

9.0 Impact Assessment and Net Effects

9.1 Atmosphere

This section provides the assessment of impacts on air quality (including dust, odour, GHG) and noise for the proposed expansion of the W12A Landfill as described in Section 8 of this EASR. This assessment was conducted in accordance with the requirements set out in the approved Amended ToR (Volume II) and the Work Plan dated December 2019 (Volume III Appendix B.01). Additional details on the impact assessment are provided in Volume IV Appendix D.01.

9.1.1 Air Quality

The details of the air quality assessment are described below. The effects of the Project on air quality were identified for different phases of the expansion and involved 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; and
- 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). The AERMOD dispersion model (Version 19191) was used to predict ground-level concentrations for the indicator compounds

Details of the specific emissions calculation methods and resulting emissions are provided in Volume IV Appendix D.01 and summarized in Section 5.2.1.

9.1.1.1 Identification of Emission Sources

Table 9.1-1 outlines the activities (i.e., sources of emissions) that have been assessed as part of the air quality assessment for both the existing scenario and the expansion phases. For sources that were identified and not included in the assessment, the rationale has been presented in the table.

Emissions during normal operations 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 project operational phase represent the greatest potential impacts.

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As the project will be conducted in eight phases, consideration was given to identifying the operational phase that results in the “worst case” emissions scenario. Three different phases were considered for this purpose:

- Phase 2E;
- Phase 4E; and
- Phase 8E.

These phases were selected as they have the longest on-site vehicle access routes (i.e., result in largest fugitive dust and vehicle exhaust emissions).

For odour, the main sources of emission are the active filling areas. As a result, all eight phases of the site were modelled and the active filling area for each respective phase was placed in the location closest to sensitive receptors, typically close to the site boundary. Emissions from the capped areas of the landfill were also modelled, using the existing landfill footprint.

Table 9.1-1: Project Emission Sources

Source Information: General Location	Source	Significant (Yes or No)?	Modelled (Yes or No)?	Rationale
Landfill	Landfill capping	Yes	Yes	—
	Landfill operations (material handling and vehicle exhaust)	Yes	Yes	—
Landfill gas collection and control system (LGCCS)	Enclosed LFG flare (existing)	Yes	Yes	—
	Enclosed LFG flare (proposed)	Yes	Yes	—
	Propane combustion equipment	No	No	Propane is used to ignite the pilot flame on the flare. The pilot flame is not ignited at the same time as the flare is operated with LFG, therefore combustion associated with the pilot flame is not included in the model as it does not represent the worst-case scenario.

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Source Information: General Location	Source	Significant (Yes or No)?	Modelled (Yes or No)?	Rationale
Paved and unpaved roads	Vehicle exhaust and fugitive road dust	Yes	Yes	—
Storage piles	On-site storage piles wind erosion	No	No	Emissions from wind erosion of the storage piles were calculated using emission factors from U.S. EPA Control of Open Fugitive Dust Source (EPA-45/3-88-008), September 1988 but are considered to be negligible in comparison to the other activities occurring on-Site. Best management practices used on-Site to minimize erosion from storage piles include the seeding of long term storage piles to minimize the exposed surface area.
Non-decomposable Area	Non-decomposable Area	Yes	Yes	—
Public Drop Off Area	Public Drop Off Area	No	No	These activities are considered to be negligible in comparison to the other activities occurring on-site.
HSW building	HSW building	No	No	These activities are considered to be negligible in comparison to the other activities occurring on-site.
Leachate collection system	Leachate collection and treatment	No	No	The leachate is treated off-site and therefore there are no emissions from on-site leachate treatment. The Facility does have a capacity for below-grade temporary leachate storage, but it is not anticipated more than a few times per year.

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Source Information: General Location	Source	Significant (Yes or No)?	Modelled (Yes or No)?	Rationale
Support activities	Emergency power generator(s)	No	No	The emergency power equipment only operates periodically (rather than continuously) and therefore produces emissions that are negligible relative to the overall emissions from the site.
	Comfort Heating	No	No	These activities are considered to be negligible in comparison to the other activities occurring on-site.
	Operational support activities, such as maintenance activities and stormwater ponds	No	No	These activities are considered to be negligible in comparison to the other activities occurring on-site.

9.1.1.2 Emission Summary

Table 9.1-2 below summarizes the estimated emission rates in grams per second (g/s) for each indicator compound from the Project operations as identified in the previous sections. More details and the emissions per source are provided in Volume IV Appendix D.01.

Table 9.1-2: Summary of Emission Rates from Project During Operation

Compound	Units	Operational Phase		
		Phase 2E	Phase 4E	Phase 8E
SPM	g/s	2.933	5.062	4.106
PM ₁₀	g/s	0.820	1.643	1.242
PM _{2.5}	g/s	0.311	0.411	0.379
NO _x	g/s	1.287	1.286	1.278
SO ₂	g/s	0.188	0.188	0.188
CO	g/s	1.988	1.988	1.985
H ₂ S	g/s	0.015	0.015	0.015
C ₂ H ₃ Cl	g/s	0.001	0.001	0.001
Odour	OU/s	4458.667	4458.667	4458.667

9.1.1.3 *Effects Prediction*

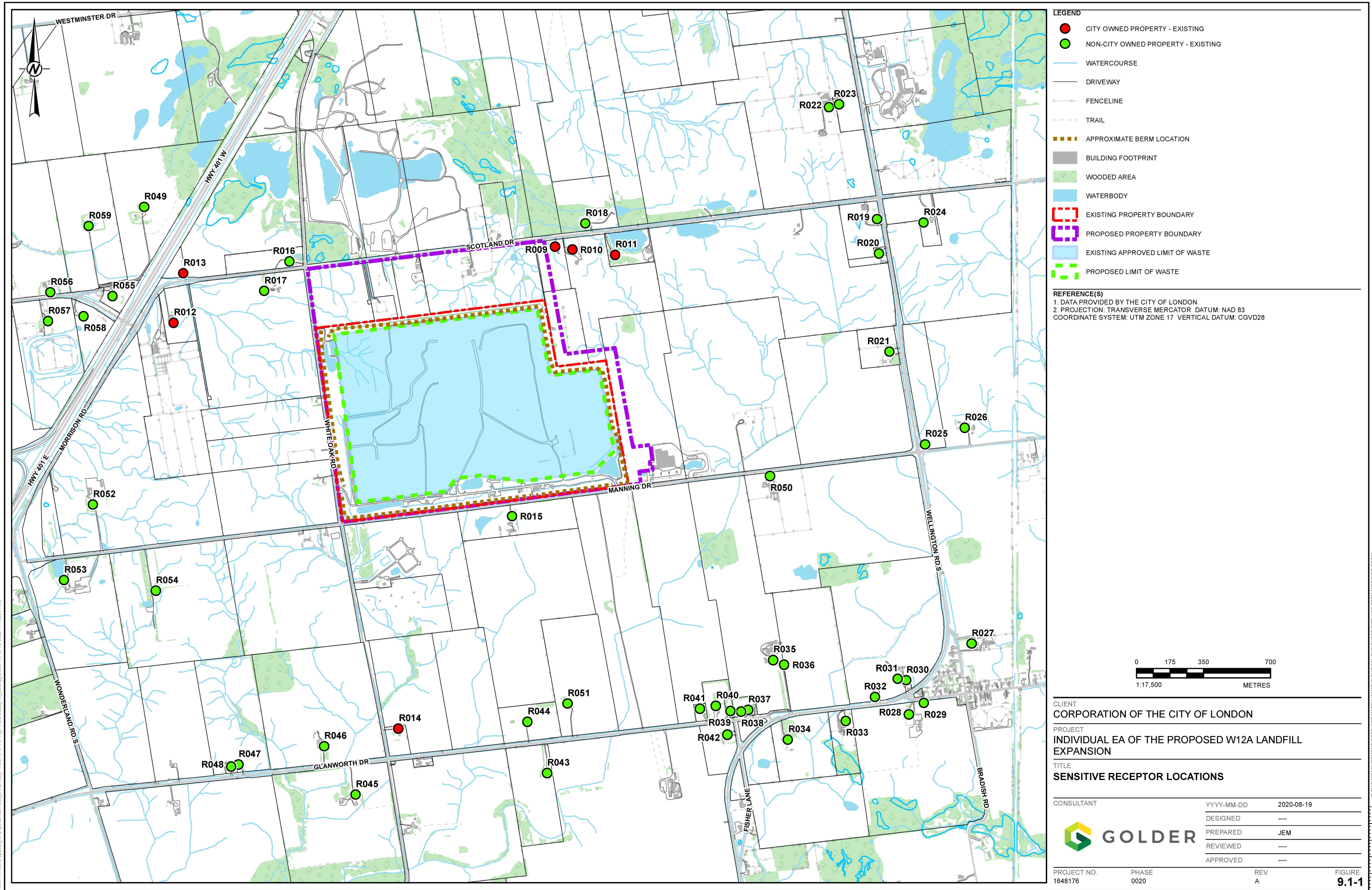
To determine potential effects of the proposed project on air quality and odour, the predicted concentrations of indicator contaminants were compared to Ontario's Ambient Air Quality Criteria (AAQC) (MECP 2020) and the Canadian Ambient Air Quality Standards (CAAQSs) (CCME 2014). For conservatism in this assessment, the lower of the Ontario AAQCs and the CAAQS, where applicable, were used for comparison to the maximum modelled concentrations. Further details on the applicable guidelines can be found in Volume IV Appendix D.01.

Maximum predicted concentrations for the expansion scenario (that presents the maximum predicted concentration from Phase 2E, 4E or 8E) at the sensitive receptors are presented in Table 9.1-3. The location and Phase at which the maximum concentration occurs is also identified. Receptors are shown on Figure 9.1-1.

The maximum cumulative concentrations of all indicator compounds are below the relevant guidelines for all indicator compounds, with the exception of NO₂ on a 1-hour basis.

For NO₂, the maximum predicted 1-hour NO₂ concentration is greater than the CAAQS of 79 µg/m³; however, comparison to the CAAQS is not appropriate and the maximum predicted 1 hour NO₂ concentrations above the CAAQS standard is not significant because neither the Site 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 (Volume IV Appendix D.01). A less conservative but more appropriate comparison to the Ontario AAQC of 400 µg/m³ for 1-hr NO₂ would result in a maximum predicted concentration that is only about 32% of the relevant criteria.

The predicted compound concentrations associated with the expansion are predicted to meet the relevant air quality criteria.



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Table 9.1-3: Maximum Predicted Concentrations at the Sensitive Receptors for Proposed Project

Indicator	Averaging Period	Air Quality Criteria ($\mu\text{g}/\text{m}^3$)	Background Conditions ¹ ($\mu\text{g}/\text{m}^3$)	Maximum Predicted Concentration - Proposed Landfill Expansion ($\mu\text{g}/\text{m}^3$) ³	Cumulative Effect - Proposed Landfill Expansion ($\mu\text{g}/\text{m}^3$)	Percentage of Air Quality Criteria (%)	Receptor Location of Maximum Predicted Concentration	Operational Phase of Maximum Prediction
SPM	24-hour	120	45.83	23.26	69.09	57.6%	R15	Phase 4E
	Annual	60	26.85	3.11	29.96	49.9%	R15	Phase 4E
PM ₁₀	24-hour	50	25.46	9.36	34.82	69.6%	R15	Phase 4E
PM _{2.5}	24-hour	27	13.75	1.14	14.89	55.2%	R10	Phase 8E
	Annual	8.8	8.06	0.21	8.27	94.0%	R10	Phase 8E
NO ₂	1-hour	400	22.57	103.63	126.20	31.6%	R10	Phase 8E
	24-hour	200	19.87	29.52	49.39	24.7%	R09	Phase 8E
	Annual	32	11.70	2.48	14.18	63.0%	R09	Phase 8E
SO ₂	10-min	180	56.19	1.22	57.41	31.9%	R15	Phase 2E
	1-hour	100	34.05	0.74	34.79	34.8%	R15	Phase 2E
	24-hour	150	32.36	0.17	32.53	21.7%	R15	Phase 8E
	Annual	10	9.08	0.01	9.09	90.9%	R11	Phase 8E
CO	1-hour	15,000	458.10	406.73	864.83	5.8%	R10	Phase 8E
	8-hour	6,000	572.62	72.16	644.78	10.7%	R10	Phase 8E
H ₂ S	10-min	13	0.50	0.52	1.36	10.5%	R24	Phase 2E
	24-hour	7	0.50	0.07	0.28	4.0%	R17	Phase 2E
C ₂ H ₃ Cl	24-hour	1	0.00334	0.006	0.0094	0.9%	R17	Phase 2E
C ₂ H ₃ Cl	Annual	0.2	0.00147	0.0011	0.0025	1.3%	R15	Phase 8E
Odour ²	10-min	1	—	0.98	0.98	Below 1 OU/m ³	R15	Phase 7E

Notes:

¹ Background conditions as described in Section 5.2.1

² Values for odour are in odour units per cubic metre (OU/m³) and presented at the 99.5 percentile

³ In accordance with Ontario guidance (MECP, 2017), meteorological anomalies have been removed when calculating the maximum predicted concentrations.

“—” indicates that there is no data available for existing conditions.

9.1.1.4 Compliance with Ontario Regulation 419/05

In addition to the assessment of the effects of the Project 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* 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. The table below summarizes the estimated emission rates for each indicator compound from the Project 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 IV Appendix D.01.

A modelling grid that satisfies s. 14 O. Reg. 419/05 assessment was used in modelling the indicator compounds. Emissions from tailpipe, 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 ESDM Procedure Document. Emission rates are outlined in Table 9.1-4.

Table 9.1-4: Summary of O. Reg. 419/05 Emission Rates

Compound	Units	Emission Rates from O. Reg. 419/05 Sources
SPM	g/s	0.307
NO _x	g/s	0.555
SO ₂	g/s	0.188
CO	g/s	0.657
H ₂ S	g/s	0.015
C ₂ H ₃ Cl	g/s	0.001
Odour	OU/s	4458.667

Maximum concentrations at the property boundary and the gridded receptors as per section 14 of O. Reg 419/05 are presented in Table 9.1-5 and were predicted with the AERMOD dispersion model (as described in Volume IV Appendix D.01).

Table 9.1-5: Predicted Air Quality Compliance with O. Reg. 419/05

Indicator	Averaging Period	Air Quality Criteria ($\mu\text{g}/\text{m}^3$)	Maximum Predicted POI Concentration ($\mu\text{g}/\text{m}^3$)	Percentage of Air Quality Criteria (%)
SPM	24-hour	120	20.90	17.4%
NO _x	1-hour	400	9.28	2.3%
NO _x	24-hour	200	2.64	1.3%
SO ₂	1-hour	690	3.23	<1%%
SO ₂	24-hour	275	0.93	<1%%
CO	½-hour	6000	13.54	<1%%
H ₂ S	10-min	13	0.5398	4.2%
H ₂ S	24-hour	7	0.0912	1.3%
C ₂ H ₃ Cl	24-hour	1	0.0074	<1%
Odour ¹	10-min	1	0.98	Below 1 OU/m ³

Note: ¹ Values for odour are in odour units per cubic metre (OU/m³) and presented at the 99.5 percentile at sensitive receptors.

