Draft Archaeological Resources Effects Assessment Report

Twin Creeks Environmental Centre Landfill Optimization Project Environmental Assessment

WM Canada

Watford, Ontario

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Executive Summary

Archaeological Services Inc. (ASI) was contracted by HDR Corporation on behalf of WM Canada (WM) to prepare this Draft Archaeological Resources Effects Assessment Report as part of the Twin Creeks Environmental Centre (TCEC) Landfill Optimization Project Environmental Assessment (EA). The EA is being carried out in accordance with the requirements of the *Ontario Environmental Assessment Act* (*OEAA*) and the EA Terms of Reference (ToR), which was approved by the Ministry of Environment, Conservation and Parks (MECP) on December 13, 2022. The Archaeological Resources Existing Conditions Report includes the evaluation of the potential for archaeological resources within the Study Area through the completion of a Stage 1 Archaeological Assessment (AA). The Stage 1 AA is a Background Study and Property Inspection includes a review of geographic, land use, and historical data, including previous assessments and existing conditions to evaluate the archaeological potential of the Study Area.

The purpose of this Effects Assessment Report is to present the:

- potential environmental effects of the alternative methods on archaeological resources;
- comparison of the net effects of each alternative method;
- selection of a preferred alternative;
- assessment of the environmental effects of the preferred alternative; and
- commitments and monitoring.

There are approximately 8 years of approved landfill airspace capacity remaining at the TCEC (i.e., capacity will be reached in approximately 2031). The proposed optimization would provide additional airspace of approximately 14 million cubic metres (m^3), which could extend the site life by approximately 12 years (from 2031 to 2043) and may be achieved through alternative landfill configurations (alternative methods) within the existing 301-hectare TCEC site area. No changes are proposed to the size of the TCEC site area, approved service area, or annual fill rate.

Activities related to construction and operation of the landfill may cause negative effects on the following indicators: archaeological sites or areas with archaeological potential including archaeological resources on-site and predicted impacts on them, and cemetery properties within approximately 10 metres (m) of the proposed impacts.

The Study Area for Archaeological Resources consists of only the general On-site Study Area identified for the EA, i.e., the existing TCEC, as archaeology is only concerned with areas of direct impact, or areas within 50 m of a known archaeological resource.

Three alternative methods for carrying out the optimization were developed to a preliminary conceptual design level in the Conceptual Design Report (CDR). The

construction and operation of all three alternative methods will take place within the existing On-site Study Area.

A net effects assessment was carried out for the three alternative methods following the methods outlined in the approved ToR incorporating the information contained in the CDR, and the Archaeological Resources Existing Conditions Report. The results of the net effects assessment were used in a comparative evaluation of the three alternative methods.

Evaluation of Alternative Methods 1, 2, and 3 concluded there is no potential for the disturbance of unassessed or documented archaeological resources or the Watford Cemetery adjacent to the TCEC property with either Alternative Method 1, 2, or 3. There are no net effects on Archaeological Resources. There is no substantial difference between the alternative methods for Archaeological Resources and therefore no Preferred Alternative is identified.

Under the “Do Nothing” Alternative, the existing Expanded Landfill will continue to operate until the approved capacity is reached, and there are no changes to operations in the On-Site or Off-site Study Areas. The “Do Nothing” Alternative is not anticipated to result in any net effects to archaeological resources.

As there are no net effects anticipated from any of the three alternative methods, no additional commitments, mitigation, or monitoring are required.

Registered archaeological site AfHl-14 is within the On-site Study Area, but outside of the existing landfill and proposed Alternative methods. The site has been protected in perpetuity with the establishment of a protective 10 m buffer and surrounding conservation area following the completion of a Stage 3 site-specific assessment in 2007 (P057-307-2006 and P057-374-2007) . The avoidance and protection measures recommended for the area around the archaeological site will not be required for the Project as no construction and operation activities are planned.

The Stage 1 AA report must be submitted to the Ministry of Citizenship and Multiculturalism to be reviewed to ensure that it complies with the standards and guidelines that are issued by the Minister, and that the archaeological field work and report recommendations ensure the conservation, preservation, and protection of the cultural heritage of Ontario.

Acronyms, Units and Glossary

Acronyms

Acronym	Definition
AA	Archaeological Assessment
ASI	Archaeological Services Incorporated
BAO	Bereavement Authority of Ontario
B.P.	Before Present
CDR	Conceptual Design Report
C.E.	Common Era
EA	Environmental Assessment
GIS	Geographic Information System
GHG	Greenhouse Gas
LFG	Landfill Gas
MCM	Ministry of Citizenship and Multiculturalism
MECP	Ministry of Environment, Conservation and Parks
OASD	Ontario Archaeological Sites Database
OEAA	Ontario Environmental Assessment Act
S&G	Standards and Guidelines for Consultant Archaeologists
TCEC	Twin Creeks Environmental Centre
ToR	Terms of Reference
WM	WM Canada

Units

Unit	Definition
km	kilometre
m	metre
m^3	cubic metres
masl	metres above sea level

Glossary

Term	Definition
Approval	Permission granted by an authorized individual or organization for an undertaking to proceed. This may be in the form of program approval, certificate of approval or provisional certificate of approval.
Capacity (Disposal Volume)	The total volume of air space available for disposal of waste at a landfill site for a particular design (typically in m^3); includes both waste and daily cover materials but excludes the final cover.
Composting	The controlled microbial decomposition of organic matter, such as food and yard wastes, in the presence of oxygen, into finished compost (humus), a soil-like material. Humus can be used in vegetable and flower gardens, hedges, etc.
Composting facility	A facility designed to compost organic matter either in the presence of oxygen (aerobic) or absence of oxygen (anaerobic).
Environment	As defined by the Environmental Assessment Act, environment means: • air, land or water; • plant and animal life, including human life; • the social, economic and cultural conditions that influence the life of humans or a community; • any building, structure, machine or other device or thing made by humans; • any solid, liquid, gas, odour, heat, sound, vibration or radiation resulting directly or indirectly from human activities; or • any part or combination of the foregoing and the interrelationships between any two or more of them (ecosystem approach).
Environmental Assessment (EA)	A systematic planning process that is conducted in accordance with applicable laws or regulations aimed at assessing the effects of a proposed undertaking on the environment.
Evaluation criteria	Evaluation criteria are considerations or factors taken into account in assessing the advantages and disadvantages of various alternatives being considered.
Greenhouse gas (GHG)	Any of the gases whose absorption of solar radiation is responsible for the greenhouse effect, including carbon dioxide, methane, ozone, and the fluorocarbons.
Indicators	Indicators are specific characteristics of the evaluation criteria that can be measured or determined in some way, as opposed to the actual criteria, which are fairly general.
Landfill gas (LFG)	The gases produced from the wastes disposed in a landfill; the main constituents are typically carbon dioxide and methane, with small amounts of other organic and odour-causing compounds.
Landfill site	An approved engineered site/facility used for the final disposal of waste. Landfills are waste disposal sites where waste is spread in layers, compacted to the smallest practical volume, and typically covered by soil.
Leachate	Liquid that drains from solid waste in a landfill and which contains dissolved, suspended and/or microbial contaminants from the breakdown of this waste.
Mitigation	Measures taken to reduce adverse impacts on the environment.
Proponent	A person who: • carries out or proposes to carry out an undertaking; or • is the owner or person having charge, management or control of an undertaking.
Receptor	The person, plant or wildlife species that may be affected due to exposure to a contaminant.
Terms of Reference (ToR)	A terms of reference is a document that sets out detailed requirements for the preparation of an Environmental Assessment.

Glossary

Term	Definition
Undertaking	Is defined in the Environmental Assessment Act as follows: • An enterprise or activity or a proposal, plan or program in respect of an enterprise or activity by or on behalf of Her Majesty in right of Ontario, by a public body or public bodies or by a municipality or municipalities; • A major commercial or business enterprise or activity or a proposal, plan or program in respect of a major commercial or business enterprise or activity of a person or persons other than a person or persons referred to in clause (1) that is designated by the regulations; or • An enterprise or activity or a proposal, plan or program in respect of an enterprise or activity of a person or persons, other than a person or persons referred to in clause (a), if an agreement is entered into under section 3.0.1 in respect of the enterprise, activity, proposal, plan or program ("enterprise").
Waste	Refuse from places of human or animal habitation; unwanted materials left over from a manufacturing process.

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1 Introduction

ASI was contracted by HDR Corporation on behalf of WM Canada (WM) to prepare this Draft Archaeological Resources Effects Assessment Report as part of the Twin Creeks Environmental Centre (TCEC) Landfill Optimization Project Environmental Assessment (EA). The EA is being carried out in accordance with the requirements of the *Ontario Environmental Assessment Act* (*OEAA*) and the EA Terms of Reference (ToR), which was approved by the Ministry of Environment, Conservation and Parks (MECP) on December 13, 2022.

