020. LandGEM – Landfill Gas Emissions Model, Version 3.03. Available: https://www.epa.gov/catc/clean-air-technology-center-products#software

U.S. Environmental Protection Agency (US EPA). 2018. *Exhaust and Crankcase Emission Factors for Non-road Compression-Ignition Engines in MOVES.* U.S. EPA, Office of Transportation and Air Quality.

Voss EG, Reznicek AA. 2012. Field Manual of Michigan Flora. Ann Arbour MI: University of Michigan Press. 990 pp.

Watson, Gordon, 1982. Prehistoric Peoples of the Rideau Waterway. In Archaeological and Historical Symposium, October 2-3, 1982, Rideau Ferry, Ontario, edited by F.C.L. Wyght, Smiths Falls: Performance Printing.

Watson, Gordon, 1999a. The Paleo-Indian Period in the Ottawa Valley. In Ottawa Valley Prehistory, edited by J.L. Pilon, pp. 28-41. Imprimerie Gauvin, Hull.

Watson, Gordon, 1999b. The Early Woodland of the Ottawa Valley. In Ottawa Valley Prehistory, pp. 56-76. Imprimerie Gauvin, Hull.

WESA, 2006. Watershed Characterization: Geologic Model and Conceptual Hydrogeological Model, Raisin Region CA and South Nation Conservation, Source Protection Plan Partnership.

Western Regional Air Partnership's (WRAP). 2004. *WRAP Fugitive Dust Handbook, November 15, 2004.*

Wright, James V., 1972. Ontario Prehistory, An Eleven-Thousand-Year Archaeological Outline. Ottawa: National Museums of Canada.