The assessment indicates that the proposed facility will be in compliance with Schedule 3 of O. Reg. 419/05.

9.1.2 Noise

The following presents the noise prediction methodology and results of the impact assessment of the Project landfilling operations, ancillary equipment, and traffic on the off-site haul routes, which were considered in both the assessment of compliance with MECP guidelines (if applicable) and the change due to the Project relative to existing noise levels. Therefore, noise predictions of landfilling operations, ancillary equipment, and off-site haul routes were each assessed independently against the MECP guidelines (where applicable), and then combined to assess change relative to existing noise levels.

9.1.2.1 Compliance with MECP Guidelines

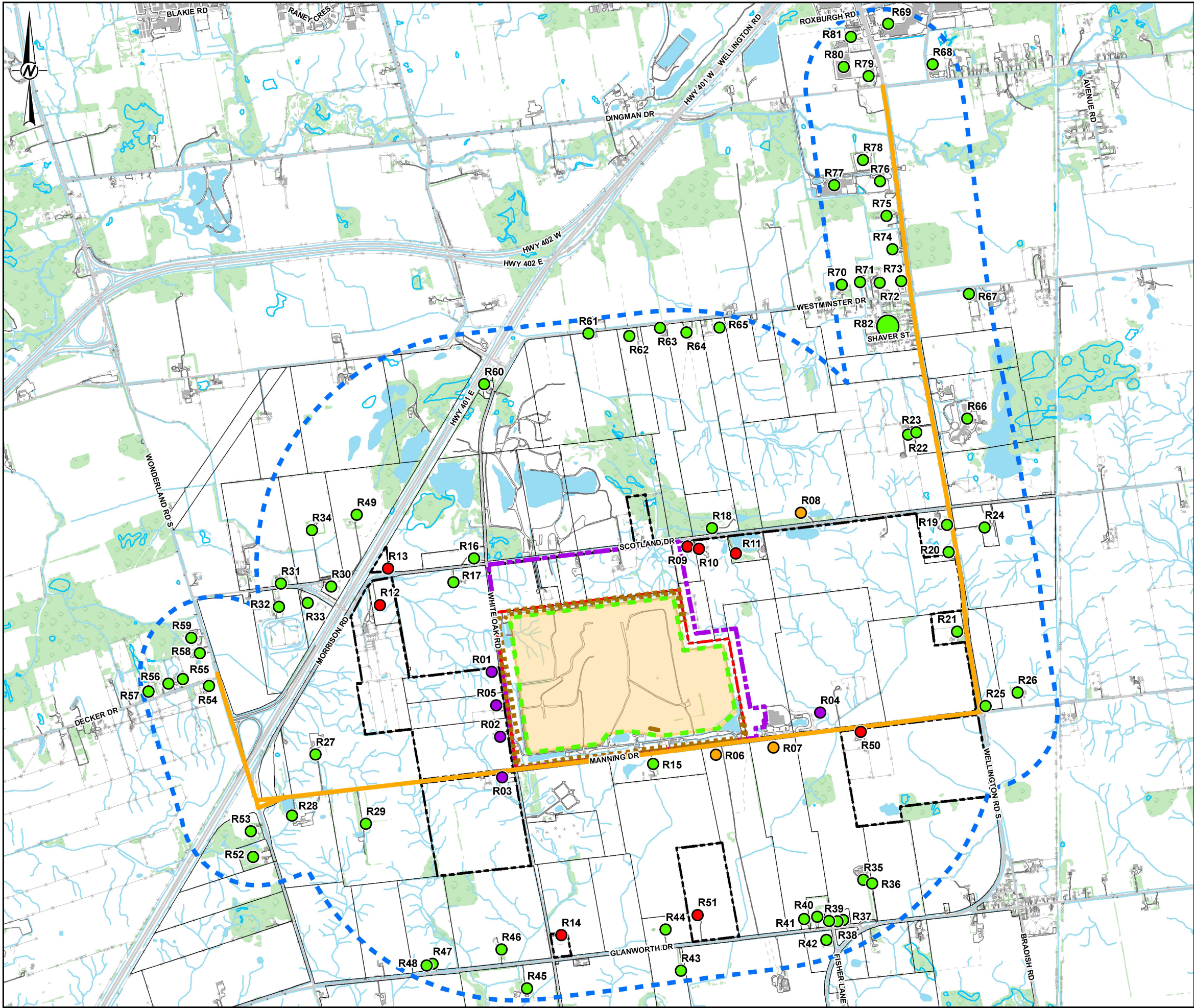
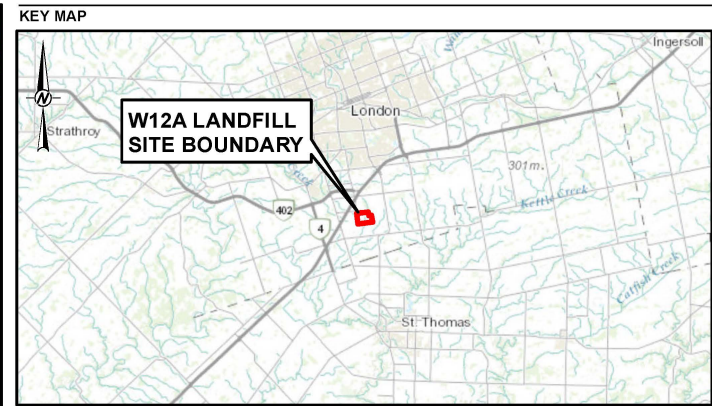
The methodology used for the noise assessment was based on the Landfill Guidelines (MECP 1998) and NPC-300 (MECP 2013). These guidelines outline the sound level limit criteria for evaluating landfilling operations and ancillary facilities (i.e., stationary noise sources).

The noise assessment was carried out at the representative PORs identified within the Site-vicinity Study Area, as shown on Figure 9.1-2. 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.

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

The Landfill Guidelines also outline the protocol for evaluating off-site vehicle traffic 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 9.1-6.



SCALE 1:750,000

LEGEND

- CITY OWNED PROPERTY - EXISTING
- CITY OWNED PROPERTY - VACANT
- NON-CITY OWNED PROPERTY - EXISTING
- NON-CITY OWNED PROPERTY - EXISTING (RURAL SUBDIVISION OF APPROXIMATELY 40 HOUSES)
- NON-CITY OWNED PROPERTY - VACANT
- WATERCOURSE
- DRIVEWAY
- FENCELINE
- TRAIL
- APPROXIMATE EXISTING BERM LOCATION
- EXAMPLE BERM
- HAUL ROUTES
- BUILDING FOOTPRINT
- WOODED AREA
- WATERBODY
- CITY OWNED PROPERTY
- EXISTING PROPERTY BOUNDARY
- PROPOSED PROPERTY / SITE STUDY AREA
- EXISTING APPROVED LIMIT OF WASTE
- PROPOSED LIMIT OF WASTE
- SITE-VICINITY STUDY AREA

REFERENCE(S)
1. DATA PROVIDED BY THE CITY OF LONDON.
2. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: UTM ZONE 17 VERTICAL DATUM: CGVD28

0 250 500 1,000
1:25,000 METRES

CLIENT
CORPORATION OF THE CITY OF LONDON

PROJECT
INDIVIDUAL EA OF THE PROPOSED W12A LANDFILL EXPANSION

TITLE
NOISE STUDY AREAS AND POINTS OF RECEPTION

CONSULTANT	YYYY-MM-DD	2021-09-10
	DESIGNED	---
	PREPARED	JEM
	REVIEWED	SC
	APPROVED	---

PROJECT NO. 1648176 PHASE 0029 REV. 0

FIGURE 9.1-2

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Table 9.1-6: 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 Project ancillary facilities are established in accordance with NPC-300 for the daytime (7 a.m. to 7 p.m.), evening (7 p.m. to 11 p.m.), and nighttime (11 p.m. to 7 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.

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 one hour equivalent sound level ($L_{eq,1hr}$) MECP exclusionary sound level limits for steady sounds from stationary noise sources at a POR in a Class 3 area are summarized in Table 9.1-7, and used to assess compliance of the Project. The potential Project 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.

Table 9.1-7: Sound Level Limits for Class 3 Area – Steady Stationary Sources

Time Period	POW MECP Exclusionary Sound Level Limit (dBA)	Outdoor MECP Exclusionary Sound Level Limit (dBA)
	Class 3	Class 3
Daytime (7 a.m. – 7 p.m.)	45	45
Evening (7 p.m. – 11 p.m.)	40	40
Nighttime (11 p.m. – 7 a.m.)	40	not applicable

As the testing of emergency equipment is limited to a periodic basis, the MECP allows for an increase to the exclusionary sound level limit. Therefore, the stationary sources sound level limits presented in Table 9.1-7 above were increased by 5 dB when assessing the testing of emergency equipment.

Impulsive sounds from stationary noise sources are currently not expected. 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 the weigh scale or 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.

Landfilling Operations

Table 9.1-8 and Table 9.1-9 provide a summary of the predictable worst case hour predicted noise levels for the landfill operation scenarios described in Section 5.2.2 during the daytime (7 a.m. to 7 p.m.) and nighttime (7 p.m. to 7 a.m.) periods, respectively. Noise levels were predicted at the identified representative PORs within 500 m of the Site Area.

Noise predictions were carried out for the five scenarios representing the landfill operations of the Project. Normal Operations, Placement of Daily Cover, and Building a Berm are expected to occur during the daytime only and therefore are compared to the Landfill Guidelines daytime sound level limit of 55 dBA. Site preparation and disposal of dewatered biosolids may occur during the nighttime and therefore are compared to the Landfill Guidelines nighttime sound level limit of 45 dBA. The following tables also include the applicable Landfill Guidelines sound level limit; bold values indicate predicted noise levels that exceed the sound level limit.

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Table 9.1-8: Daytime Landfilling Operations Predictable Worst Case Hour Noise Predictions

Receptor	Normal Operations Noise Level (dBA)	Placement of Daily Cover Noise Level (dBA)	Berm Building Noise Level (dBA)	Landfill Guidelines Daytime Sound Level Limit (dBA)
R01	58	53	53	55
R02	58	53	53	55
R04	48	42	42	55
R06	57	52	52	55
R10	51	46	46	55
R15	55	50	49	55
R16	49	44	44	55

Note: **Bold** indicates predicted noise levels that exceed Landfill Guidelines sound level limits

Table 9.1-9: Nighttime Landfilling Operations Predictable Worst Case Hour Noise Predictions

Receptor	Site Preparation Noise Level (dBA)	Disposal of Dewatered Biosolids Noise Level (dBA)	Landfill Guidelines Nighttime Sound Level Limit (dBA)
R01	50	44	45
R02	49	44	45
R04	39	34	45
R06	49	44	45
R10	43	38	45
R15	47	41	45
R16	41	36	45

Note: **Bold** indicates predicted noise levels that exceed Landfill Guidelines sound level limits

The results presented in Table 9.1-8 and Table 9.1-9 indicate that mitigation is required for normal operations (at R01, R02 and R06) and site preparation (at R01, R02, R06 and R15) scenarios to meet the Landfill Guidelines sound level limits. Mitigation is further discussed in Section 9.1.2.2.

Ancillary Equipment

Table 9.1-10 provides a summary of the predictable worst case hour predicted noise levels due to ancillary equipment and testing of emergency diesel generators at the identified representative PORs within 500 m of the Site Area. The predicted noise levels from the ancillary equipment are compared to the nighttime NPC-300 stationary source sound level limits, as it is expected the equipment will operate continuously for 24 hours per day and the nighttime limits are more stringent. Testing of the emergency diesel generators will be limited to the daytime period, and therefore the results are compared to the daytime NPC-300 sound level limits for emergency equipment.

As shown in Table 9.1-10, the ancillary equipment and emergency diesel generators are expected to operate below the NPC-300 sound level limits at the representative PORs.

Table 9.1-10: Ancillary Equipment / Emergency Generator Predictable Worst Case Hour Noise Predictions

Receptor	Ancillary Equipment Noise Level (dBA)	NPC-300 Nighttime Stationary Source Sound Level Limit (dBA)	Emergency Diesel Generator Noise Level (dBA)	NPC-300 Daytime Emergency Equipment Sound Level Limit (dBA)
R01	10	40	7	50
R02	15	40	23	50
R04	16	40	18	50
R06	26	40	38	50
R10	7	40	7	50
R15	34	40	31	50
R16	9	40	5	50

Off-site Haul Route

Predicted noise levels due to the daytime existing traffic (without the traffic associated with the existing landfill) were compared to noise levels due to future expected traffic (i.e., existing plus the Project) during the predictable worst case hour (i.e., the hour when Project impacts are predicted to be the greatest), with the assumption that the Project traffic will be distributed across the daytime period in a similar manner to existing landfill traffic. The road traffic modelling indicated the predictable worst case hour was from 10:00 to 11:00 am. Table 9.1-11 summarizes the expected change between future and existing noise levels at representative PORs along the haul routes as well as the associated qualitative rankings (as summarized above). Results are shown for all representative PORs discussed in Section 5.2.2.

Table 9.1-11: Predicted Change in Noise Levels along Haul Routes

Receptor	Existing Traffic Worst Case One-Hour Noise Level (dBA)	Project Traffic Worst Case One-Hour Noise Level (dBA)	Change in Noise Level (dB)	Qualitative Rating ¹
R02	48	50	2	Insignificant
R04	45	54	9	Significant
R06	46	55	9	Significant
R15	46	54	8	Significant
R19	62	66	4	Noticeable
R23	51	55	4	Noticeable
R25	59	64	5	Noticeable
R50	56	65	9	Significant

Note: ¹ See Table 9.1-6 for details of qualitative ranking system

The results in Table 9.1-11 indicate that during the Project predictable worst case hour, the change in noise levels ranges from insignificant to significant. The significant changes occur on Manning Drive, where the landfill contributes a large portion of the traffic. Noise mitigation (i.e., acoustic barriers and berms) would typically be implemented within the Haul Routes' right-of-way but it does not appear they would be technically feasible to reduce the noise levels in accordance with general industry practices when assessing road traffic (i.e., achieve a 5 dB reduction). The PORs are standalone, front facing residences with driveways that intersect the Haul Routes. Noise barriers would not be able to extend continuously along the roadway for a sufficient distance to be effective due to the openings required to accommodate the driveways. It is important to note that if the Project worst case hour noise levels were compared to existing worst case hour noise levels with the existing landfill traffic included, more representative of current conditions, changes in noise level of 0 dB to 1 dB were predicted (i.e., an insignificant qualitative rating) at all PORs.