The *OEAA* defines the environment in a broad, general sense that comprises physical, biological, and human considerations. In this EA, the environment has been separated broadly into the natural, socio-economic, cultural, and built aspects, with environmental components and evaluation criteria identified within each aspect as listed in **Table 1-1**, consistent with the approved ToR. The organization of the Effects Assessment Reports is also provided in **Table 1-1**.

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

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

Archaeological resources are non-renewable cultural resources that can be destroyed by the construction and operation of a waste disposal facility. Activities related to construction and operation of the landfill may cause negative effects on archaeological sites or areas with archaeological potential. The purpose of a Stage 1 Archaeological Assessment (AA) is to identify known archaeological sites that may be affected by the undertaking, and to describe the potential for the presence of archaeological resources throughout the Study Area where potential disturbance may occur. The Stage 1 AA provides an inventory of known or potentially existing archaeological resources within the Study Area (Existing Conditions) for the purposes of assessing alternative methods, development of mitigation measures and monitoring programs of the undertaking. The Stage 1 AA is documented in the Archaeological Resources Existing Conditions Report.

The purpose of this Effects Assessment Report is to present the potential environmental effects of the alternative methods on the identified Archaeological Resources, a comparison of the net effects of each alternative method, the selection of a preferred alternative, the assessment of the environmental effects of the preferred alternative, and commitments and monitoring.

This Archaeological Resources Effects Assessment Report is one component of the EA. The EA Study Report will incorporate the information presented herein as appropriate, and this report will be included with the EA Study Report as a supporting document.

1.1 Project and Alternative Methods

There are approximately 8 years of approved landfill airspace capacity remaining at the TCEC (i.e., capacity will be reached in approximately 2031). The proposed landfill optimization would provide additional airspace of approximately 14 million cubic metres (m^3), which could extend the site life by approximately 12 years (from 2031 to 2043) and may be achieved through alternative landfill configurations (alternative methods) within the existing 301-hectare TCEC site area. No changes are proposed to the size of the TCEC site area, approved service area, haul route, or annual fill rate.

Three alternative methods for carrying out the landfill optimization were developed to a preliminary conceptual design level in the Conceptual Design Report (CDR) and are described below as they are relevant to Archaeology.

1.1.1 Alternative Method 1

The geometry of Alternative Method 1 is shown in plan view in **Figure 1-1**. Under the proposed vertical expansion, the existing approved waste disposal footprint area of the TCEC would not change, but rather, the maximum permitted height of waste would be increased by 44.5 m, from 280 masl (the current approved elevation for top of waste) to 324.5 masl, which is the maximum elevation of the top of the final cover for Alternative Method 1.

Four stormwater management ponds that are situated at the corners of the Expansion Landfill footprint collect runoff from the surface of the landfill and release flows through

culvert outlets. The full buildout of the landfill in the northeast corner will move the bordering swales to the east as shown in **Figure 1-2**. The proposed vertical landfill expansion will impact the stormwater management system by altering catchment areas within the landfill site. All four stormwater management ponds on the landfill site have enough capacity under Alternative Method 1 scenarios and they do not require alteration or enlargement. The existing swales around the landfill site currently are also able to safely convey the 25-year design storm without overtopping, so modification to the existing cross-section geometries of the swales is not warranted. The relocated swales (SWC1A) and SWG2A) and new culvert will also be able to convey these flows appropriately.

No additional ancillary facilities, beyond those already existing on the site, will be required for Alternative Method 1.

Figure 1-1. Alternative Method 1

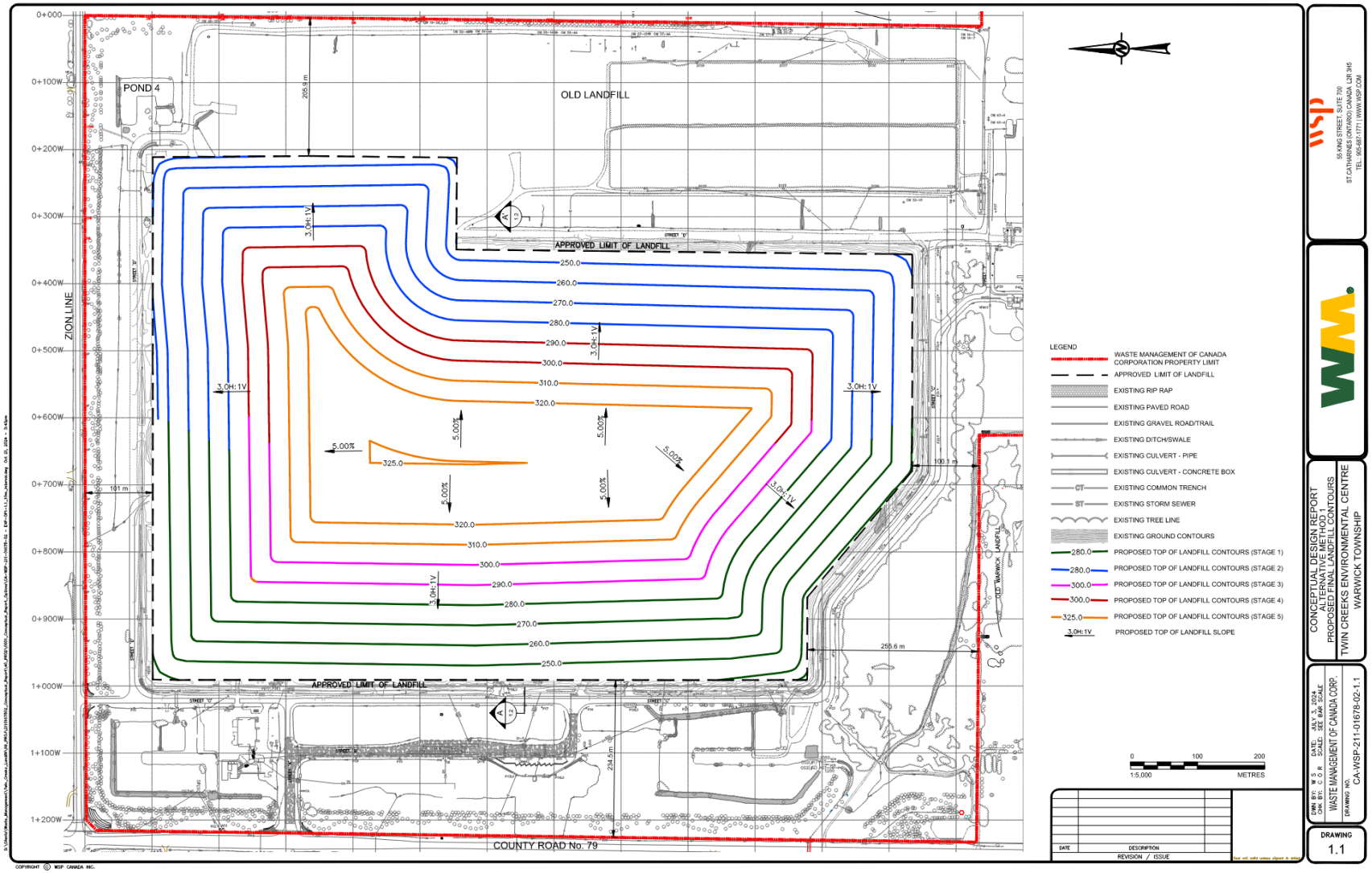
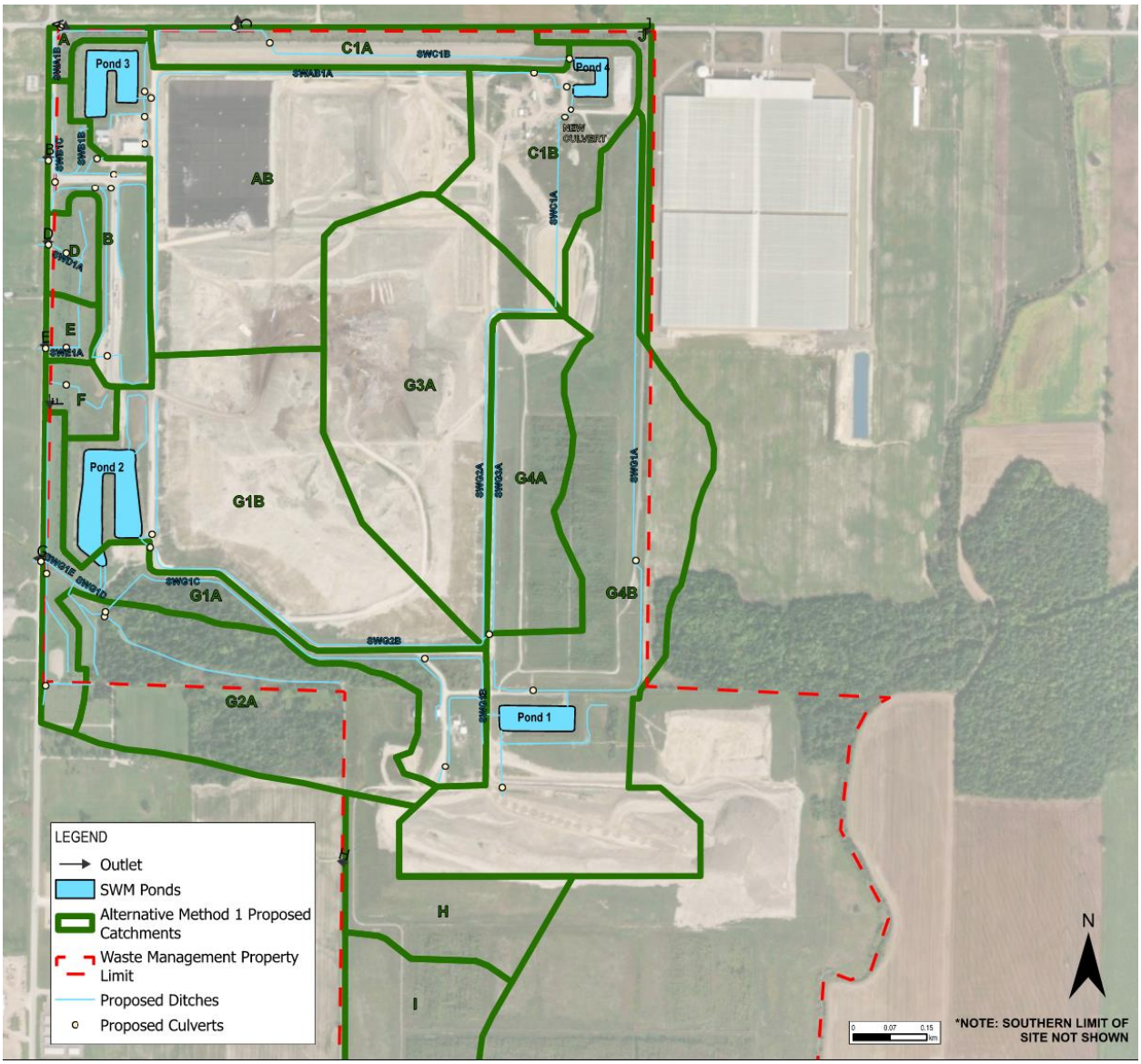