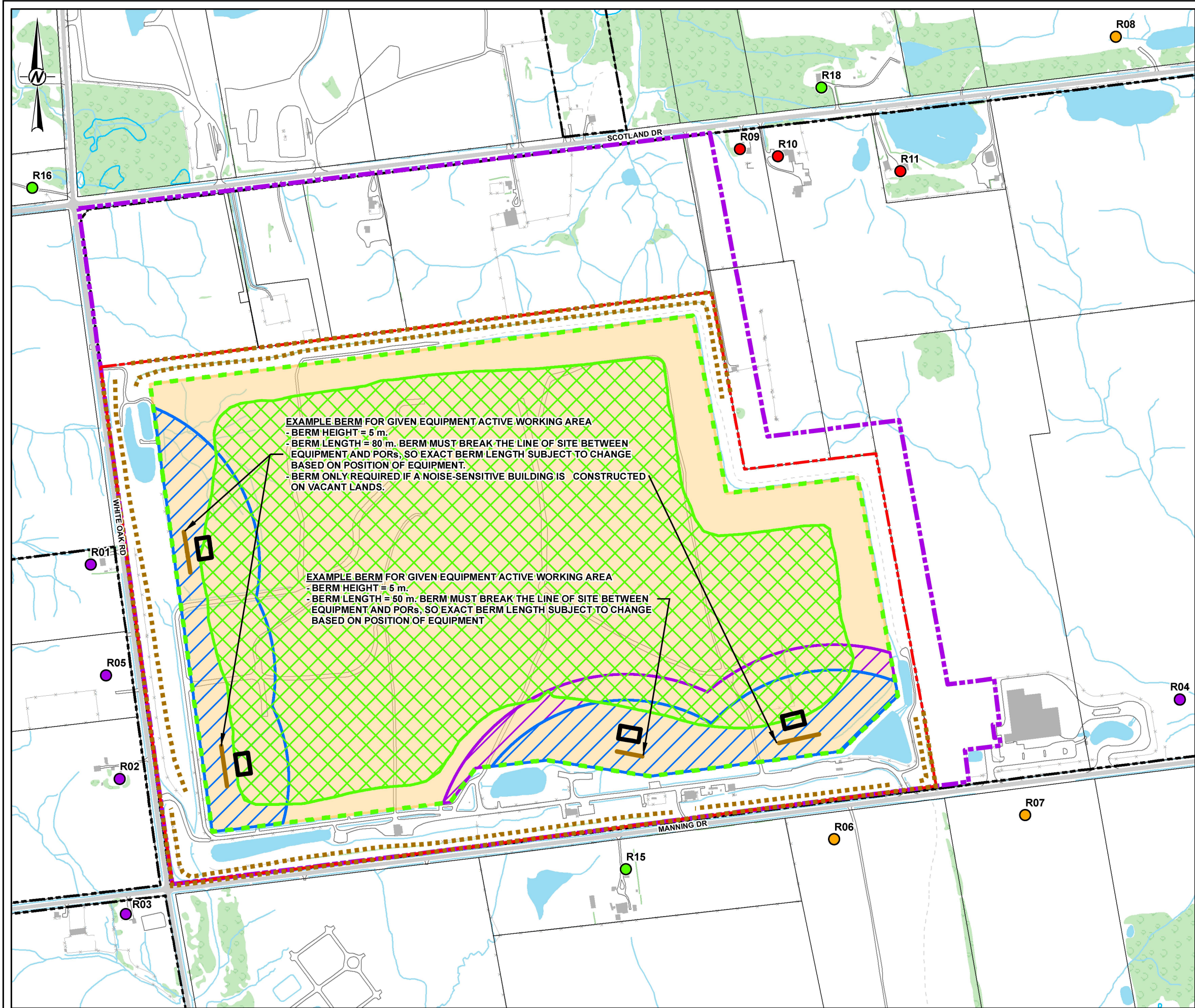
Additional Mitigation Measures

The following mitigation as described below and shown on Figure 9.1-3 has been designed such that the landfilling operations satisfy the MECP sound level limits:

- When in the western section of Phase 1E or Phase 2E:
 - For all landfill operating scenarios, except for the Building a Berm scenario, working equipment within the active area must be behind a 5 m high berm when operating within 330 m of a POR to the west.
 - Note that the PORs to the west (i.e., R01 and R02) are all currently vacant and therefore implementation of this mitigation is not required unless a noise-sensitive building is constructed.

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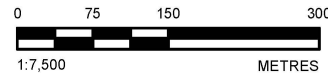
- When in the southern section of Phase 5E, Phase 7E, or the dedicated non-decomposable waste cell:
 - For all landfill operating scenarios, except for the Building a Berm scenario, working equipment must be behind a 5 m high berm when operating within 330 m of a POR to the south.
 - Site preparation must not start before 07:00 a.m. when operating between 330 m and 380 m of a POR to the south.
- Note that a POR does exist at 3691 Manning Drive (i.e., R15), but is located approximately 310 m from the edge of the area of new waste placement. As discussed in Section 4.3.3.1, the active area was located 20 m from the edge of the area of new waste placement and therefore a 5 m berm is not expected to be required. All other PORs to the south (i.e., R06) are all currently vacant and therefore implementation of this mitigation is not required for these PORs unless a noise-sensitive building is constructed.



LEGEND

- CITY OWNED PROPERTY - EXISTING
- CITY OWNED PROPERTY - VACANT
- NON-CITY OWNED PROPERTY - EXISTING
- NON-CITY OWNED PROPERTY - VACANT
- WATERCOURSE
- DRIVEWAY
- FENCELINE
- TRAIL
- APPROXIMATE EXISTING BERM LOCATION
- EXAMPLE BERM
- EQUIPMENT ACTIVE WORKING AREA
- BUILDING FOOTPRINT
- WOODED AREA
- WATERBODY
- CITY OWNED PROPERTY
- EXISTING PROPERTY BOUNDARY
- PROPOSED PROPERTY
- EXISTING APPROVED LIMIT OF WASTE
- PROPOSED LIMIT OF WASTE
- AREA OF NEW WASTE PLACEMENT
- NO SITE PREPARATION BEFORE 7 am
- MUST WORK BEHIND A 5 m HIGH BERM

REFERENCE(S)
1. DATA PROVIDED BY THE CITY OF LONDON.
2. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: UTM ZONE 17 VERTICAL DATUM: CGVD28



CLIENT
CORPORATION OF THE CITY OF LONDON

PROJECT
INDIVIDUAL EA OF THE PROPOSED W12A LANDFILL EXPANSION

TITLE
MITIGATION AT EXISTING POINT OF RECEPTION R15

CONSULTANT	YYYY-MM-DD	2021-09-10
	DESIGNED	---
	PREPARED	JEM
	REVIEWED	SC
	APPROVED	---

PROJECT NO. 1648176	PHASE 0029	REV. 0	FIGURE 9.1-3
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Table 9.1-12 and Table 9.1-13 provide a summary of the mitigated predictable worst case hour predicted noise levels, with the noise controls described above, at the identified representative PORs during the daytime and nighttime, respectively. The mitigated predicted noise levels at all of the identified representative PORs meet the Landfill Guidelines sound level limits.

Table 9.1-12: Mitigated Daytime Landfilling Operations Predictable Worst Case Hour Noise Predictions

Receptor	Normal Operations Noise Level (dBA)	Daily Cover Noise Level (dBA)	Landfill Guidelines Daytime Sound Level Limit (dBA)
R01	55	49	55
R02	55	50	55
R04	48	40	55
R06	55	47	55
R10	51	46	55
R15	55	50	55
R16	49	44	55

Table 9.1-13: Mitigated Nighttime Landfilling Operations Predictable Worst Case Hour Noise Predictions

Receptor	Site Preparation Noise Level (dBA)	Disposal of Dewatered Biosolids Noise Level (dBA)	Landfill Guidelines Nighttime Sound Level Limit (dBA)
R01	45	41	45
R02	45	41	45
R04	39	31	45
R06	45	38	45
R10	43	38	45
R15	45	41	45
R16	41	36	45

9.1.2.2 Change from Existing Noise Levels for EA purposes

In addition to meeting compliance with MECP guidelines, the change relative to existing noise levels within the Site-vicinity Study Area was evaluated to support the EA. This section does not address any MECP requirements. The combined noise levels from all significant noise sources during the predictable worst case daytime and nighttime periods were calculated, based on the operating hours of each scenario presented in Section 5.2.2. Noise levels were evaluated as an average over the daytime (7 a.m. to 11 p.m.) and nighttime (11 p.m. to 7 a.m.) periods.

To determine potential adverse effects from the Project, two criteria were used. The first was a comparison against applicable noise limits (i.e., the assessment in Sections 9.1.2.1 and 9.1.2.2), and the second was an assessment of changes to noise levels relative to existing noise levels at the most sensitive PORs within the Site-vicinity Study Area. These changes were assessed against the magnitude ratings identified in Table 9.1-14.

As per the Landfill Guidelines (i.e., Table 9.1-6), a change in level of 3 dB is generally accepted as the smallest change detectable by the human auditory system in the environment (MECP 1998). Changes in noise levels for the period L_{eq} (A-weighted energy equivalent sound level) that would be hardly perceptible (i.e., less than or equal to 3 dB) were assigned a negligible magnitude. A noticeable change in the period L_{eq} (i.e., greater than 3 dB, but less than or equal to a 5 dB change) was classified as having a low magnitude. Clearly noticeable changes in the period L_{eq} , perceived as less than twice as loud (i.e., greater than 5 dB, but less than or equal to 10 dB), were considered of moderate magnitude. Very significant changes in the noise levels for the period L_{eq} that are perceived as more than twice as loud (i.e., greater than 10 dB) were classified as having a high magnitude.

A potential adverse effect is expected when a magnitude rating of moderate or high is predicted.

Table 9.1-14: Magnitude Ratings for Potential Noise Effects

Magnitude	Criteria
Negligible	<ul style="list-style-type: none"> Project related noise levels do not exceed MECP sound level limits; and Project related change relative to existing noise levels in daytime and nighttime equivalent noise level is ≤ 3 dB.
Low	<ul style="list-style-type: none"> Project related noise levels do not exceed MECP sound level limits; and Project related change relative to existing noise levels in daytime and nighttime equivalent noise level is > 3 dB and ≤ 5 dB.
Moderate	<ul style="list-style-type: none"> Project related noise levels do not exceed MECP sound level limits; and Project related change relative to existing noise levels in daytime and nighttime equivalent noise level is > 5 dB and ≤ 10 dB.

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Magnitude	Criteria
High	<ul style="list-style-type: none">• Project related noise levels exceed MECP sound level limits; or• Project related change relative to existing noise levels in daytime and nighttime equivalent noise level is > 10 dB.

Table 9.1-15 summarizes: the existing noise levels, the predicted worst case Project noise levels averaged over the daytime or nighttime considering the mitigation measures presented in Section 9.1.2.2, and the corresponding change and magnitude rating (Table 9.1-14) at the identified representative PORs.

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Table 9.1-15: Predicted Daytime and Nighttime Noise Levels and Change from Existing Conditions due to the Project

Receptor	Predicted Existing Noise Level (dBA)	Predicted Existing Noise Level (dBA)	Mitigated Predicted Project Average Noise Level (dBA)	Mitigated Predicted Project Average Noise Level (dBA)	Change in Noise Level (dB)	Change in Noise Level (dB)	Meets Applicable MECP Sound Level Limit (Yes/No) ¹	Meets Applicable MECP Sound Level Limit (Yes/No) ¹	Magnitude Rating ²	Magnitude Rating ²
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
R01	52	42	54	44	2	2	Yes	Yes	Negligible	Negligible
R02	53	42	55	45	2	3	Yes	Yes	Negligible	Negligible
R04	50	34	52	37	2	3	Yes	Yes	Negligible	Negligible
R06	52	36	55	41	3	5	Yes	Yes	Low	Low
R10	49	41	52	43	3	2	Yes	Yes	Negligible	Low
R15	53	39	55	43	2	4	Yes	Yes	Negligible	Low
R16	55	48	56	49	1	1	Yes	Yes	Negligible	Negligible
R19	64	57	65	57	1	0	Yes ³	Yes ³	Negligible	Negligible
R23	53	46	54	46	1	0	Yes ³	Yes ³	Negligible	Negligible
R25	62	54	62	54	0	0	Yes ³	Yes ³	Negligible	Negligible
R50	60	44	61	44	1	0	Yes ³	Yes ³	Negligible	Negligible

Notes:

¹ See Tables 9.1-8 through 9.1-13 for assessment of compliance with MECP sound level limits.

² See Table 9.1-14 for details of qualitative ranking system.

³ The noise sources that require MECP approval comply with the applicable MECP criteria.

Table 9.1-15 indicates that, with the implementation of the mitigation described, the Project is predicted to have a 'negligible' to 'low' magnitude impact on existing noise levels and therefore there are no likely adverse effects.

Note that the short-term monitoring indicated other sources of noise from facilities in the Site-vicinity Study Area (i.e., the aggregate pits north of the landfill and the MRF to the east) that were not considered in the existing noise level predictions and could impact the acoustic environment in the Site-vicinity Study Area. As discussed in Section 5.2.2, measured daytime noise levels were higher by an average of 5 dB than predicted, which would reduce all mitigated magnitude impacts to 'negligible'.

Note that the impact assessment noise predictions considered when landfilling operations are expected to be predictable worst case and/or maximum noise levels (i.e., near the edges of the Project limit of waste). Ambient noise levels can be expected to increase by a noticeable amount, on occasion, due to the landfilling operations at the identified representative PORs, but will be short-term relative to the life of the Project, occurring when the active area of the landfill approaches the identified representative PORs. The range in increased noise levels will depend primarily on the number, type and operating time of noise sources and their proximity to the PORs when operating within the active area.

Based on the attenuation of sound due to distance and a lack of a direct line-of-sight between equipment and the receptors when the equipment is further set back, noise levels are expected to decrease when operating away from the edges of the Project limit of waste and the distance increases. Therefore, any noticeable increases in noise levels due to the Project are expected to be short-term in duration and become negligible as the Project progresses.

9.2 Geology and Hydrogeology

This section provides the assessment of impacts on long-term groundwater quality and quantity for the proposed expansion of the W12A Landfill as described in Section 8 of this EASR. This assessment was conducted in accordance with the requirements set out in the approved Amended ToR (Volume II) and the Work Plan dated November 2019 (Volume III Appendix B.02) that was developed with input from First Nation Communities (Aamjiwnaang First Nation, Chippewas of the Thames First Nation, Munsee-Delaware First Nation, Oneida First Nation) and their consultant (Dragun Corporation) and circulated to the MECP. In addition, the work also included additional contaminant transport modelling as a result of feedback from a First Nation Communities workshop held in August 2020 (Volume V Appendix H.12).

The details of the impact assessment are provided in Volume IV Appendix D.03; a summary is provided below.

9.2.1 Groundwater Quality Impact Assessment

Modelling of long-term groundwater quality impacts for new or expanding landfill sites is required under O. Reg. 232/98 MECP, 1998a) to demonstrate that the proposed design will meet the requirements of the MECP Reasonable Use Guideline (RUG) B-7 (MECP, 1994).

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The Reasonable Use Guideline B-7 establishes a quantitative benchmark for protecting off-site groundwater quality for drinking water purposes. The Reasonable Use Guideline makes the following statement regarding groundwater impact at the landfill property boundary:

“In the case of drinking water, the quality must not be degraded by an amount in excess of 50% of the difference between background and the Ontario Drinking Water Objectives for non-health related parameters and in excess of 25% of the difference between background and the Ontario Drinking Water Objectives for health related parameters. Background is considered to be the quality of the groundwater prior to any man-made contamination.”

The assessment of potential long-term groundwater quality impacts from the expanded landfill was carried out using the contaminant transport model POLLUTE (Rowe et. al., 1994). POLLUTE is a one-dimensional, analytical contaminant transport model that can simulate vertical contaminant migration from a landfill situated on a multi-layered soil deposit. The model considers individual cross-sections through the landfill that are oriented in the direction of principal groundwater flow. The geologic units below the landfill for each cross-section are modelled as individual layers, with each assigned a set of physical and chemical parameters.

Transport mechanisms modelled by POLLUTE are advection and dispersion (which includes mechanical mixing and molecular diffusion). Advection refers to the process whereby the solute is transported as a result of groundwater movement. Dispersion, on the other hand, refers to spreading of the solute due to a gradient in its concentration (the diffusion mechanism), and due to mechanical mixing of groundwater arising from heterogeneity in the size and geometry of soil pores (the hydrodynamic mechanism). The model can also account for adsorption onto the soil solids and biological/chemical decay, which are processes that remove the solute from the porewater phase and hence decrease the net rate of migration. The adsorption process is modelled according to a linear/reversible isotherm and the biological/chemical decay process according to a first order decay rate.

The POLLUTE model output is in the form of calculated concentrations versus time at any specified depth below the waste, at the down-gradient edge of the landfill cross-section.

Simply, the landfill is underlain by the following soil layers in sequence starting from the base of the waste fill:

- Surficial Aquitard (Silty Clay);
- Upper Aquifer (Sand);
- Lower Aquitard (Silty Clay); and
- Lower Sand Aquifer (White Oak Aquifer).

The selected locations of the POLLUTE model cross-sections are shown in Figure 9.2-1 in relation to the Upper Aquifer groundwater piezometric surface contours and Surficial Aquitard thickness contours. The cross-sections with the greatest potential to impact

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groundwater quality beneath the landfill are Sections A-A' and B-B' through Phase 1, which does not have an underdrain LCS. Section A-A' passes through the central part of Phase 1 where the post-expansion waste fill thickness (up to 36 m) and landfill footprint length in the direction of groundwater flow (800 m) are the greatest. Section B-B' is through the southeastern portion of Phase 1 where the thickness of the Surficial Aquitard beneath the waste fill is the least.

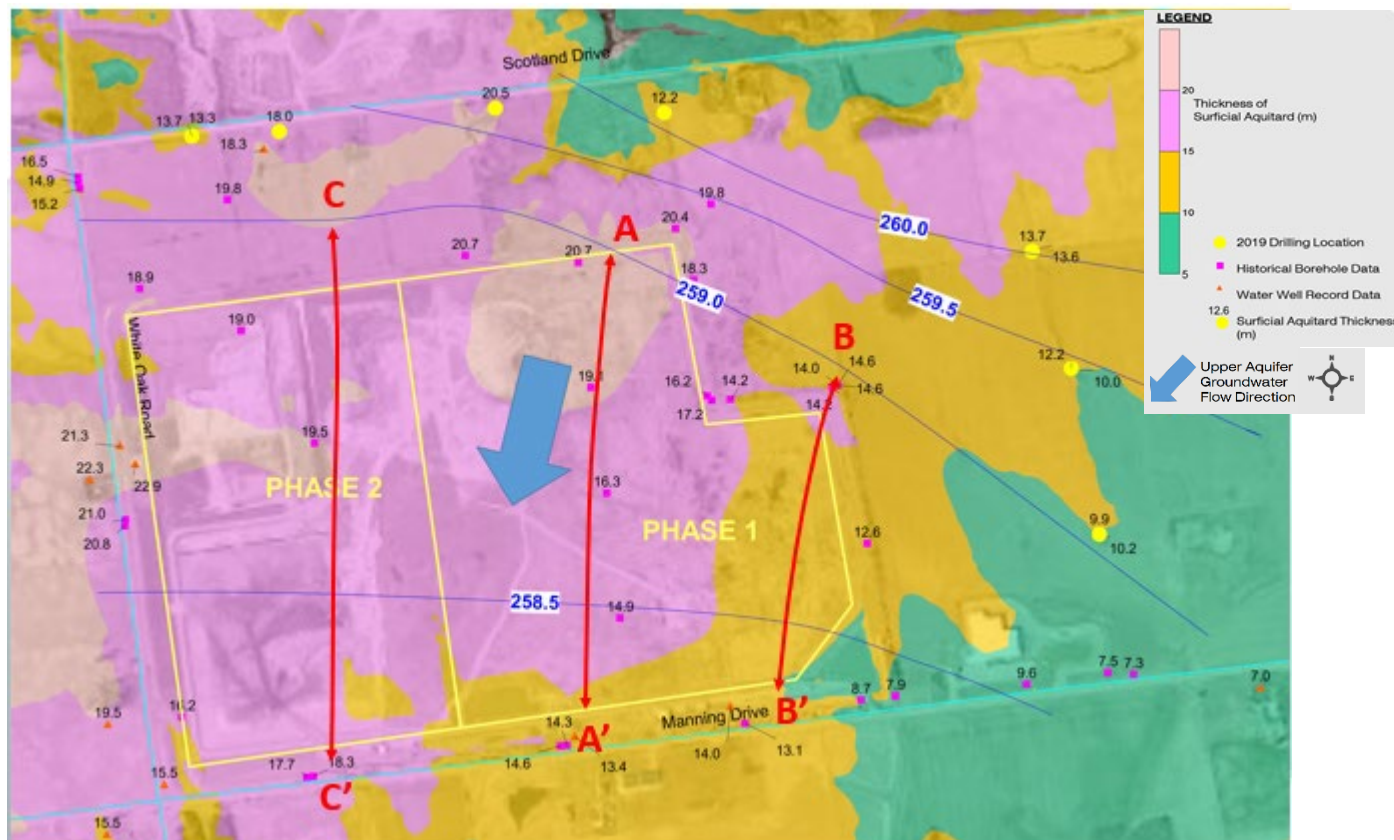


Figure 9.2-1: Plan View of The Landfill Showing Modelled Cross-Sections (A-A', B-B' and C-C'), Inferred Thickness of the Surficial Aquitard and Fall 2019 Groundwater Elevations in the Upper Aquifer

The main differences between the three modelled cross-sections is the thickness of Surficial Aquitard between the base of the landfill and the Upper Aquifer, the height of waste, and the type of LCS. On Section A-A' the thickness of Surficial Aquitard is 14 m; on Section B-B' it is 9 m; and on Section C-C' it is 16 m. The height of waste above the portion of the landfill where the cross-section is located is greatest for Sections A-A' and C-C' and less for Section B-B' that is in the sideslope area of the expanded landfill. Sections A-A' and B-B' are within Phase 1 of the existing landfill where the base of the waste is directly on the Surficial Aquitard and there is a perimeter LCS; Section C-C' is within Phase 2 of the existing landfill that is underlain by a continuous granular drainage blanket and LCS network; the type of LCS determines the rate, timing and magnitude of leachate mound buildup within the waste.

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The fractures in the Surficial Aquitard that were evaluated in the site investigation (Section 5.3.2 of the EASR) were accounted for in the model by considering the unfractured and fractured vertical hydraulic conductivities in a weighted geometric mean value.

Using the Hydrologic Evaluation of Landfill Performance (HELP) Model (USEPA 1997), the average annual percolation (or infiltration) into the landfill waste, which results in leachate generation, was estimated. The average annual infiltration rate through daily/interim cover during the filling period is approximately 245 mm/year. The average annual percolation rate through the final cover during the post-closure period is approximately 235 mm/year (approximately 24% of the average annual precipitation).

In accordance with O. Reg. 232/98 (MECP, 1998), the key leachate contaminants modelled to address long-term compliance with the MECP RUG B-7 (MECP, 1994) are: benzene, cadmium, chloride, lead, 1,4 dichlorobenzene, dichloromethane, toluene and vinyl chloride. These are the parameters that the MECP has determined to have the greatest potential to cause exceedances of the Guideline B-7 values at municipal landfill sites, because they have relatively high initial source concentrations, higher ability to diffuse through liner systems and natural soil deposits, and/or lower decay rates and adsorption ability. Chloride is typically the critical inorganic parameter for landfill compliance and therefore is the focus of this modelling.

The results of the hydrogeologic/contaminant transport modelling for all key landfill leachate contaminants are summarized in Table 9.2-1 for the Phase 1 and Phase 2 cross-sections. The results are presented as predicted peak concentration and time of peak concentration in the Upper Aquifer at the downgradient (southern) limit of the waste fill. For all parameters modelled, the Reasonable Use Criteria for the Upper Aquifer is met over the 1000 year modelling time frame except for chloride at the Phase 1 Section A-A, which gave a peak impact of 129 mg/L versus the Reasonable Use Guideline value of 128 mg/L at approximately $t=700$ years. Figures 9.2-2, 9.2-3 and 9.2-4 show the predicted concentrations for chloride versus time in the Upper Aquifer at the downgradient (southern) limit of the waste fill for the modelling cross-sections. The modelling indicated no impacts on the Lower Aquifer (White Oak Aquifer).

The negligible predicted impact for the organic contaminants (i.e., benzene, 1,4-dichlorobenzene, dichloromethane, toluene and vinyl chloride) on the Upper Aquifer relates primarily to biodegradation, mass removal through leachate collection, the very slow (diffusion controlled) rate of transport into the Surficial Aquitard and adsorption uptake within the Surficial Aquitard. For lead and cadmium, the negligible impact is due to the same processes noted above, except that biodegradation does not apply for these parameters.

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Table 9.2-1: Predicted Concentrations of Key Leachate Contaminants in the Upper Aquifer

Contaminant	Background Concentration in the Aquifer (mg/L) ¹	Ontario Drinking Water Quality Objective ² (mg/L)	Reasonable Use Guideline ³ (mg/L)	Phase 1 (Section A-A') Predicted Peak Conc.* (mg/L)	Phase 1 (Section A-A') Time of Peak Conc.** (years)	Phase 1 (Section B-B') Predicted Peak Conc.* (mg/L)	Phase 1 (Section B-B') Time of Peak Conc.** (years)	Phase 2 (Section C-C') Predicted Peak Conc.* (mg/L)	Phase 2 (Section C-C') Time of Peak Conc.** (years)
Chloride	5	250 (A)	128	129	706	75	808	72	855
Cadmium	<0.0002	0.005 (H)	0.0014	<0.00002	>1000	<0.00002	>1000	<0.00002	>1000
Lead	<0.002	0.01 (H)	0.004	<0.0002	>1000	<0.0002	>1000	<0.0002	>1000
Benzene	<0.0005	0.005 (H)	0.0016	<0.00005	>1000	<0.00005	>1000	<0.00005	>1000
1,4-Dichlorobenzene	<0.0005	0.005 (H)	0.0008	<0.00005	>1000	<0.00005	>1000	<0.00005	>1000
Dichloromethane	<0.0020	0.05 (H)	0.014	<0.0002	>1000	<0.0002	>1000	<0.0002	>1000
Toluene	0.00075	0.024 (A)	0.0124	<0.00005	>1000	<0.00005	>1000	<0.00005	>1000
Vinyl Chloride	<0.0005	0.002 (H)	0.0009	<0.00005	>1000	<0.00005	>1000	<0.00005	>1000

Notes:

¹ Median of 2015 to 2019 concentration in background monitoring wells 92-11, 82-6 and 01-14.

² Ontario Drinking Water Quality Standards (ODWQS).

³ Reasonable Use Guideline = Background Concentration + X (ODWQS Criteria - Background Concentration):
 where X = 0.25 for health related drinking water parameters
 = 0.50 for aesthetic related drinking water parameters

* Based on a 1,000 year contaminant transport modelling time frame, has been added to the background concentration.

** Relative to year 10 of the landfilling period.

(A) Denotes aesthetic drinking water objective.

(H) Denotes health related drinking water objective.

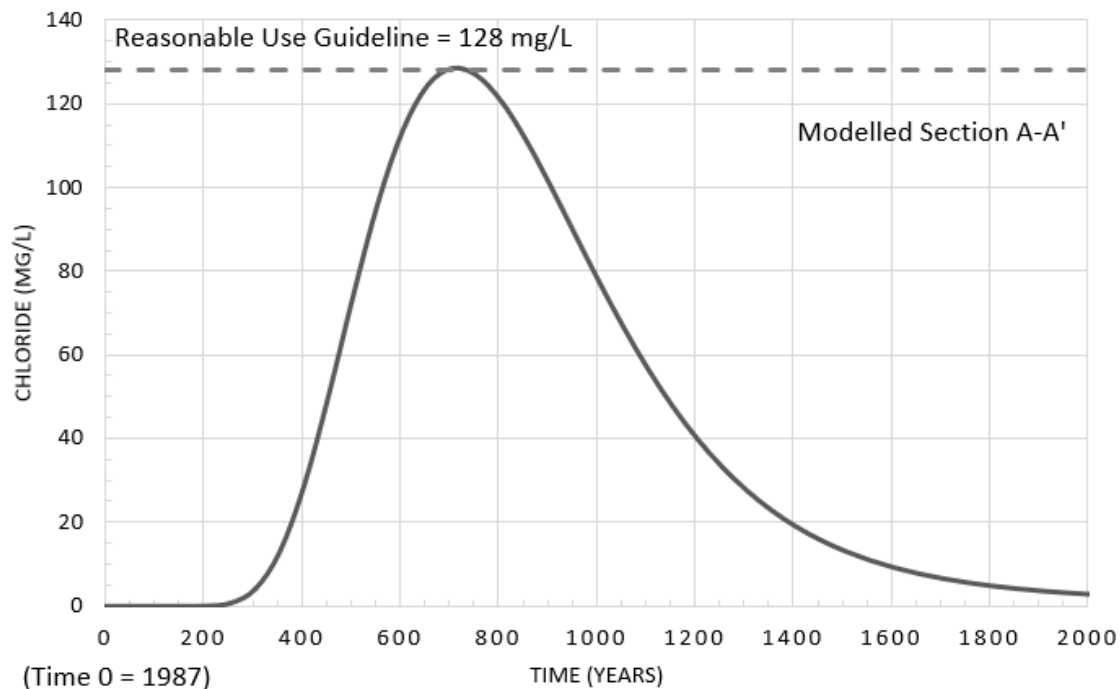


Figure 9.2-2: Chloride Concentration Versus Time for Cross-Section A-A'