Figure 1-2. Stormwater Management for Alternative Method 1



1.1.2 Alternative Method 2

The geometry of Alternative Method 2 is shown in plan view in **Figure 1-3**. Under the proposed vertical expansion, the existing approved waste disposal footprint area of the TCEC would not change, but rather, the maximum permitted height of waste would be increased by 39 m, from 280 masl (the current approved elevation for top of waste) to 319 masl, which is the maximum elevation of the top of the final cover for Alternative Method 2.

The stormwater impacts of Alternative Method 2 would be similar to that of Alternative Method 1 in several ways. The factors altering the magnitude and timing of the peak flows (although not the total runoff volume) are the same. The redistributed catchment areas for Alternative Method 2 are shown on **Figure 1-4**. The existing stormwater management ponds and swales will have enough capacity to process their respective design storms under Alternative Method 2. The relocated swales (SWC1A and SWG2A) and new culvert will also be able to convey these flows appropriately.

No additional ancillary facilities, beyond those already existing on the site, will be required for Alternative Method 2.

Figure 1-3. Alternative Method 2

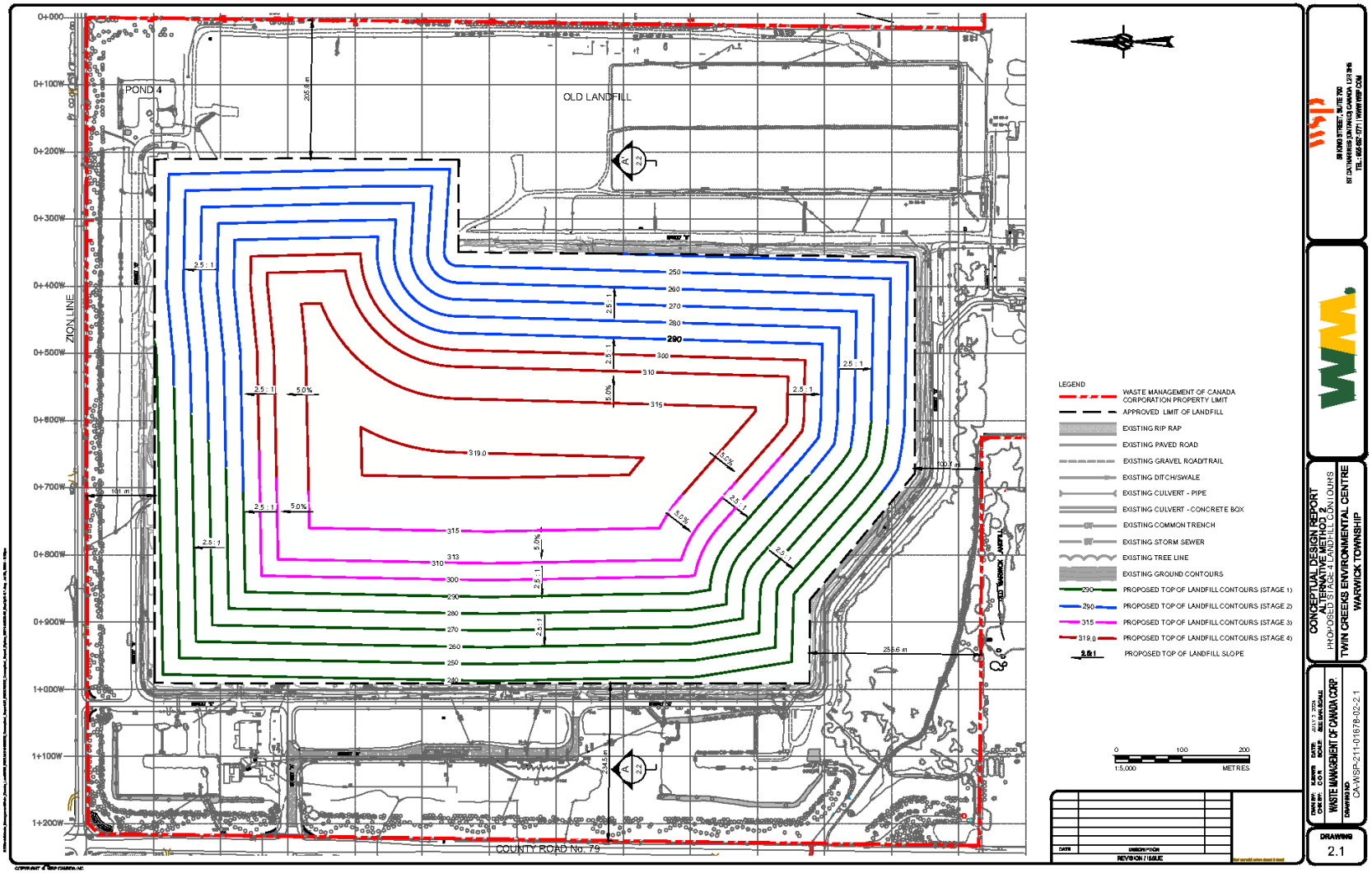
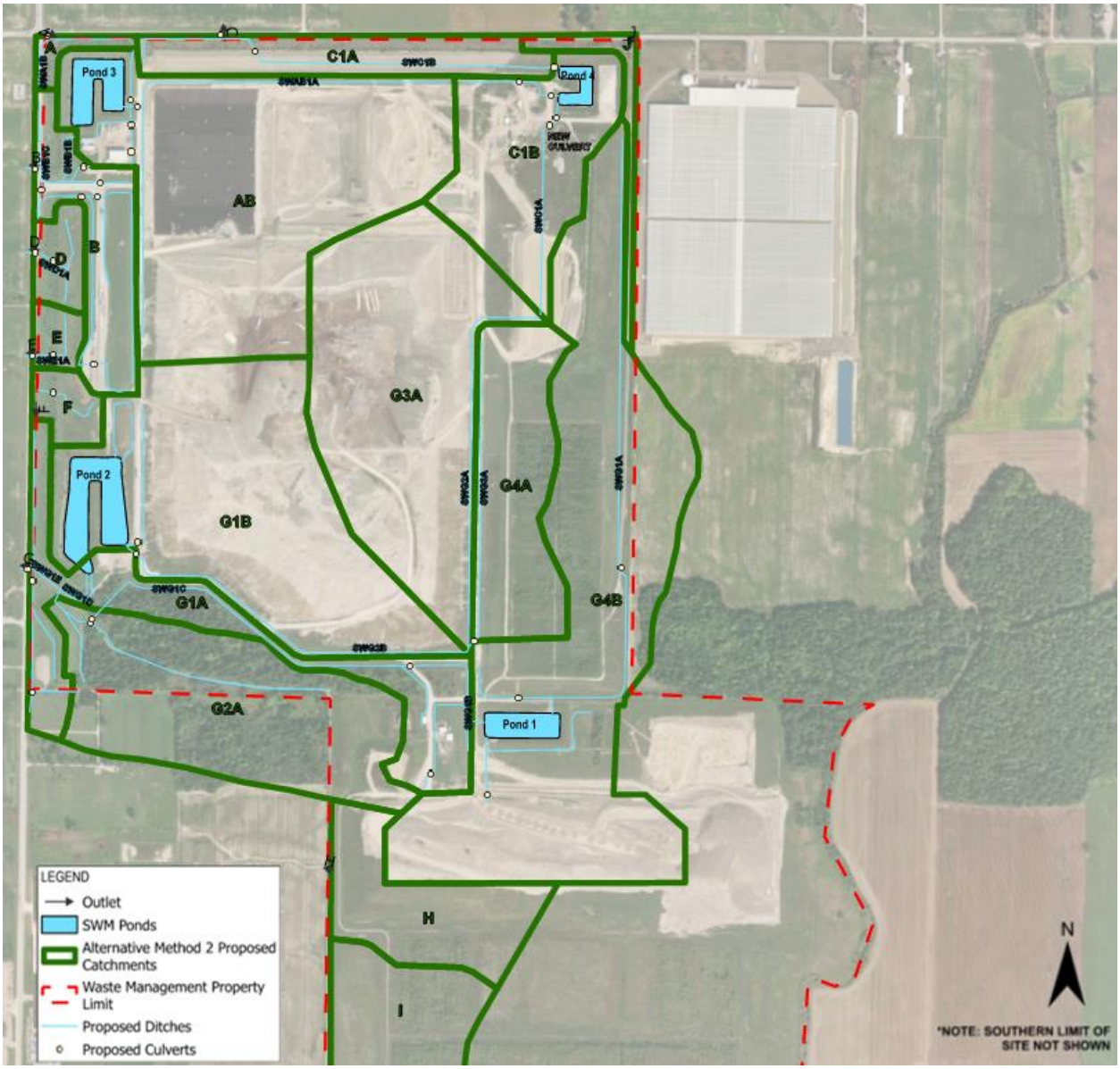


Figure 1-4. Stormwater Management for Alternative Method 2



1.1.3 Alternative Method 3

The geometry of Alternative Method 3 is shown in plan view in **Figure 1-5**. Under the proposed vertical expansion, the existing approved waste disposal footprint area of the TCEC would not change, but rather, the maximum permitted height of waste would be increased by 80 m, from 280 masl (the current approved elevation for top of waste) to 360 masl, which is the maximum elevation of the top of the final cover for Alternative Method 3.

The impacts of Alternative Method 3 would be similar to that of Alternative Methods 1 and 2 in several ways. The factors altering the magnitude and timing of the peak flows (although not, again, the total runoff volume) are consistent. The redistributed catchment areas for Alternative Method 3 are shown on **Figure 1-6**. The existing stormwater management ponds and swales will have enough capacity to process their respective design storms under Alternative Method 3. The relocated swales (SWC1A) and SWG2A) and new culvert will also be able to convey these flows appropriately.

No additional ancillary facilities, beyond those already existing on the site, will be required for Alternative Method 3.

Figure 1-5. Alternative Method 3

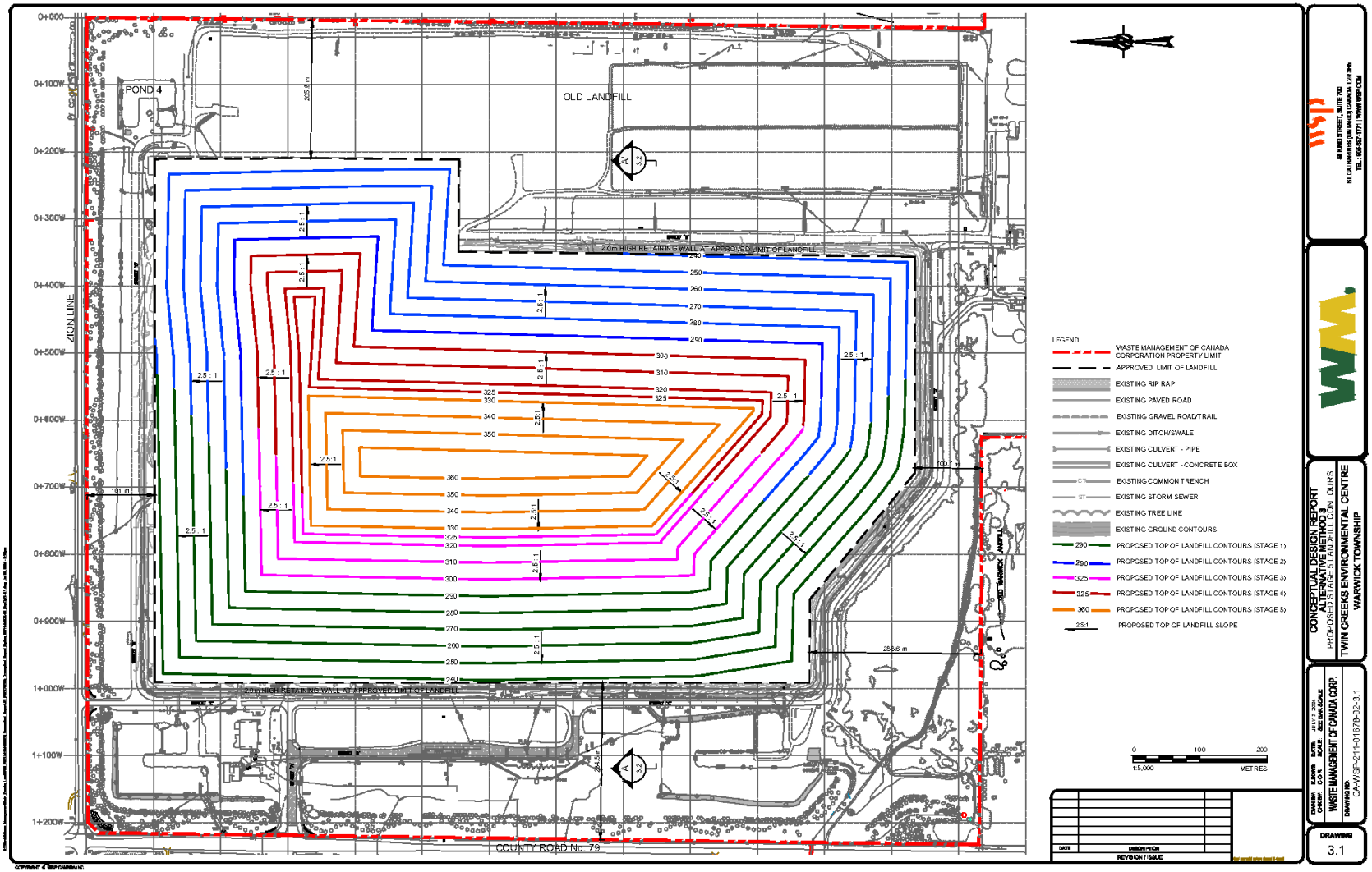
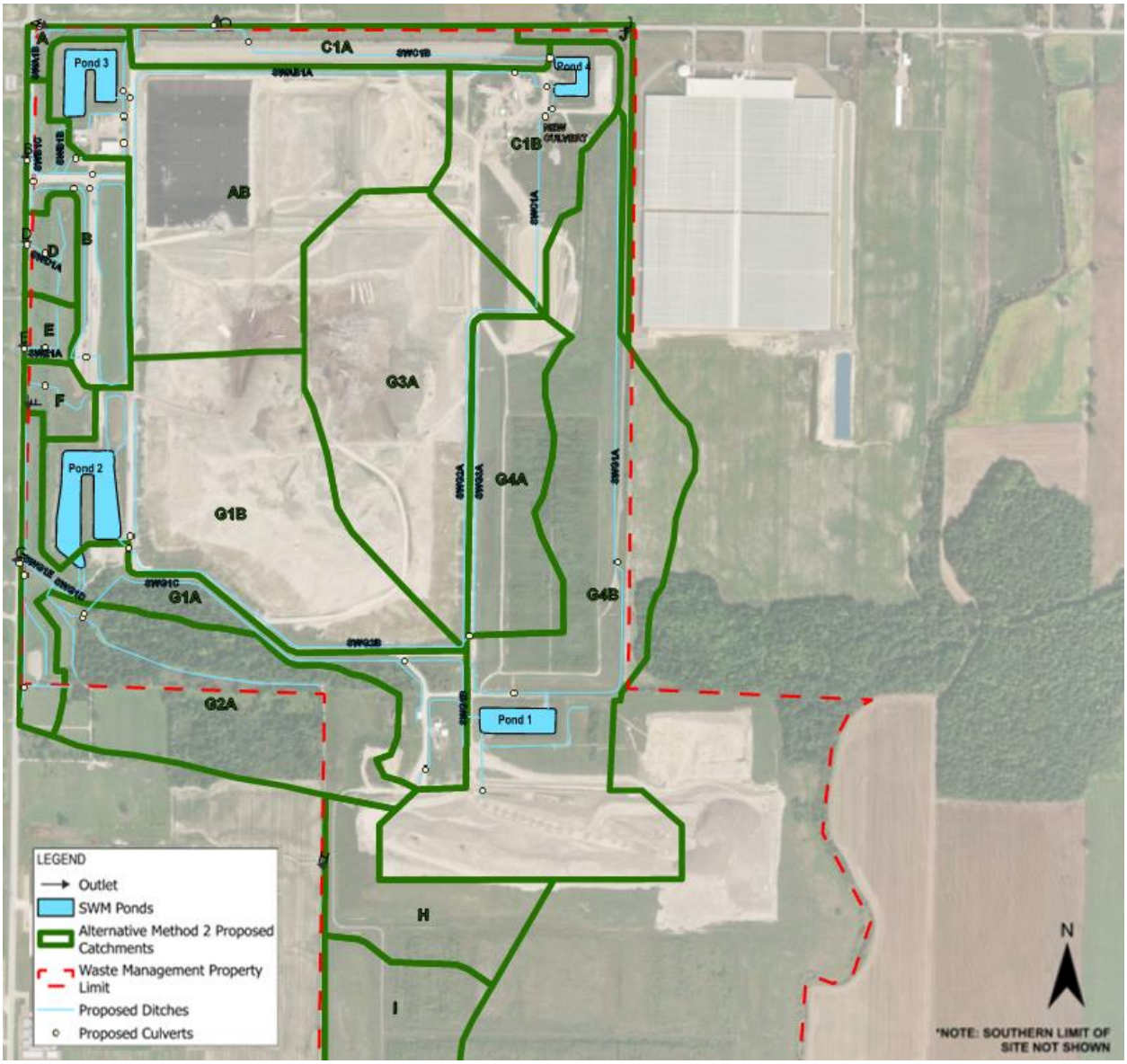