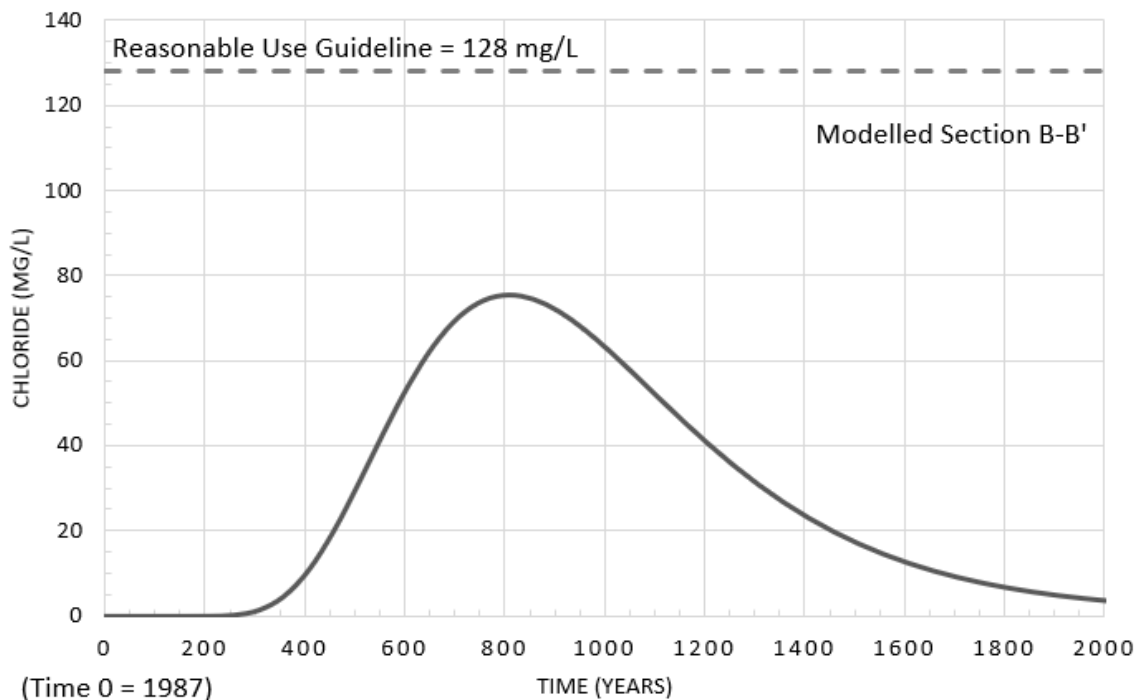


Figure 9.2-3: Chloride Concentration Versus Time for Cross-Section B-B'

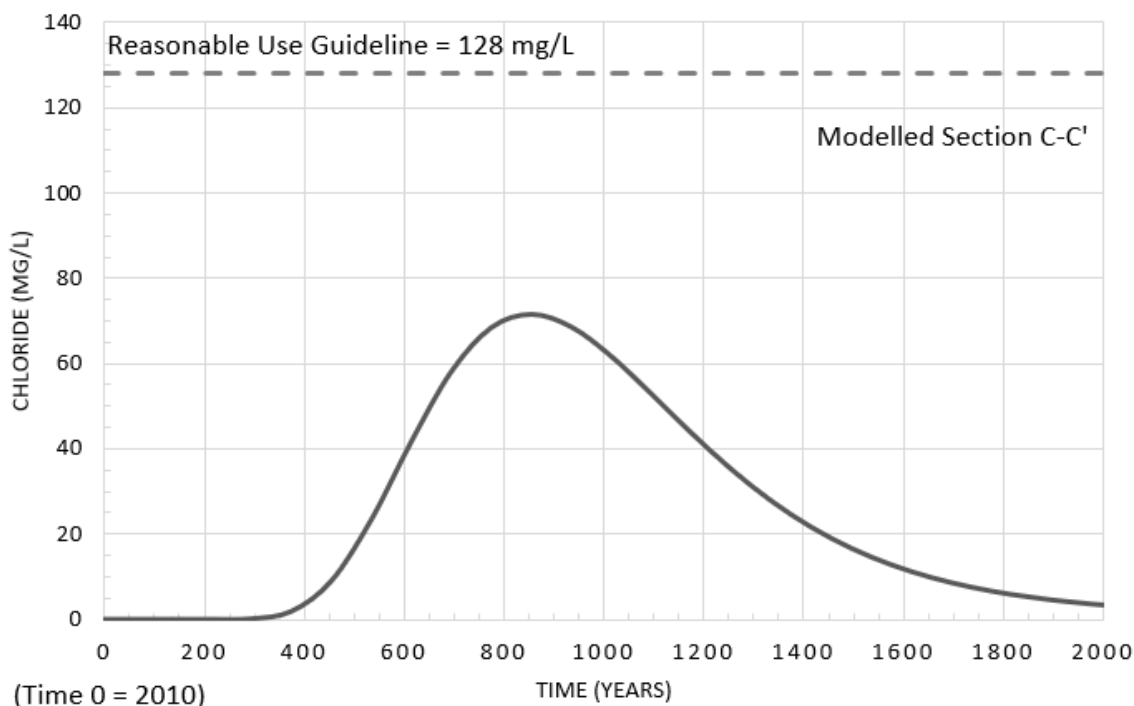


Figure 9.2-4: Chloride Concentration Versus Time for Cross-Section C-C'

9.2.2 Groundwater Quantity Impact Assessment

As described previously, the W12A landfill is underlain by a deposit of low permeability clayey till that is about 15 to 20 m thick beneath much of the landfill and decreasing to about 10 m in the southeast corner area. This is in turn underlain by a sandy Upper Aquifer layer (a local aquifer) that is about 2 to 8 m thick, then about 20 m of clayey till (Lower Aquitard) and then the White Oak Aquifer (a regional scale aquifer). Because the upper few metres of the Surficial Aquitard is fractured to a variable degree, precipitation can infiltrate towards the lower limit of the fracture zone; however, because of the low permeability and very slow groundwater velocity associated with the unfractured remainder of the Surficial Aquitard deposit, the infiltration of precipitation to greater depth is very low. The sand and gravel deposits exposed at ground surface and ponds in the gravel pits in the area north of Scotland Drive (north of the landfill site) have been identified as the groundwater recharge zone to both the Upper Aquifer and White Oak Aquifer, since both of these aquifers are directly connected to these exposed sand and gravel deposits. The groundwater flow direction in the Upper Aquifer is generally from northeast to southwest/south, while the flow direction in the regional White Oak Aquifer is from northwest to southeast.

Because of the existing landfill's location overlying the Surficial Aquitard, its presence does not affect the recharge of the groundwater system and has no effect on groundwater levels or groundwater quantity in the Upper and White Oak Aquifers beneath the landfill or off-site further to the south of the landfill site. With the proposed landfill expansion consisting of a vertical expansion above the existing landfill footprint, the expansion will not have an effect on downgradient groundwater levels or groundwater quantity off-site to the south of the

landfill site. As such, the expansion is not expected to affect: the groundwater supply available to water supply wells in the area; groundwater baseflow to off-site watercourses or other natural environment features in the area of the landfill, or; off-site groundwater levels that support vegetation.

9.2.3 Additional Mitigation Measures

The results of the groundwater impact assessment in Section 9.2.1 indicate that the leachate control systems currently proposed in the design of the proposed vertical expansion will result in the W12A Landfill complying with MECP requirements for impacts on off-site groundwater quality, with the exception of potentially chloride that gave a predicted peak concentration slightly higher than that allowed by the RUG in the Upper Aquifer at the downgradient (south) limit of the Phase 1 waste fill area at Section A-A' (i.e., 129 mg/L peak impact versus the RUG value of 128 mg/L, at approximately time $t=700$ years). The exceedance is primarily the result of leachate mounding within the Phase 1 area, which unlike the Phase 2 area does not have a leachate drainage layer throughout its base.

To address the predicted RUG exceedance for chloride at the downgradient limit of the Phase 1 waste fill, consideration was given to acquisition of an additional approximately 50 m of buffer zone lands downgradient (south) of the landfill, with the objective of meeting the RUG for chloride at the limit of the buffer zone. However, by applying the POLLUTE model to simulated one-dimensional (horizontal) advective-dispersive transport within the Upper Aquifer downgradient of the landfill, it was determined that the additional buffer zone would have very little effect in attenuating chloride impacts. Chloride does not undergo adsorption or bio-chemical decay reactions and therefore the attenuation mechanism would be by longitudinal dispersion and mixing with the downgradient recharge to the Upper Aquifer, which in this case is minimal given the low vertical hydraulic conductivity of the Surficial Aquitard.

Consideration was also given to incorporating leachate mound control / collection into the design of a first tier of horizontal landfill gas collector trenches installed in a north-south direction at 30 m spacing and to a depth of 3 m into the existing waste fill over the top surface of the Phase 1 area prior to the vertical expansion. These trenches would be backfilled with 50 mm clear stone and connect to the perimeter leachate collector system to allow leachate removal. The POLLUTE modelling for chloride was repeated for Phase 1 Section A-A' with mound control by these horizontal collectors over a service life period of 100 years from the start of the vertical expansion in Phase 1 (refer to Appendix C in Volume IV Appendix D.03 for service life calculation with respect to bio-chemical clogging). The results of the modelling indicate a peak chloride concentration of 120 mg/L, which meets the RUG of 128 mg/L (Table 9.2-2). It is therefore recommended that the horizontal landfill gas collectors be designed for dual purpose as gas and leachate mound control collectors, at the horizontal spacing/depth described above.

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Table 9.2-2: Predicted Concentrations of Key Leachate Contaminants in the Upper Aquifer (Phase 1 Cross-Section A-A' with Mound Control)

Contaminant	Background Concentration in the Aquifer (mg/L) ¹	Ontario Drinking Water Quality Objective ² (mg/L)	Reasonable Use Guideline ³ (mg/L)	Phase 1 (Section A-A' with Mound Control) Predicted Peak Conc.* (mg/L)	Phase 1 (Section A-A' with Mound Control) Time of Peak Conc.** (years)
Chloride	5	250 (A)	128	120	708
Cadmium	<0.0002	0.005 (H)	0.0014	<0.00002	>1000
Lead	<0.002	0.01 (H)	0.004	<0.0002	>1000
Benzene	<0.0005	0.005 (H)	0.0016	<0.00005	>1000
1,4-Dichlorobenzene	<0.0005	0.005 (H)	0.0008	<0.00005	>1000
Dichloromethane	<0.0020	0.05 (H)	0.014	<0.0002	>1000
Toluene	0.00075	0.024 (A)	0.0124	<0.00005	>1000
Vinyl Chloride	<0.0005	0.002 (H)	0.0009	<0.00005	>1000

Notes:

¹ Median of 2015 to 2019 concentration in background monitoring wells 92-11, 82-6 and 01-14.

² Ontario Drinking Water Quality Standards (ODWQS).

³ Reasonable Use Guideline = Background Concentration + X (ODWQS Criteria - Background Concentration):
where X = 0.25 for health related drinking water parameters
= 0.50 for aesthetic related drinking water parameters

* Based on a 1,000 year contaminant transport modelling time frame, has been added to the background concentration.

** Relative to year 10 of the landfilling period.

(A) Denotes aesthetic drinking water objective.

(H) Denotes health related drinking water objective.

Although the results of the contaminant transport modelling indicate that the proposed expanded landfill will meet the RUG B-7 criteria for the Upper and White Oak Aquifer layers, for the successful performance of the landfill in this regard it is important that the perimeter LCS (i.e., perimeter leachate collector trench and sideslope finger drains) for the Phase 1 area and the Phase 2 area (to be installed when the Phase 2 blanket LCS reaches the end of its service life) be maintained over the long term to protect against leachate break-out to surface. These perimeter control systems are accessible for inspection, maintenance and replacement as necessary. The implications of not maintaining these systems over the long-term include potential impacts to surface water, aesthetic impacts (e.g. leachate staining on the perimeter slopes and along perimeter drainage ditches) and erosion/vegetation kill on the final cover.

9.3 Surface Water

This section provides the assessment of impacts on surface water quality and quantity for the proposed expansion of the W12A Landfill as described in Section 8 of this EASR. This assessment was conducted in accordance with the requirements set out in the approved Amended ToR (Volume II) and the Work Plan dated August 2019 (Volume III Appendix B.03). Additional details on the impact assessment are provided in Volume IV Appendix D.04.

9.3.1 Stormwater Management System Design

As described in Section 5.4, the existing drainage network in the vicinity of the landfill is currently divided into four general areas with a system of berms, slopes and perimeter drainage ditches directing runoff generated within the W12A Landfill Operations Area to four separate SWM ponds. Under the proposed vertical expansion, the peak of the landfill mound will shift to the south and sideslopes of the mound will be longer and somewhat steeper in places, resulting in changes to the drainage boundaries to each of the ponds and, in general, reduced times to peak runoff. In addition, a proposed ancillary facility including public drop off areas, access roads, bins, and storage areas is proposed to be added east of Pond 5 and stormwater from this area will require management. The post-expansion, post-closure drainage areas are shown on Figure 9.3-1. To address these changes in surface water runoff, some modifications to the existing SWM ponds will be required.

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Under current conditions, Ponds 2/3, 4 and 5 collect an area of 129.3 hectares of surface water runoff and provide treatment and attenuation prior to discharge off-site to the south, to the Dodd Creek subwatershed. The proposed landfill expansion and mound configuration will result in a reduction of the drainage area being collected and treated by these ponds and discharged to the Dodd Creek subwatershed to 106.5 hectares, including an additional drainage area to Pond 5 from the proposed ancillary facilities. Under current conditions, Pond 1 collects a drainage area of 14.4 hectares of surface water runoff and discharges off-site to the north, to the Dingman Creek subwatershed. The proposed landfill expansion would result in an increased drainage area of 34.5 hectares to Pond 1. The outlet structure for Pond 1 will be designed such that discharge will match or be below pre-expansion peak flows for the 1:5 year through 1:100 year design storm events.

The changes to the drainage areas from pre-development to the existing landfill to the proposed landfill expansion are provided in Table 9.3-1.

Table 9.3-1: Drainage Areas

Drainage Area ID / (SWM Pond)		Area (ha)
101 (Pond 1)	Pre-Development	14.50
201 (Pond 1)	Current	14.40
301 (Pond 1)	Proposed	34.48
102 (Pond 2/3)	Pre-Development	16.60
103 (Pond 2/3)	Pre-Development	13.00
202/203 (Pond 2/3)	Current	30.60
302/303 (Pond 2/3)	Proposed	24.71
104 (Pond 4)	Pre-Development	52.00
204 (Pond 4)	Current	57.70
304 (Pond 4)	Proposed	25.17
105 (Pond 5)	Pre-Development	46.00
205 (Pond 5)	Current	41.00
305 (Pond 5)	Proposed	56.60

Modifications to the SWM ponds will meet the following design criteria where possible:

- Match post-expansion outlet flows to corresponding pre-expansion flows for the 1:5 year through the 1:100 year return period design storm.
- Provide Enhanced Level Protection (80% TSS removal) as defined by the MECP SWM Planning and Design Manual (MECP, 2003).

- iii) 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 and eventually into the leachate management system. 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.
- iv) 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.
- v) The 1:250 year return period design storm and Regional Storm (Hurricane Hazel) will also be assessed to predict conditions during such an event to evaluate potential climate change effects.

Runoff scenarios for the proposed expansion under the range of storm events were assessed with the Visual Otthymo (VO2) model and, together with the MECP SWM Planning and Design Manual (MECP, 2003), used to determine the required modifications to the existing SWMS. The resulting SWMS for the proposed expansion is shown on Figure 9.3-1. To achieve the design objectives and criteria described above, the proposed modifications to each of the SWM ponds are described below.