Figure 1-6. Stormwater Management for Alternative Method 3



2 Effects Assessment Methods

Using the evaluation criteria, indicators, rationale and data sources from the approved ToR and the existing conditions from the Archaeological Resources Existing Conditions Report, the effects assessment is carried out as follows:

- predict the potential environmental effects for each alternative method (**Section 2.1**);
- identify the preferred alternative based on a comparative evaluation of the potential environmental effects of each alternative method (**Section 2.2**);
- conduct an effects assessment on the preferred alternative, including the identification of mitigation measures and monitoring programs (**Section 2.3**); and
- compare the effects of the preferred alternative to those of the 'do nothing' alternative (i.e., the Expansion Landfill as approved) (**Section 2.4**).

2.1 Predict Potential Environmental Effects for Alternative Methods

The potential environmental effects for each alternative method are identified within the study areas based on the application of the evaluation criteria, indicators and data sources in the approved ToR and based on the maximum allowable waste receipt level for the TCEC landfill. The potential effects can be positive or negative, direct or indirect, and short- or long-term. Mitigation measures are identified to minimize or mitigate the potential effects and then the net effects are evaluated taking into consideration the application of mitigation measures. The study areas, evaluation criteria, indicators, data source, and key design considerations and assumptions for Archaeological Resources are provided below.

2.1.1 Study Areas

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

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

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

As archaeology is only concerned with areas of direct impact, or within 50 m of a known archaeological resource, the general Off-site Study Area is not included. The On-site Study Area was used as the Study Area for the purposes of the Archaeological Resources effects assessment.

2.1.2 Evaluation Criteria, Indicators, and Data Sources

The evaluation criteria, rationale, indicators, and data sources used for Archaeology as per the approved ToR are provided in **Table 2-1**.

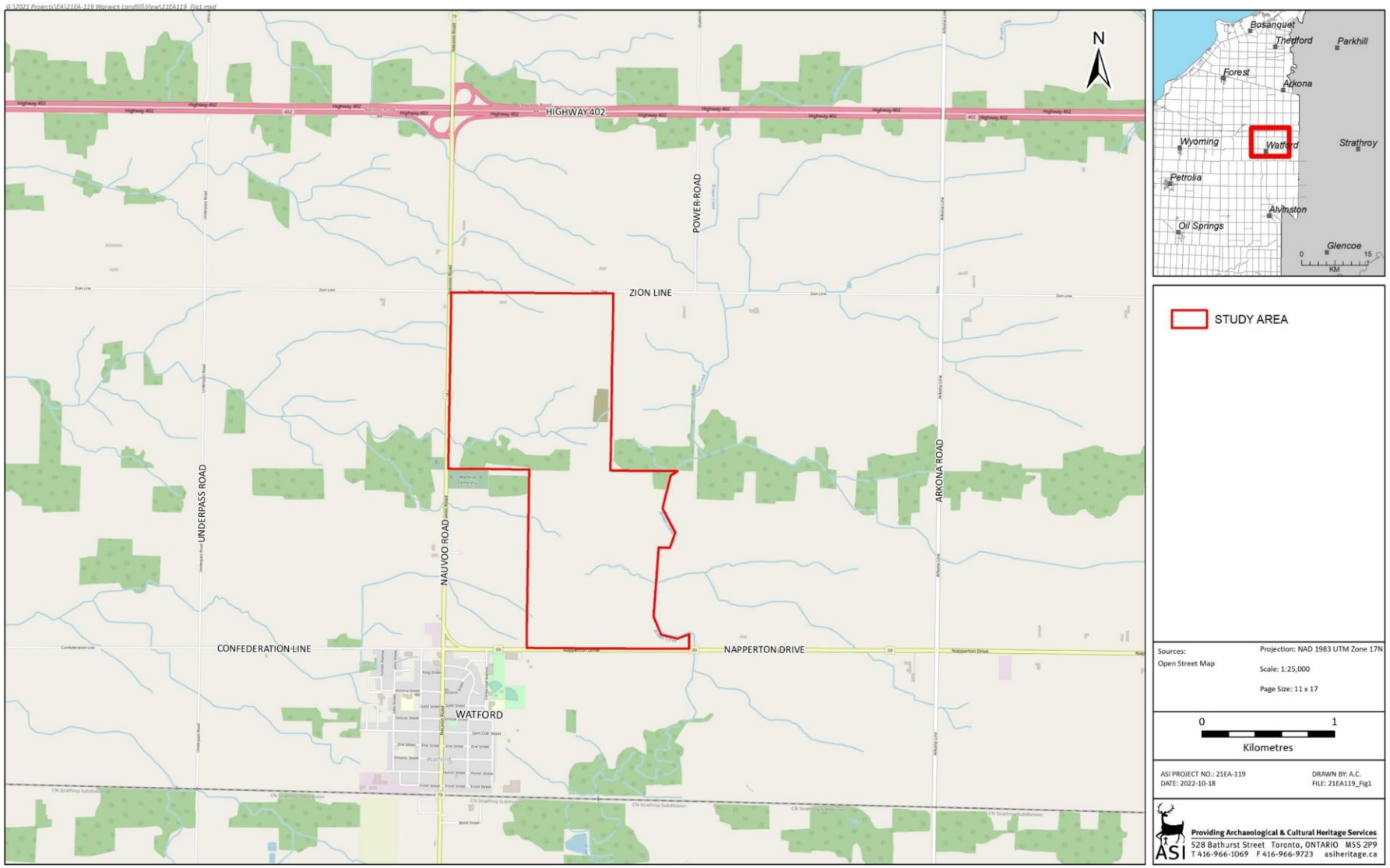
Table 2-1. Evaluation Criteria, Indicators, and Data Sources for Archaeology

Evaluation Criteria	Rationale	Indicators	Data Sources
Cultural Environment			
Archaeology			
Archaeological Resources	Archaeological resources are non-renewable cultural resources that can be destroyed by the construction and operation of a waste disposal facility. Activities related to construction and operation of the landfill may cause negative effects on archaeological sites or areas with archaeological potential.	• Archaeological resources on-site and predicted impacts on them • Cemetery property within approximately 10 metres of the proposed impacts	• Published data sources • Standards and Guidelines for Consultant Archaeologists • Ontario Archaeological Sites Database • MCM register of archaeological reports • Existing Stage 1, 2, 3 Archaeological Assessments for the landfill site • Stage 1 property inspection results • Bereavement Authority of Ontario (BAO) Cemetery records, plans and plot maps • Historical mapping, topographical maps and aerial photographs and imagery • Proposed facility characteristics • Landfill design and operations data

2.1.3 Key Considerations and Assumptions

The key existing conditions elements, design considerations, and assumptions for the Archaeological Resources effects assessment are described below.

Figure 2-1. On-site Study Area for Archaeology



2.1.3.1 Key Elements of Existing Conditions

The Archaeological Resources Existing Conditions Report (Stage 1 AA) determined that archaeological site AfHl-14 is the only archaeological site relevant to the Project and it is located within the On-site Study Area. This site is considered to have further cultural heritage value or interest and has been protected in perpetuity with the establishment of a protective 10 m buffer and surrounding conservation area following the completion of a Stage 3 site-specific assessment in 2007 (P057-307-2006 and P057-374-2007). Site AfHl-14 is located in the southeast corner of the On-site Study Area. A protective buffer with a minimum of 10 m has been applied to the limits of AfHl-14 by converting the area surrounding AfHl-14 into a conservation area, where no activities that may alter the archaeological site may occur, as per S&G Section 4.1.4, Standard 2. Continued avoidance and protection is required for the site AfHl-14.

The northern portion of Watford Cemetery is immediately adjacent to the On-site Study Area on the east side of Nauvoo Road within the Off-site area. It is over 200 metres from the approved Expansion Landfill footprint. This cemetery is well defined and has low potential for unmarked burials outside of the cemetery boundary and into the On-site Study Area, as confirmed during the Stage 1 AA property inspection and by the information gathered from the BAO. No cemetery investigation is required for this project.

The Stage 1 AA determined that the remainder of the On-site Study Area beyond the protected area of Site AfHl-14 has been previously assessed and has no further archaeological concern.

Recommendations made in the Stage 1 AA Archaeological Resources Existing Conditions Report are presented in **Figure 2-2**.

2.1.3.2 Key Design Considerations

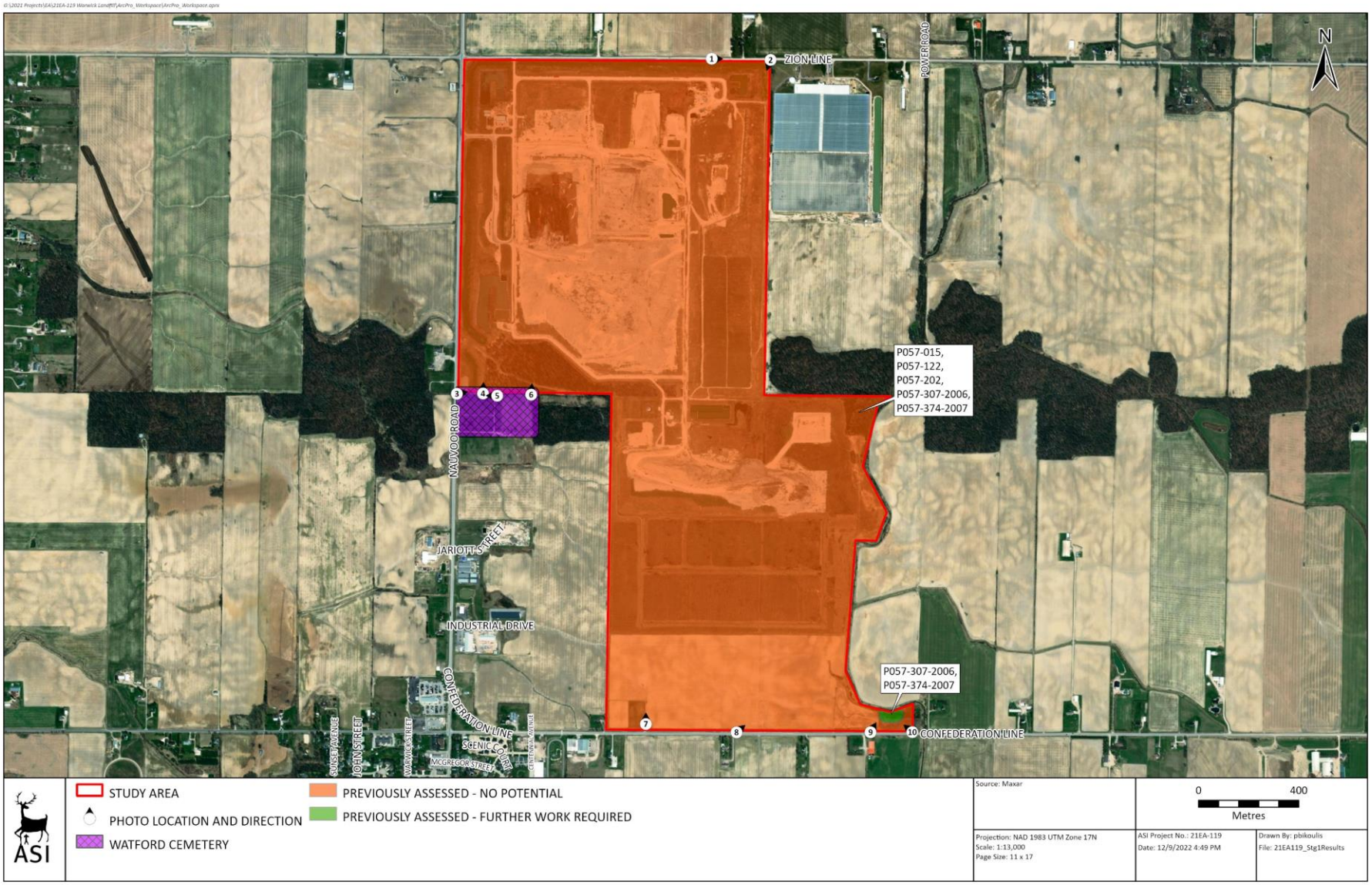
Key design considerations include any construction or operation activities that could affect Archaeological Resources. The net effects analysis for Alternative Methods 1, 2, and 3 are based on the proposed construction and operational activities outlined in the CDR including:

- Landfill design and geometry, including the waste disposal footprint area;
- Construction activities relate to waste placement, gravel access roads, and Landfill Gas management;
- Leachate management systems;
- Stormwater management systems; and
- Ancillary facilities

2.1.3.3 Key Assumptions

The construction and operation of Alternative Methods 1, 2, and 3 will take place within the existing On-site Study Area. The landfill expansion will occur within the existing approved Expansion Landfill footprint.

Figure 2-2. Archaeological Resources Existing Conditions – Stage 1 Recommendations



2.2 Comparative Evaluation and Identification of the Preferred Alternative

The three alternative methods are comparatively assessed and evaluated using the criteria and indicators to determine the preferred alternative. The differences in the potential environmental effects remaining following the implementation of potential mitigation/management measures (i.e., net effects) are used to identify and compare each alternative method.

The net environmental effects are used to compare the three alternative methods to one another at the criteria and indicator level for each discipline. The following two step methodology was applied to carry out the comparative evaluation for Archaeological Resources:

1. Identify the predicted net effect(s) associated with each alternative method for each indicator and assign a preference rating (i.e., Preferred, Not Preferred, No Substantial Difference); and
2. Rate each alternative method at the criteria level (i.e., Preferred, Not Preferred, No Substantial Difference) based on the identified preference rating for each indicator and provide a rationale.

2.3 Effects Assessment of the Preferred Alternative

An assessment of the environmental effects of the Preferred Alternative is carried out considering the same criteria, indicators, and data sources, considering potential mitigation/management measures and cumulative effects. The effects assessment of the Preferred Alternative will be compiled and presented in the EA Study Report.

2.4 Comparison of the Preferred Alternative against the ‘Do Nothing’ Alternative

The effects of the Preferred Alternative are compared against the predicted effects of the currently approved Expansion Landfill based on similar environmental criteria and indicators, with the understanding that the criteria and indicators used in the current effects assessment may differ from those used for the effects assessment of the Expansion Landfill. The effects are compared against each other in terms of magnitude, extent, and duration. The advantages and disadvantages of the Preferred Alternative compared to the ‘Do Nothing’ alternative are identified. The comparison of the effects of the Preferred Alternative against the ’Do Nothing’ alternative will be compiled and presented in the EA Study Report.

3 Net Effects Assessment

To identify the potential effects of the Project on Archaeological Resources, the conceptual design of each alternative method for the landfill optimization is examined to determine if it will have an effect on:

- Archaeological resources on-site and predicted impacts; and
- Cemetery property within approximately 10 metres of the proposed impacts.

The results of the net effects assessment for each alternative method are provided in Sections 3.1 through 3.3, below.

3.1 Future Baseline Conditions

The future baseline conditions are assumed to be the same as the existing conditions described in the Archaeological Resources Existing Conditions Report. The existing approved waste disposal footprint area of the TCEC will not change when the project begins, or in any alternative method in the proposed vertical expansion. Similarly, existing archaeological resources will not change before the start of construction. The Archaeological Resources existing conditions and future baseline conditions are depicted in **Figure 2-2**.

3.2 Alternative Method 1

The assessment of effects for Alternative Method 1 is described below for the environmental criteria and indicators of Archaeological Resources and is summarized in **Table 3-1**. The construction and operation of Alternative Method 1 will take place within the existing On-site Study Area and landfill expansion will only be occurring within the approved Expansion Landfill footprint. There will be no change to any Off-site activities associated with the Project.

3.2.1 Archaeological Resources

Activities related to construction and operation of the landfill may cause negative effects on the following indicators: archaeological sites or areas with archaeological potential including archaeological resources on-site, and cemetery properties within approximately 10 m of the proposed impacts.