Pond 1: SWM Pond 1 is an extended detention wet pond that currently receives stormwater runoff from a total drainage area of 14.4 hectares. The pond discharges to the Dingman Creek subwatershed. The existing pond has a permanent pool storage capacity of 2,470 m³ and an active storage capacity of 5,800 m³. Under proposed expansion conditions Pond 1 would receive stormwater runoff from a larger total drainage area of 34.48 hectares. Due to the increased drainage area and reduction in time to peak resulting from the landfill expansion, the pond will be expanded to the north, increasing the size of the main pond and forebay. The extended detention wet pond outlet structure provides a 100-hour retention time for runoff produced by a 25-mm rainfall event with a 4-hour modified Chicago distribution. The outlet structure will be modified to match or be less than pre-development flows resulting from the smaller pre-development area that was initially directed to the Dingman Creek subwatershed.. The outlet is designed as a submerged reverse sloped pipe to promote separation/floating of oils, providing potential for spilled material to be recovered prior to off-site release occurring. The existing outlet structure for the pond has an existing sluice gate to allow emergency closure to assist in spill / leachate containment activities, if needed. A 600 mm diameter pipe with a ditch inlet grate will be provided at elevation 274.80 masl to provide discharge control for larger storm events. In addition, a 5.0 m wide overflow weir has been provided to convey storm events greater than the 1:100 year return period design storm.

Table 3.2 of the MECP Manual 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 190 m³/ha, for 80% TSS removal at an impervious level of 55%. For the Pond 1 drainage area of 34.48 ha, this results in a minimum total required pond volume of 6,551 m³, with 40 m³/ha required as extended detention. Therefore, 5,172 m³ and 1,379 m³ are required, at minimum, for the permanent pool and extended detention, respectively. A permanent pool volume of

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8,480 m³ is provided in the proposed wet pond, which exceeds the required permanent pool volume. An additional 2,105 m³ of extended detention storage is provided for the 25 mm design storm.

Pond 2/3: SWM Pond 2/3 is an extended detention wet pond that currently receives stormwater runoff from a total drainage area of 29.6 hectares and under proposed expansion conditions would have a smaller drainage area of 24.71 hectares. The pond discharges to the Dodd Creek subwatershed.

The existing Pond has a permanent pool storage capacity of 2,660 m³ and an active storage capacity of 11,100 m³. The landfill expansion will result in a decreased drainage area to this pond; however, to meet the Enhanced Level Protection (80% TSS removal) as defined by the MECP Stormwater Management Planning and Design Manual (MECP, 2003) the permanent pool depth will be increased and some modifications will be made to the existing outlet structure.

A baseflow storage volume of 6,320 m³ is provided as stacked storage and is therefore in addition to the active storage for the 25 mm and 1:5 year through 1:250 year return period design storms (i.e., the baseflow is in addition to the storage provided for these events). A minimum sized orifice of 75 mm will be used to control the pond outflow for the baseflow storage and 25 mm storm, which provides a 85-hour retention time for runoff produced by a 25 mm rainfall event with a 4-hour modified Chicago distribution and assumes the baseflow storage is full at the time of the 25 mm storm event. The outlet pipe for the pond is designed as a submerged reverse sloped pipe to promote separation/floating of oils, providing potential for spilled material to be recovered prior to off-site release occurring. The existing outlet structure for the pond has an existing sluice gate which will be used to allow emergency closure to assist in spill / leachate containment activities, if needed. The resultant average release rate over the extended drawdown period for the baseflow volume is about 11 L/s. An overflow weir with 3.2 m bottom width, 3H:1V sideslopes with rip-rap covering at invert 273.10 masl is proposed to provide discharge control for larger storm events.

Table 3.2 of the MECP Manual 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 190 m³/ha, for 80% TSS removal at an impervious level of 55%. For the pond drainage area of 24.71 ha, this results in a minimum total required pond volume of 4,673 m³, with 40 m³/ha permitted as extended detention. Therefore, 3,707 m³ and 988.4 m³ are required, at minimum, for the permanent pool and extended detention, respectively. A permanent pool volume of 4,602 m³ is provided in the proposed wet pond, which exceeds the required permanent pool volume. A baseflow volume of 6,315 m³ is provided and an additional 1,451 m³ of extended detention storage is provided for the 25 mm design storm.

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Pond 4: SWM Pond 4 is an extended detention wet pond that currently receives stormwater runoff from a total drainage area of 57.7 hectares. The pond discharges to the Dodd Creek subwatershed. The existing pond has a permanent pool storage capacity of 5,200 m³ and an active storage capacity of 20,200 m³. Under proposed expansion conditions Pond 4 would receive stormwater runoff from a smaller total drainage area of 25.17 hectares.

The existing permanent pool and active storage is sufficiently sized to meet the Enhanced Level Protection (80% TSS removal) as defined by the MECP Stormwater Management Planning and Design Manual (MECP, 2003). The existing outlet structure will be modified with an appropriately sized orifice to control discharge and the existing double inlet catchbasin would be maintained for larger storm events. An overflow weir would be added for storm events larger than the 1:100 year return period design storm.

The extended detention wet pond outlet structure provides an 60-hour retention time for runoff produced by a 25 mm rainfall event with a 4-hour modified Chicago distribution. The outlet pipe for the pond for quality control will use the existing perforated 1500 mm CSP maintenance hole and internal 200 mm orifice with the Hickenbottom riser structure removed. A 600 mm outlet pipe with a ditch inlet grate will be provided at elevation 270.40 masl for the controlled discharge of large storm events. In addition, the secondary outlet structure will be modified with stop logs adjusted to an elevation of 270.80 masl, providing a 1.2 m wide overflow weir at this elevation. Downstream of the pond is an additional storage ditch with an outlet which has an existing sluice gate to allow emergency closure to assist in spill / leachate containment activities, if needed

Table 3.2 of the MECP Manual 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 190 m³/ha, for 80% TSS removal at an impervious level of 55%. For the pond drainage area of 25.17 ha, this results in a minimum total required pond volume of 4,782 m³, with 40 m³/ha permitted as extended detention. Therefore, 3,776 m³ and 1,007 m³ are required, at minimum, for the permanent pool and extended detention, respectively. A permanent pool volume of 3,974 m³ is provided in the proposed wet pond, which exceeds the required permanent pool volume. An additional 1,451 m³ of extended detention storage is provided for the 25 mm design storm.

Pond 5: SWM Pond 5 is an extended detention wet pond that currently receives stormwater runoff from a total drainage area of 41.0 hectares. The pond discharges to the Dodd Creek subwatershed. The existing Pond has a permanent pool storage capacity of 3,690 m³ and an active storage capacity of 11,800 m³. Under proposed expansion conditions, Pond 5 would receive stormwater runoff from a larger total drainage area of 56.60 hectares. The Pond would be expanded to the east and north to increase both the permanent pool and active storage capacities. The existing outlet structure orifice and weir will be modified to match pre-development peak flows.

The extended detention wet pond outlet structure provides a 100-hour retention time for runoff produced by a 25 mm rainfall event with a 4-hour modified Chicago distribution.

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The existing outlet structure for the pond will be modified and used and is fitted with a valve to allow emergency closure to assist in spill / leachate containment activities, if needed. The outlet structure includes a 200 mm diameter orifice at elevation 268.50 masl and a 1.2 m wide weir at elevation 269.40 masl. Stop logs can be installed in the existing outlet structure for the pond to allow emergency closure to assist in spill / leachate containment activities, if needed. In addition, a 5 m wide overflow weir with 3H:1V sideslopes and 0.5% slope is proposed at elevation 270.10 masl for events greater than the 1:100 return period design storm.

Table 3.2 of the MECP Manual 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 190 m³/ha, for 80% TSS removal at an impervious level of 55%. For the pond drainage area of 56.60 ha, this results in a minimum total required pond volume of 10,754 m³, with 40 m³/ha permitted as extended detention. Therefore, 8,490 m³ and 2,264 m³ are required, at minimum, for the permanent pool and extended detention, respectively. A permanent pool volume of 12,098 m³ is provided in the proposed wet pond, which exceeds the required permanent pool volume. An additional 2,288 m³ of extended detention storage is provided for the 25 mm design storm.

The comparison of pre-development to post-expansion flows to each of the subwatersheds under the range of design storms is summarized in Table 9.3-2 below and demonstrates that the post-expansion flows will be controlled to below the pre-development flows up to and including the 1:100 year return period design storm.

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Table 9.3-2: Pre-Development and Proposed Expansion Conditions for Subwatersheds

Sub-watershed	W12A Site Drainage Areas (ha)	W12A Site Drainage Areas (ha)	Peak Discharge (L/s)	Peak Discharge (L/s)	Peak Discharge (L/s)	Peak Discharge (L/s)	Peak Discharge (L/s)	Peak Discharge (L/s)	Peak Discharge (L/s)	Peak Discharge (L/s)
			1:5 year	1:5 year	1:10 year	1:10 year	1:100 year	1:100 year	1:250 year	1:250 year
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Dingman Creek	14.5	34.48	315	190	434	317	941	709	1,206	1,882
Dodd Creek	127.6	106.48	1,995	396	2,725	797	5,231	3,182	7,467	6,614

The proposed modifications to the SWMS will all occur within the proposed landfill expansion site, specifically to the SWM ponds and their outlet structures, and there is no proposed work on the downstream stormwater management infrastructure including the ditches, culverts or the downstream off-site watercourses themselves. As such, the proposed expansion will not involve physical alterations to downstream watercourses. Also, the ponds will provide Enhanced Level Protection (80% Total Suspended Solids (TSS) removal) and post-development flows designed to match pre-development flows using the controls in the outlet structures for the SWM ponds.

9.3.2 Assessment of Surface Water Impacts

Because of the proposed Enhanced Level Protection (80% TSS removal) and post-development flows matching pre-development flows due to the controls in the outlet structures for the SWM ponds, there is not expected to be an adverse impact on off-site surface water quantity or quality. The design of Ponds 2/3, 4 and 5 to provide an improved 80% TSS removal, compared to 70% TSS removal in the existing pond design, should result in an overall improvement in the quality of surface water released from these ponds and an overall improvement in surface water quality in receiving watercourses south of Manning Drive.

Pond 1 is currently designed for 80% TSS removal and will be expanded to remain at the same removal level for the larger drainage area and will provide attenuation of flows with post-development flows matching pre-development flows for the 1:5 through 1:100 year return period design storm. As such it is expected that surface water quality to the receiving watercourse to the north (Dingman Creek tributary) will remain the same as current conditions.

9.3.2.1 Surface Water Quantity

Since the proposed expansion has the potential for effects on surface water management, predicted impacts were assessed with consideration of design mitigation measures. Several mitigation measures are incorporated into the conceptual site design to manage surface water quantity and minimize potential off-site impacts.

Predicted Changes in Drainage Areas

As noted in previous sections, the existing drainage network in the vicinity of the landfill is currently divided into four general areas with a system of berms, slopes and perimeter drainage ditches directing runoff generated within the W12A Landfill Operations Area to four separate SWM ponds. Under the proposed vertical expansion, the peak of the landfill mound will shift to the south and sideslopes of the mound will be longer and somewhat steeper in places, resulting in changes of the drainage boundaries to each of the ponds and, in general, reduced times to peak runoff. In addition, a proposed ancillary facility including public drop off areas, access roads, bins, and storage areas is proposed to be added east of Pond 5.

Dingman Creek

The proposed area of drainage to the Dingman Creek subwatershed from the Operations Area, including Pond 1, will increase by 20.08 ha, to a total area of 34.48 ha. The proposed expansion conditions drainage area includes primarily landfill with some access roads, a SWM pond, and surrounding berms.

The Dingman Creek subwatershed overall is 17,200 ha consisting of approximately 30 tributaries to the Creek with the main channel of Dingman Creek converging with the Thames River near Delaware. The increase of 20.08 ha to the subwatershed represents a 0.12% increase to the overall subwatershed area and is in the upper reaches of the subwatershed adjacent to the divide between the Dingman Creek and Dodd Creek subwatersheds. As such, the change in drainage area is expected to have negligible effect on runoff and drainage within areas of the subwatershed downstream of the W12A landfill site. Further, discharge from the site to Dingman Creek subwatershed will be attenuated by Pond 1 to below pre-development flows up to and including the 1:100 year return period design storm under the proposed design.

Dodd Creek

The proposed area of drainage to the Dodd Creek subwatershed will include discharge from Ponds 2/3, 4 and 5, which will collect surface water runoff from a development area of 106.48 ha. This area includes the additional drainage area to Pond 5 from the proposed ancillary facilities; however, this area was already within the subwatershed. The net change in subwatershed area is the same 20.08 ha as noted above. The ponds will provide treatment and attenuation prior to discharge off-site to the south to below pre-development flows up to and including the 1:100 year return period design storm under the proposed design.

The Dodd Creek subwatershed overall is approximately 9,800 ha and is the headwaters to Kettle Creek. The decrease of 20.08 ha to the subwatershed represents a 0.20% decrease to the overall subwatershed area and is in the upper reaches of the subwatershed adjacent to the divide between the Dingman Creek and Dodd Creek subwatersheds. As such, the change in drainage area is expected to have negligible effect on runoff and drainage within areas of the subwatershed downstream of the W12A Landfill site.

Predicted Effects on Regional Storm Event Flows

Post-closure conditions are used for the surface water quantity assessment as the entire Operations Area will be contributing to the site runoff once the landfill has been capped. The ponds have been sized for the 1:100 year storm event and assessed for the 1:250 year Regional Storm event. Once the modifications to the SWM ponds are complete:

- i) the 1:250 year return period design storm event peak will be about 11% less than the pre-development peak for the area of the landfill draining to Dodd Creek and less than the 1:100 pre-development peak; and
- ii) the 1:250 year return period design storm event peak will be about 56% more than the pre-development peak for the area of the landfill draining to Dingman Creek; however, the 1:100 year design storm event peak will be about 34% less than the 1:100 pre-development peak..

9.3.2.2 Surface Water Quality

During the operational/construction phase of the Project, ditches and swales at the perimeter of unvegetated portions of the site will be protected from potential runoff containing suspended solids through the use of temporary berms and silt fences. Perimeter ditches along the completed and capped areas will divert runoff through grass lined swales to the SWM ponds.

The ponds and swales will serve to remove suspended sediment from the runoff and to prevent significant outflows that could potentially impair the water quality in downstream watercourses in extreme events.

In the post-closure phase of the Operations Area, finalized perimeter ditches along the outer perimeter of the landfill footprint will capture and direct runoff from the landfill surface and will continue to direct the water via grass lined swales or ditches to the SWM ponds. As described previously, the SWM ponds are designed for Enhanced Level Protection (MECP, 2003). The proposed works are predicted to result in surface water quality conditions that are comparable to existing conditions and meet MECP PWQO (MOEE, 1994) requirements. Post-closure, the pond operations will continue such that surface water quality downstream of the site remains protected.

9.4 Biology

This section provides the assessment of impacts on the biology (natural heritage) aspects of the environment associated with the proposed expansion of the W12A Landfill as described in Section 8 of this EASR. This assessment was conducted in accordance with the requirements set out in the approved Amended ToR (Volume II) and the Work Plan dated August 2019 (Volume III Appendix B.04). Additional details on the impact assessment are provided in Volume IV Appendix D.05.

Figure 9.4-1 shows the landfill expansion and associated SWM ponds in relation to natural heritage features and existing infrastructure.