3.2.1.1 Archaeological Resources on-site

The Stage 1 AA determined that 37 previously registered archaeological sites are located within one kilometre of the TCEC site. Of these, only one site (AfHl-14) is of concern for the Project and has further cultural heritage value or interest. This site (AfHl-14) is located in the southeastern corner of the TCEC site and has been protected in perpetuity with the establishment of a protective 10 m buffer and surrounding conservation area upon the completion of a Stage 3 site-specific

assessment in 2007 (P057-307-2006 and P057-374-2007). Continued avoidance and protection is required for the site.

The background research determined that the remainder of the Study Area beyond the protected limits of AfHl-14 has been previously assessed (CIF 1999-007-054; PIFs P057-015 (2003), P057-122 (2004), P057-202 (2005), P057-307-2006, and P057-374-2007) and has no further archaeological concern.

The Stage 1 AA determined that the remainder of the On-site Study Area beyond the protected area of site AfHl-14 has been previously assessed and has no further archaeological concern.

The entire area of Alternative Method 1 is cleared of archaeological concern and therefore there will be no impacts expected to any On-site Study Area archaeological resources. There is no potential for the disturbance of unassessed or documented archaeological resources and there are no net effects for Alternative Method 1.

3.2.1.2 Cemetery property within approximately 10 metres

A historic cemetery, Watford Cemetery, is located outside of, but adjacent to, the western portion of the TCEC site. It is over 200 metres from the approved Expansion Landfill footprint. The Stage 1 AA predetermined that no cemetery investigation is required for this project.

The entire area of Alternative Method 1 is within the On-site Study Area and therefore there will be no impacts expected to the cemetery property. There is no potential for the disturbance of the cemetery and there are no net effects for Alternative Method 1.

3.2.2 Summary

A summary of the effects assessment of Alternative Method 1 is presented below in **Table 3-1**.

Table 3-1. Net Effects Assessment – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Archaeological Resources	Archaeological resources on-site and predicted impacts on them	• The construction and operation of Alternative Method 1 will take place within the existing On-site Study Area. Landfill expansion will only be occurring within the approved Expansion Landfill footprint • There will be no change to any Off-site activities associated with the Project • Archaeological site AfHl-14 is located in the southeastern corner of the TCEC site and will not be impacted by the construction and operation of Alternative Method 1 • The Stage 1 AA determined that the remainder of the On-site Study Area beyond the protected area of site AfHl-14 has been previously assessed and has no further archaeological concern	• No potential for the disturbance of unassessed or documented archaeological resources • Site AfHl-14 has further cultural heritage value or interest and has been protected in perpetuity with the establishment of a protective 10 metre buffer and surrounding conservation area following the completion of a Stage 3 site-specific assessment in 2007 (P057-307-2006 and P057-374-2007). The avoidance and protection measures recommended for the area around the archaeological site will not be required for the Project as no construction and operation activities are planned.	• None required	• No net effects on on-site Archaeological Resources
	Cemetery property within approximately 10 metres of the proposed impacts	• The construction and operation of Alternative Method 1 will take place within the existing On-site Study Area. Landfill expansion will only be occurring within the approved Expansion Landfill footprint. • There will be no change to any Off-site activities associated with the Project • A historic cemetery, Watford Cemetery, is located adjacent to the western portion of the TCEC site. • The Stage 1 AA determined that no cemetery investigation is required for this project.	• No potential for the disturbance of the cemetery	• None required	• No net effects on the cemetery property

3.3 Alternative Method 2

The assessment of effects for Alternative Method 2 is described below for the environmental criteria and indicators of Archaeology and is summarized in **Table 3-2**. The construction and operation of Alternative Method 2 will take place within the existing On-site Study Area and landfill expansion will only be occurring within the approved Expansion Landfill footprint. There will be no change to any Off-site activities associated with the Project.

3.3.1 Archaeological Resources

Activities related to construction and operation of the landfill may cause negative effects on the following indicators: archaeological sites or areas with archaeological potential including archaeological resources on-site and predicted impacts on them, and cemetery properties within approximately 10 metres of the proposed impacts.

3.3.1.1 Archaeological Resources on-site and predicted impacts

The Stage 1 AA determined that 37 previously registered archaeological sites are located within one kilometre of the TCEC site. Of these, only one site (AfHl-14) is of concern for the Project and has further cultural heritage value or interest. This site (AfHl-14) is located in the southeastern corner of the TCEC site and has been protected in perpetuity with the establishment of a protective 10 metre buffer and surrounding conservation area upon the completion of a Stage 3 site-specific assessment in 2007 (P057-307-2006 and P057-374-2007). Continued avoidance and protection is required for the site.

The background research determined that the remainder of the Study Area beyond the protected area of AfHl-14 has been previously assessed (CIF 1999-007-054; PIFs P057-015 (2003), P057-122 (2004), P057-202 (2005), P057-307-2006, and P057-374-2007) and has no further archaeological concern.

The Stage 1 AA determined that the remainder of the On-site Study Area beyond the protected area of site AfHl-14 has been previously assessed and has no further archaeological concern.

The entire area of Alternative Method 2 is cleared of archaeological concern and therefore there will be no impacts expected to any On-site Study Area archaeological resources. There is no potential for the disturbance of unassessed or documented archaeological resources and there are no net effects for Alternative Method 2.

3.3.1.2 Cemetery property within approximately 10 metres

A historic cemetery, Watford Cemetery, is located outside of but adjacent to the western portion of the TCEC site. It is over 200 metres from the approved Expansion Landfill footprint. The Stage 1 AA predetermined that no cemetery investigation is required for this project.

The entire area of Alternative Method 2 is within the On-site Study Area and therefore there will be no impacts expected to the cemetery property. There is no potential for the disturbance of the cemetery and there are no net effects for Alternative Method 2.

3.3.2 Summary

A summary of the effects assessment of Alternative Method 2 is summarized below in **Table 3-2**.

Table 3-2. Net Effects Assessment – Alternative Method 2

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Archaeological Resources	Archaeological resources on-site and predicted impacts on them	• The construction and operation of Alternative Method 2 will take place within the existing On-site Study Area. Landfill expansion will only be occurring within the approved Expansion Landfill footprint • There will be no change to any Off-site activities associated with the Project • Archaeological site AfHl-14 is located in the southeastern corner of the TCEC site and will not be impacted by the construction and operation of Alternative Method 1 • The Stage 1 AA determined that the remainder of the On-site Study Area beyond the protected area of site AfHl-14 has been previously assessed and has no further archaeological concern	• No potential for the disturbance of unassessed or documented archaeological resources • Site AfHl-14 has further cultural heritage value or interest and has been protected in perpetuity with the establishment of a protective 10 metre buffer and surrounding conservation area upon the completion of a Stage 3 site-specific assessment in 2007 (P057-307-2006 and P057-374-2007). Continued avoidance and protection is required for the site should the area be impacted by any construction and operation activities.	• None required	• No net effects on Archaeological Resources
	Cemetery property within approximately 10 metres of the proposed impacts	• The construction and operation of Alternative Method 2 will take place within the existing On-site Study Area Landfill design and geometry. landfill expansion will only be occurring within the approved Expansion Landfill footprint • There will be no change to any Off-site activities associated with the Project • A historic cemetery, Watford Cemetery, is located adjacent to the western portion of the TCEC site. • The Stage 1 AA determined that no cemetery investigation is required for this project.	• No potential for the disturbance of the cemetery	• None required	• No net effects on Archaeological Resources

3.4 Alternative Method 3

The assessment of effects for Alternative Method 3 is described below for the environmental criteria and indicators of Archaeology and is summarized in **Table 3-3**. The construction and operation of Alternative Method 3 will take place within the existing On-site Study Area and landfill expansion will only be occurring within the approved Expansion Landfill footprint. There will be no change to any Off-site activities associated with the Project.

3.4.1 Archaeological Resources

Activities related to construction and operation of the landfill may cause negative effects on the following indicators: archaeological sites or areas with archaeological potential including archaeological resources on-site and predicted impacts on them, and cemetery properties within approximately 10 metres of the proposed impacts.

3.4.1.1 Archaeological Resources on-site and predicted impacts

The Stage 1 AA determined that 37 previously registered archaeological sites are located within one kilometre of the TCEC site. Of these, only one site (AfHl-14) is of concern for the Project and has further cultural heritage value or interest. This site (AfHl-14) is located in the southeastern corner of the TCEC site and has been protected in perpetuity with the establishment of a protective 10 metre buffer and surrounding conservation area upon the completion of a Stage 3 site-specific assessment in 2007 (P057-307-2006 and P057-374-2007). Continued avoidance and protection is required for the site.

The background research determined that the remainder of the Study Area beyond the protected area of AfHl-14 has been previously assessed (CIF 1999-007-054; PIFs P057-015 (2003), P057-122 (2004), P057-202 (2005), P057-307-2006, and P057-374-2007) and has no further archaeological concern.

The Stage 1 AA determined that the remainder of the On-site Study Area beyond the protected area of site AfHl-14 has been previously assessed and has no further archaeological concern.

The entire area of Alternative Method 3 is cleared of archaeological concern and therefore there will be no impacts expected to any On-site Study Area archaeological resources. There is no potential for the disturbance of unassessed or documented archaeological resources and there are no net effects for Alternative Method 3.