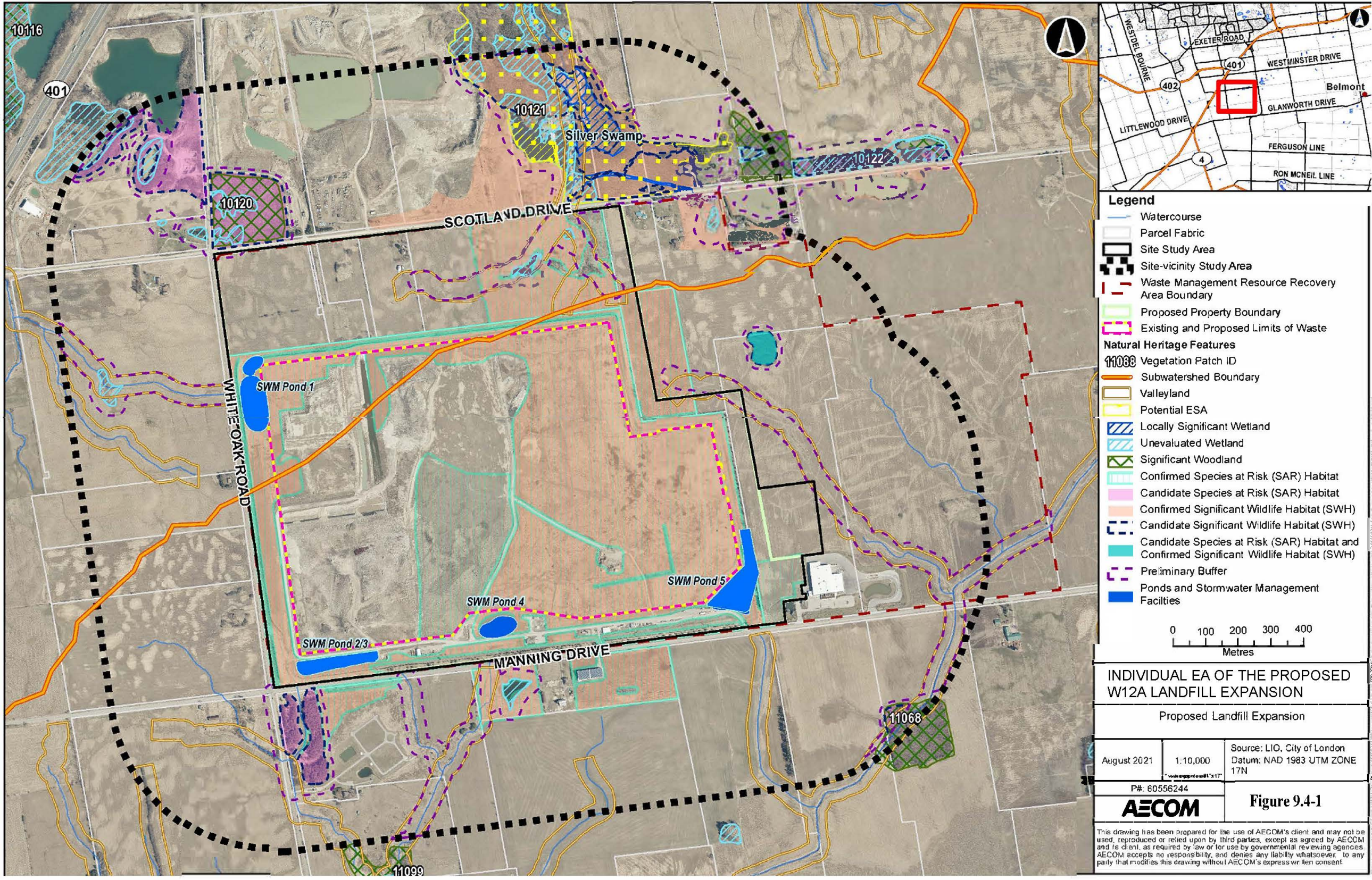
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The following impact assessment considers the potential direct and indirect impacts of the W12A Landfill expansion preferred alternative on the aquatic and terrestrial ecosystems within the Study Area for the construction, operations and closure stages 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 project works. 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 project works cause impacts to an adjacent or downstream feature or function through the alteration of the project 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 is required.

The proposed expansion of the W12A Landfill avoids many potential impacts by situating the future expansion on the existing landfill fill area.



9.4.1 Construction Stage

9.4.1.1 Aquatic Ecosystems

Direct Impacts

Since all aquatic habitat for both Dingman Creek and Dodd Creek are outside of the proposed expansion area, no direct impacts to aquatic species or habitat are anticipated.

The proposed modification to stormwater management facilities' (SWMF) weirs and outlets will all occur within the landfill area. As there are no physical alterations to the downstream SWMF infrastructure including the ditches, culverts, or other downstream watercourses, no direct impacts to aquatic species or habitat are anticipated from the proposed modifications to SWMF system.

Indirect Impacts

As described above, construction and alterations associated with the proposed modification to the SWMF weirs and outlets are not proposed for existing structures that convey pond discharge to downstream watercourses. As such, no indirect impacts to aquatic species or habitat are anticipated during the Construction Stage.

9.4.1.2 Terrestrial Ecosystems

Direct Impacts

While the preferred alternative avoids areas of natural heritage features and functions by restricting the landfill expansion to the existing landfill footprint, direct impacts are anticipated. These impacts are based on the occurrence of Confirmed Significant Wildlife Habitat for Monarch and Species at Risk Habitat for grassland birds that overlaps with the existing landfill. The habitat for Eastern Meadowlark and Bobolink within the Study Area includes the existing landfill due to the grassland habitat characteristics of the vegetation cover over the existing landfill area and adjacent lands. The direct impacts to these areas during the Construction Stage are not considered to be significant and may be avoided based on the specific location of trenching activities.

Should stripping of existing vegetation for the new diversion and drop-off facilities in the southeastern corner occur during the breeding bird window (April 1st to August 31st), there is potential for impacts to nesting birds and may contravene the Migratory Birds Convention Act. Often during the construction phase of projects involving the excavation/stripping and stockpiling of soil there are unintended impacts related to the creation of environments suitable for the nesting of breeding birds or other species (nesting turtles). Should stockpiling of stripped soil or fill be conducted during the breeding bird window, there is a potential for birds such as Banks Swallows or Cliff Swallows to establish nests in newly exposed slopes that are greater than 3:1 in inclination. Once established, the nests cannot be disturbed until the young have fledged from the nests.

Other potential direct impacts may include common wildlife species that may occupy areas of the existing landfill site; these may include groundhogs, Killdeer, common snake species, etc.

Indirect Impacts

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

- Dust deposition on vegetation in adjacent vegetation communities;
- Noise related impacts to wildlife in adjacent habitat;
- Introduction of invasive plant species via construction equipment; and,
- Accidental injury or mortality of wildlife or vegetation (i.e., adjacent trees) from construction equipment and vehicles.

These indirect impacts are not considered significant and are mitigatable with standard measures.

9.4.2 Operations Stage

9.4.2.1 Aquatic Ecosystems

Direct Impacts

During the Operations Stage of the expansion of the W12A Landfill, direct impacts to aquatic ecosystems are not anticipated.

Indirect Impacts

While the proposed works associated with the Operations Stage for the proposed expansion are not expected to result in direct impacts to aquatic ecosystems, there will be changes to drainage areas and the resulting water balance. These changes are outlined in the Stormwater Management Report –W12A Landfill Expansion (Volume IV Appendix D.04) and include the following:

- 1) The reduction of surface water drainage to Dodd Creek from SWM Ponds 2/3, 4 and 5. The reduction in drainage area from pre-expansion to post-expansion is estimated to be 20.1 hectares, from 127.6 ha to 106.5 ha.
- 2) The increase in surface water drainage to Dingman Creek from Pond 1. The increase in drainage area from pre-expansion to post-expansion is estimated to be 20 hectares, from 14.5 ha to 34.5 ha.

The alteration to drainage areas for Dingman and Dodd Creek occur in the upper reaches of the subwatershed and represent a 0.12% decrease and 0.20% increase in overall subwatershed area, respectively. Additionally, discharge from the site to the Dingman Creek subwatershed will be attenuated by Pond 1 to below pre-development flows up to and including the 1:100-year return period design storm under the proposed design (Golder, 2020b). As such, these changes in drainage area are expected to have a negligible effect on runoff and drainage downstream of the site in both the Dingman and Dodd Creek subwatersheds. Further, modifications to the existing SWM infrastructure, along with mitigation measures (i.e., erosion and sediment control), are expected to result in surface water quality conditions that are comparable to existing conditions and meet the MECP PWQOs (Volume IV Appendix D.04).

As described in the Groundwater Impact Assessment – W12A Landfill Expansion (Volume IV Appendix D.03), the existing landfill is located overlying a surficial aquitard of low permeability clayey till (15-20 m thick) and will not affect recharge of the groundwater system or groundwater levels/quantity. Therefore, the proposed vertical expansion is not anticipated to have any direct impacts on downgradient groundwater levels or quantity off-site.

The above indirect impacts are not considered significant and are mitigatable with standard measures.

9.4.2.2 *Terrestrial Ecosystems*

Direct Impacts

During the Operations Stage of the landfill expansion, potential direct impacts to terrestrial features and functions are anticipated from the progressive removal of grassland cover to facilitate the vertical expansion. These impacts are based on the Confirmed SWH for Monarch and SAR Habitat for grassland birds. Although the aforementioned habitat will be removed for the proposed landfill expansion, these impacts will be temporary in nature as they will be revegetated when vertical capacity is reached to mimic habitat conditions currently present (e.g., grassland species, common milkweed). In addition to temporary habitat removal, accidental destruction of nests, stockpiling of stripped material creating nesting opportunities for birds, or wildlife mortality may occur as part of the Operations Stage (as outlined above for the Construction Stage). These occurrences can be avoided through the implementation of standard operational measures, the continuation of measures implemented during the Construction Stage, and potential compensation for SAR Habitat (as described in Section 9.4.4).

Indirect Impacts

During the Operations Stage of the expansion of the W12A Landfill, potential indirect impacts to terrestrial ecosystems are likely to be limited to the following types of impacts:

- Dust and airborne waste deposition in natural habitat;
- Noise related impacts to wildlife in adjacent habitat;
- Introduction of invasive plant species via construction equipment; and,
- Accidental injury or mortality of wildlife or vegetation (i.e., adjacent trees) from construction equipment and/or vehicles.

9.4.3 Closure and Post-closure Stage

9.4.3.1 *Aquatic Ecosystems*

Direct Impacts

Potential direct impacts to aquatic systems are not anticipated during closure and post-closure activities.

Indirect Impacts

Potential indirect impacts associated with closure and post-closure activities are limited to the management of leachate and stormwater management within the landfill. With the continued operation of the leachate control system and the proposed SWMS, indirect impacts as a result of landfill closure are not anticipated.

9.4.3.2 Terrestrial Ecosystems

Direct Impacts

Activities associated with landfill closure include the addition of topsoil and plantings of native vegetation; as such, the project closure will result in no net loss of natural heritage features and functions despite short term impacts to natural communities during construction and operations.

Indirect Impacts

Potential indirect impacts associated with closure and post-closure activities are limited to the management of leachate and stormwater management within the landfill. With the continued operation of the leachate control system and the proposed SWMS, indirect impacts as a result of landfill closure are not anticipated.

9.4.4 Mitigation and Compensation

9.4.4.1 Construction Stage

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 or minimize impacts related to the construction stage (as outlined in Section 9.4.1), a detailed Environmental Mitigation and Monitoring Plan (EMMP) will be developed. It is recommended that the EMMP be developed prior to the issuance of engineering drawings to allow for mitigation measures to be incorporated into contract drawings for future planning. The contents of the EMMP will be determined at Detailed Design, but may include typical construction mitigation measures such as erosion and sediment control, work area delineation, construction timing windows, etc.

Vegetation removal associated with the construction stage will have to avoid direct impacts to the SAR Birds, including Bobolink and Eastern Meadowlark; all habitat removal should occur outside of the bird nesting season (April 1 to August 31). This also avoids potential incidental take and therefore contravention of the *Migratory Bird Convention Act* (MBCA). Should vegetation clearing be required during the nesting period, a nest search may be completed by a quality ecologist. Once the ecologist has confirmed no active nests are present, clearing may take place up to 24 hours after completion of the inspection. Nest searches should only be completed within simple habitats or where nests are conspicuous.

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Based on the preferred alternative and its proximity to natural heritage features and significant species, the preparation and implementation of a Species at Risk and Wildlife Observation Protocol will be required. This protocol will outline the steps to take in the event of an encounter with wildlife, including Species at Risk (SAR), during the construction stage. Detailed information and specific requirements related to wildlife and SAR encounters will be incorporated in the protocol including proper species identification, taxonomic species-specific handling methods, and reporting of wildlife and SAR as required by provincial legislation.

Along with the Species at Risk and Wildlife Observation 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 Species at Risk and Wildlife Observation 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, or portions of the landfill should be considered at Detailed Design to mitigation wildlife encounters on site during construction and operations.

Compensation Mitigation of Potential Impacts to SAR and Wildlife

As habitat for SAR grassland birds cannot be avoided within the proposed expansion alternative, compensation for habitat loss will be required as regulated under the ESA (O. Reg. 242/08). Consultation with the MECP will be required to determine appropriate compensation measures for Bobolink and Eastern Meadowlark. These measures may include enhancing existing grasslands in adjacent habitats or creating additional grassland habitats within the same eco-region.

Compensation for Significant Wildlife Habitat for Monarch will be achieved at project closure with the implementation of native plantings which are recommended to include common milkweed, a host plant for the species.

9.4.4.2 Operations Stage

During the Operations Stage, standard mitigation measures for erosion and sediment control, dust suppression, timing of operations (e.g., 7a.m. to 7p.m.), maintenance of the SWMS and facilities, and maintenance of the leachate treatment system will be required.

Based on the proposed expansion, vegetation removal associated with the operations stage will be required. To avoid direct impacts to the SAR Birds, including Bobolink and

Eastern Meadowlark, all habitat removal should occur outside of the bird nesting season (April 1 to August 31). Further, mitigation measures outlined in Section 9.4.4.1 should be implemented related to vegetation removal and nest searches. Although the vegetation removal during this stage will be progressive, with revegetation upon vertical landfill capacity for a given area, compensation (as described in Section 9.4.4.1) for the removal of SAR Habitat and SWH may be required as determined through consultation with MECP and other applicable regulatory agencies.

As heavy machinery activity will continue throughout the operations phase, considerations for wildlife exclusionary fencing and implementation of The Species at Risk and Wildlife Observation Protocol developed for the Construction Stage (as outlined in Section 9.4.4.1) should occur.

9.4.4.3 Closure and Post-closure Stage

The Closure and Post-Closure stage of the project is self mitigating, as the site will be progressively vegetated as landfilling is completed in the expansion phases. Plantings should include native species that are known to occur within the region and may include compensation plantings as determined through consultation with the MECP for Bobolink and Eastern Meadowlark habitat compensation.

9.5 Land Use

This section provides the assessment of impacts from the proposed expansion of the W12A Landfill (as described in Section 8) on land use. The details of the impact assessment are provided in Volume III Appendix D.06; and are summarized below.