3.4.1.2 Cemetery property within approximately 10 m

A historic cemetery, Watford Cemetery, is located outside of but adjacent to the western portion of the TCEC site. It is over 200 metres from the approved Expansion Landfill footprint. The Stage 1 AA predetermined that no cemetery investigation is required for this project.

The entire area of Alternative Method 3 is within the On-site Study Area and therefore there will be no impacts expected to the cemetery property. There is no potential for the disturbance of the cemetery and there are no net effects for Alternative Method 3.

3.4.2 Summary

A summary of the effects assessment of Alternative Method 3 is summarized below in **Table 3-3**.

Table 3-3. Net Effects Assessment – Alternative Method 3

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Archaeological Resources	Archaeological resources on-site and predicted impacts on them	• The construction and operation of Alternative Method 3 will take place within the existing On-site Study Area Landfill design and geometry. Landfill expansion will only be occurring within the approved Expansion Landfill footprint • There will be no change to any Off-site activities associated with the Project • Archaeological site AfHl-14 is located in the southeastern corner of the TCEC site and will not be impacted by the construction and operation of Alternative Method 1 • The Stage 1 AA determined that the remainder of the On-site Study Area beyond the protected area of site AfHl-14 has been previously assessed and has no further archaeological concern	• No potential for the disturbance of unassessed or documented archaeological resources • Site AfHl-14 has further cultural heritage value or interest and has been protected in perpetuity with the establishment of a protective 10 metre buffer and surrounding conservation area upon the completion of a Stage 3 site-specific assessment in 2007 (P057-307-2006 and P057-374-2007). Continued avoidance and protection is required for the site should the area be impacted by any construction and operation activities.	• None required	• No net effects on Archaeological Resources
	Cemetery property within approximately 10 metres of the proposed impacts	• The construction and operation of Alternative Method 3 will take place within the existing On-site Study Area Landfill design and geometry. landfill expansion will only be occurring within the approved Expansion Landfill footprint • There will be no change to any Off-site activities associated with the Project • A historic cemetery, Watford Cemetery, is located adjacent to the western portion of the TCEC site. • The Stage 1 AA determined that no cemetery investigation is required for this project.	• No potential for the disturbance of the cemetery	• None required	• No net effects on Archaeological Resources

4 Comparative Evaluation of Net Effects and Identification of the Preferred Alternative

The comparative evaluation of the net effects of each alternative method and the identification of a Preferred Alternative are carried out in accordance with the methods described in Section 2.2. The three alternative methods are comparatively assessed and evaluated using the criteria and indicators to determine the Preferred Alternative. The differences in the potential environmental effects remaining following the implementation of potential mitigation/management measures (i.e., net effects) are used to identify and compare each alternative method. The comparative evaluation of the alternative methods for Archaeological Resources is provided in **Table 4-1**, below.

Table 4-1. Comparative Evaluation of the Net Effects of the Alternative Methods for Archaeology

Evaluation Criteria	Indicator	Net Effects of Alternative Methods		
		Alternative Method 1	Alternative Method 2	Alternative Method 3
Archaeological Resources	Archaeological resources on-site and predicted impacts on them	No net effects on on-site Archaeological Resources. **No Substantial Difference**	No net effects on on-site Archaeological Resources. **No Substantial Difference**	No net effects on on-site Archaeological Resources. **No Substantial Difference**
	Cemetery property within approximately 10 metres of the proposed impacts	No net effects on the cemetery property. **No Substantial Difference**	No net effects on the cemetery property. **No Substantial Difference**	No net effects on the cemetery property. **No Substantial Difference**
	Criteria Rating & Rationale	***There is no substantial difference between the alternative methods for Archaeological Resources*** There is no potential for the disturbance of unassessed or documented archaeological resources or the cemetery property; consequently, no effects on Archaeological Resources are anticipated as a result of the Project.		
Preferred Alternative: There is no substantial difference between the alternative methods for Archaeological Resources; therefore, no Preferred Alternative is identified.				

There is no potential for the disturbance of unassessed or documented archaeological resources or the cemetery with either Alternative Method 1, 2, or 3. There is no substantial difference between the alternative methods for Archaeological Resources. No Preferred Alternative is identified for Archaeological Resources.

5 Effects Assessment of the Preferred Alternative

There is no potential for the disturbance of unassessed or documented archaeological resources or the cemetery. There are no net effects on Archaeological Resources.

6 Comparison of the Preferred Alternative against the 'Do Nothing' Alternative

The effects of the Preferred Alternative are compared against the predicted effects of the currently approved Expansion Landfill based on similar environmental criteria and indicators, with the understanding that the criteria and indicators used in the current effects assessment may differ from those used for the effects assessment of the Expansion Landfill. The effects are compared against each other in terms of magnitude, extent, and duration below. The advantages and disadvantages of the Preferred Alternative compared to the 'Do Nothing' alternative are identified.

6.1 Effects of the 'Do Nothing' Alternative

Under the "Do Nothing" Alternative, the existing Expanded Landfill will continue to operate until the approved capacity is reached, and there are no changes to operations in the On-Site or Off-site Study Areas. The "Do Nothing" Alternative is not anticipated to result in any net effects to archaeological resources.

6.2 Comparison of the Preferred Alternative against the 'Do Nothing' Alternative

There is no potential for the disturbance of unassessed or documented archaeological resources or the cemetery with either Alternative Method 1, 2, or 3. The "Do Nothing" Alternative is not anticipated to result in any net effects to archaeological resources. There is no substantial difference between the "Do Nothing" Alternative or the three proposed Alternative methods for Archaeological Resources. There is no Preferred Alternative from an archaeological perspective.

6.3 Advantages and Disadvantages of the Preferred Alternative

The differences in net effects between the Preferred Alternative and the 'Do Nothing Alternative' are used to determine the advantages and disadvantages of the Preferred Alternative. The advantages and disadvantages of the Preferred Alternative are listed in **Table 6-1**. There is no preferred Alternative from an archaeological perspective.

Table 6-1. Advantages and Disadvantages of the Preferred Alternative

Evaluation Criteria	Advantages	Disadvantages
Archaeological Resources	• None	• None

There are no advantages or disadvantages of the three alternative methods compared to the 'do nothing' alternative, since none of the three alternative methods will result in an effect on archaeological resources.

7 Commitments and Monitoring

No mitigation measures are proposed for Archaeological Resources as no net effects are predicted for Alternative Methods 1, 2, or 3.

The commitments associated with Archaeological Resources are listed in Section 7.1. The proposed environmental effects monitoring is provided in Section 7.2. Compliance monitoring for Archaeological Resources is described in Section 7.3.

7.1 Archaeological Resources Commitments

As identified in the Stage 1 AA completed for the Project (i.e., the Archaeological Resources Existing Conditions Report), Archaeological site AfHl-14 is within the On-site Study Area and has further cultural heritage value or interest. The site has been protected in perpetuity with the establishment of a protective 10 m buffer and surrounding conservation area following the completion of a Stage 3 site-specific assessment in 2007 (P057-307-2006 and P057-374-2007), as defined in the Stage 1 AA. Continued avoidance and protection is required for the site for any construction activities in future. The avoidance and protection measures recommended for the area around the archaeological site will not be required for the Project as no construction and operation activities are planned.

The remainder of the On-site Study Area has no further archaeological concern.

7.2 Environmental Effects Monitoring for Archaeological Resources

Monitoring plans are developed as part of the detailed effects assessments carried out for the Preferred Alternative to confirm:

- the net effects are as predicted;
- unanticipated negative effects are addressed; and
- the effectiveness of the proposed mitigation measures.

Environmental Effects Monitoring is not required as there are no net effects on Archaeological Resources and no Preferred Alternative from an archaeological perspective.

7.3 Archaeology Compliance Monitoring

Compliance monitoring is not required as there are no net effects on Archaeological Resources and no Preferred Alternative from an archaeological perspective.

8 Archaeology Approvals

In addition to EA approval, the following Archaeology approvals are required:

- The Stage 1 AA report must be submitted to the Ministry of Citizenship and Multiculturalism as a condition of licensing in accordance with Part VI of the *Ontario Heritage Act*, RSO 2005, c 0.18. The report will be reviewed to ensure that it complies with the standards and guidelines that are issued by the Minister, and that the archaeological field work and report recommendations ensure the conservation, preservation, and protection of the cultural heritage of Ontario. When all matters relating to archaeological sites within the project area of a development proposal have been addressed to the satisfaction of the Ministry of Citizenship and Multiculturalism, a letter will be issued by the Ministry stating that there are no further concerns with regards to alterations to archaeological sites by the proposed development.

9 References

Archaeological Services Inc.

2001 Stage 1/2 Archaeological Resource Assessment, Warwick Landfill Expansion Project, Township of Warwick, County of Lambton, Ontario [1999-007-054].

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2011 Standards and Guidelines for Consultant Archaeologists. Cultural Programs Branch, Ministry of Tourism and Culture