The assessment of impacts on current and future land uses in the Site Area and Site-vicinity Study Area was predicated on a study methodology designed at the outset of the evaluation. Generally, this methodology integrated a review of the regulatory context and planning policy framework applicable to these areas, data collected during a field survey, an analysis of aerial photography and information obtained through interviews with City staff. The evaluation process was carried out between September 2019 and August 2020. Through this review, land uses that may be sensitive to the potential impacts of landfilling activities were highlighted and identified.

The following data sources were utilized for this assessment:

- Policy documents and guidelines applicable to the Site Area and Site-vicinity Study Area;
- Information collected from a field survey of the Site Area and Site-vicinity Study Area conducted on October 8, 2019;
- Digital sources to supplement the characterization of existing conditions;
- Interviews and discussions carried out with City staff in September 2019 to identify planning issues and any potential development activity within Site-vicinity Study Area;
- Study reports completed by the groundwater, biology, heritage and air quality disciplines to inform the EA; and,
- W12A Landfill Annual Status Report: January 1 to December 31, 2019.

9.5.1 Policy Overview

Following is an overview of the policy and guidelines described above that were used to discern the existing Site Area and potential future Site-vicinity Study Area characteristics in terms of land use composition.

9.5.1.1 Provincial Policy Statement, 2020

The 2020 PPS came into effect on May 1, 2020 under Section 3 of the *Planning Act* (MMAH 2020). The PPS provides overall policy direction on matters of provincial interest related to land use planning and development and sets the policy foundation for regulating the development and use of land. In this respect, Section 3 of the *Planning Act* requires that all decisions affecting planning matters “shall be consistent with” policy statements issued under the Planning Act.

The PPS provides a vision for land use planning in Ontario that focuses growth within settlement areas, and encourages an efficient use of land, resources, and public investment in infrastructure. To support this vision, the PPS defines a number of policies to promote strong, liveable, healthy and resilient communities and to promote Ontario’s long-term prosperity, environmental health and social well-being.

The Project has been evaluated with regard to the policy direction and provisions of the PPS. Based on this analysis, specific policies in Section 1.0 (Building Strong Healthy Communities) and Section 2.0 (Wise Use and Management of Resources) are particularly relevant to the proposed landfill expansion. Commentary regarding these policies is provided in the following section of this Report.

In the context of the 2020 PPS, the activities associated with the W12A Landfill and the Project would be considered a ‘waste management system’. A landfill would be classified as a ‘major facility’ under the terms of the PPS. Section 6.0 of the PPS defines these relevant terms as follows:

“Waste management system: means sites and facilities to accommodate solid waste from one or more municipalities and includes recycling facilities, transfer stations, processing sites and disposal sites.

Major facilities: means facilities which may require separation from sensitive land uses, including but not limited to airports, manufacturing uses, transportation infrastructure and corridors, rail facilities, marine facilities, sewage treatment facilities, waste management systems, oil and gas pipelines, industries, energy generation facilities and transmission systems, and resource extraction activities.”

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Given the nature and scale of the Project and the surrounding development context the following policies contained within Sections 1.0 and 2.0 of the PPS have specific relevance to the landfill expansion:

Policy 1.1.1 prescribes 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;”

The proposed landfill expansion would help to promote an efficient land use pattern to help to sustain the financial well-being of the Province and the City over the long term. In this regard, the proposed expansion is expected to increase the available capacity of the landfill by 25 years which will allow the City to continue to use these lands for this purpose so that waste can continue to be disposed of locally. Further, the expansion is also expected to create a public disposal option for nearby municipalities that is also expected to provide a financial benefit to the City.

With respect to health and safety, the analysis provided herein describes how the identified Project is not expected to result in health and safety impacts to surrounding sensitive uses. Further, the results of the other supporting studies on noise, odour and air impacts (Volume IV Appendices D.01 and D.02) concluded that the proposed expansion is expected to meet all Provincial criteria with respect to these items. Noise and air quality monitoring programs for the W12A landfill have been proposed to verify emission rates for air quality indicators and to verify that planned mitigation measures are implemented as planned and are effective. Also, the proposed vertical expansion would not result in the encroachment of the landfill towards existing sensitive land uses.

Provided the recommended impact mitigation program is implemented in project planning, the proposed landfill expansion would satisfy Policy 1.1.1.

Policy 1.2.1 states that a coordinated, integrated and comprehensive approach should be used when dealing with planning matters within, and across, municipalities, and with other orders of government, including:

- “d) infrastructure, multimodal transportation systems, public service facilities and waste management systems.”

The planned expansion of the W12A Landfill site, which is detailed in this EASR, has followed a coordinated, integrated and comprehensive approach. In this regard, multiple public consultation events occurred, and the project involved review by multiple agencies at various levels of government. In addition, the following facets of the environment have been studied including: atmosphere; biology; geology and hydrogeology; surface water; agriculture; archaeology; cultural heritage landscapes and built heritage resources; land use; agriculture; socio-economic; visual; design and operations, and transportation.

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Policy 1.2.6.1 of the PPS provides direction regarding land use compatibility for major facilities:

“Major facilities and sensitive land uses shall be planned and developed to avoid, or if avoidance is not possible, minimize and mitigate any potential adverse effects from odour, noise and other contaminants, minimize risk to public health and safety, and to ensure the long-term operational and economic viability of major facilities in accordance with provincial guidelines, standards and procedures.”

Section 6.0 of the PPS defines ‘sensitive uses’ as follows:

“Sensitive land uses: means buildings, amenity areas, or outdoor spaces where routine or normal activities occurring at reasonably expected times would experience one or more adverse effects from contaminant discharges generated by a nearby major facility. Sensitive land uses may be a part of the natural or built environment. Examples may include, but are not limited to: residences, day care centres, and educational and health facilities.”

The City has implemented measures to reduce the potential impacts of the existing W12A Landfill on sensitive land uses in the vicinity of the site, (e.g., farm decommissioning, dwelling removal). In addition, the policy framework under both the 1989 Official Plan and The London Plan largely restrict development of sensitive land uses in the vicinity of this landfill facility.

With respect to the Project, as noted above, studies of noise, odour, and air were carried out to assess the potential impacts of the proposed landfill expansion on adjacent sensitive land uses. Generally, it is concluded in these associated reports that the identified landfill expansion is expected to meet all Provincial criteria with respect to noise, odour and air quality. Also, the proposed vertical expansion will not result in the encroachment of the landfill towards any existing sensitive land uses.

Further, in accordance with this policy, the Project has been evaluated relative to applicable components of the Land Use Compatibility (D-Series) Guidelines administered by the Ministry of Environment, Conservation and Parks.

Based on review of the published D-Series Guidelines, Guideline D-4 (Land Use On or Near Landfills and Dumps) (MOE, 1995) relates most directly to the proposed landfill expansion project. This Guideline identifies restrictions and controls on land use in the vicinity of landfills and dumps, in order to protect the health, safety, convenience and welfare of residents near such facilities. As set out in the Synopsis to this Guideline, the direction provided in this document is to complement existing Ministry abatement programs for landfills and is a direct application of Guideline D-1: "Land Use Compatibility" (MOE, 1995a).

Application of Guideline D-4 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.

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Pursuant to Section 5.1 of the Guideline, the Ministry will normally recommend against proposals for sensitive land use adjacent to operating landfills, and on land used for waste disposal purposes where there are completed or partially completed fill areas.

In accordance with Section 5.1.1 of the Guideline, the following uses are considered sensitive land uses for landfills currently in operation:

“Any existing or committed land use which includes:

- a. a permanent structure used in animal husbandry; or
- b. agricultural land used for pasturing livestock; or
- c. a permanent structure where:
 - i. a person sleeps, or
 - ii. a person is present on a full time basis;

but not including food or motor vehicle service facilities adjacent to a highway, utility operations, scrap yards, heavy industrial uses, gravel pits, quarries, mining or forestry activities; or

- d. cemeteries”

Section 5.1.2 identifies compatible land uses for landfills currently in operation, which includes:

- 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 Impact Assessment provided under Section 9.5.2 and 9.5.3 of this EASR had regard for Guideline D-4, including the list of sensitive and compatible land uses, to determine potential impacts as a result of the landfill expansion. As discussed, the proposed expansion is not expected to have adverse impacts on any sensitive land uses within the Site-vicinity Study Area around the landfill. As such, this Project is compatible with the surrounding area and has regard for the D-Series Guidelines.

Given these key considerations, the proposed expansion is consistent with the direction defined in Policy 1.2.6.1.

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Policy 1.6.10.1 prescribes requirements for the provision and location of waste management systems:

“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.

Waste management systems shall be located and designed in accordance with provincial legislation and standards.”

As defined in Section 7, the EA has been carried out to evaluate options for expansion of the W12A Landfill, and to identify a preferred landfill expansion alternative that can effectively accommodate present and future requirements.

With respect to the policies under Section 2.0 related to natural heritage, water, agricultural, and cultural heritage resources, additional studies have been prepared in support of this EA with respect to these attributes within their Site-vicinity Study Areas. The assessment of these resources has been accounted for in the identification of the preferred alternative for landfill expansion and further evaluated during similar impact assessments for the proposed landfill expansion. Accordingly, design and operational recommendations along with any additional mitigation have been incorporated to ensure that there will not be any adverse impacts beyond allowable Provincial thresholds or regulations on the surrounding natural heritage features or sensitive land uses as a result of the proposed landfill expansion.

Policy 2.1.1 of the PPS directs that natural features and areas shall be protected for the long term. In this regard, the potential impacts on the natural heritage features within the Site-Vicinity Study Area and Site Area were investigated, as detailed in Volume IV Appendix D.05. The investigation detailed in this report examined aquatic and terrestrial ecosystems and determined that an Environmental Mitigation and Monitoring Plan is required to mitigate potential direct and indirect impacts of the proposed expansion to protect natural features and areas during the construction, operations, closure and post-closure phases. Provided that the recommended mitigation program is implemented in project planning, the proposed landfill expansion would satisfy Policy 2.1.1.

With respect to Water, Section 2.2 of the PPS provides policies related to improving or restoring the quality and quantity of water. To address these policies, a Stormwater Management Existing Conditions and Impact Assessment was completed (Volume IV Appendix D.04) to investigate surface water impacts. This report generally concludes that the proposed works are predicted to result in surface water quality conditions that are comparable to existing conditions and meet MECP Provincial Water Quality Objective (PWQO) (MOEE, 1994) requirements. A monitoring program is also recommended in these reports to help minimize potential stormwater management and surface water impacts associated with landfill operations following implementation of the Project.

A Groundwater Existing Conditions and Impact Assessment, dated November 2020, was also completed (Volume IV Appendix D.03). Generally, it was concluded in this study report that the proposed expansion project is not expected to affect: the groundwater supply

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available to water supply wells in the area; groundwater baseflow to off-site watercourses or other natural environment features in the area of the landfill, or; off-site groundwater levels that support vegetation. Mitigation and monitoring programs are also recommended in this report (1) to meet groundwater quality objectives at the landfill boundary and (2) to continue the existing landfill groundwater monitoring program.

Provided the identified monitoring programs and mitigation measures are implemented, the Project would satisfy Policy 2.2.

Section 2.3 of the PPS relates to Agriculture. To address these policies, an assessment of the agricultural land in the Site Area and Site-vicinity Study Area and the potential impacts on these lands was completed (Volume IV Appendix D.07). Respecting Policies 2.3.1, 2.3.3.1 and 2.3.3.2, the Project integrates vertical expansion over the existing landfill footprint, as well as a boundary expansion to accommodate additional buffer areas and a Waste and Resource Material Drop-off Area. The expansion area is located within the defined boundaries of the site-specific W12A Landfill policy area. The proposed Site Area would be accommodated on lands specifically designated for a waste management system. Accordingly, in the context of the PPS, the Project would not introduce a new non-agricultural use into a prime agricultural area. Further, the components of the Project would not specifically constrain, or compromise, existing agricultural uses and normal farm practices within the prime agricultural area proximate to the Site Area.

With regard to Policy 2.3.3, MDS setbacks are applied to separate uses to reduce incompatibility concerns relating to odour emissions from livestock facilities. Specific direction on the applicability of MDS formulae is provided in the Minimum Distance Separation Document, prepared by OMAFRA (Publication 853). Guideline No. 3 of this Publication states that MDS I and II setbacks are not required for landfills. Accordingly, consistent with Policy 2.3.1 of the PPS, the existing landfill area and the proposed buffer area should not constrain existing agricultural operations in proximity of this facility, including those within the Site-vicinity Study Area.

Regarding Section 2.6 of the PPS that contains policies related to Cultural Heritage, the Heritage Impact Assessment detailed the areas of potential cultural heritage within the vicinity of the W12A Landfill site (Volume IV Appendix D.09). The report generally concluded that built heritage resources would not be impacted by the proposed expansion and no further studies or monitoring is required.

In conclusion, provided recommended monitoring and mitigation measures are implemented, it is considered that the Project satisfies, and is consistent with, the Provincial Policy Statement.

9.5.1.2 *City of London Official Plan (1989)*

Section 1.2 of the 1989 Official Plan states that, “The Official Plan for the City contains City Council’s objectives and policies to guide the short-term and long-term physical development of all lands within the boundary of the municipality.” Policies defined within the Official Plan provide direction on a range of planning considerations, such as growth management, urban form, urban design and public consultation, in order to promote the physical development of a healthy, sustainable community.

As described in Section 5.6, the Site-vicinity Study area contains the following land use designations pursuant to Schedule ‘A’ (Land Use Plan) of the 1989 Official Plan:

- Agricultural;
- Open Space; and
- Environmental Review.

The proposed vertical expansion will not result in the encroachment of the W12A Landfill into any Open Space or Environmental Review areas.

In terms of Waste Management Area policies, and notwithstanding the permissions set out for the Agricultural designation, specific policies for landfill sites are provided under Section 9.2.15 ‘Waste Management and Resource Recovery Area’ (the lands generally located within the block bounded by Wellington Road South, Manning Drive, White Oak Road and Scotland Drive) and Section 17.4 ‘Operating and Closed Landfill Sites’ of this Official Plan.

Section 9.2.15.2 provides a set of objectives for the use of land within the Waste Management and Resource Recovery Area.

The proposed expansion supports this broad objective by planning for additional capacity in a manner that supports the environment, public health and safety and the interests of residents by studying and mitigating all potential effects of the expansion.

In accordance with Section 9.2.15.3, a variety of waste management/resource recovery uses may be permitted within this defined area subject to site-specific zoning. Among the permitted uses in this defined area are Municipal waste disposal facility, as well as other waste disposal facilities such as material recovery facilities, yard waste composting facilities, and source separated organic composting facilities.

It is further noted in this Section that:

- Permitted uses are subject to the criteria listed in Section 9.2.15, 17.4 and 17.5 of the Official Plan;
- Farm dwellings and secondary farm dwellings shall not be permitted within this area; and
- Waste management and resource recovery uses should be planned so as to cause the least disruption to existing agricultural uses and facilities.

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Section 17.4.3 of the 1989 Official Plan pertains to landfill sites with Section 17.4.3 outlining criteria for development in proximity of these sites.

In conclusion, the above noted policies will help to ensure that landfill operations will not impact future land uses in the vicinity of the landfill site. In addition, given the boundary of the Waste Management and Resource Recovery Area, this area does not require expansion to accommodate the proposed expansion of the W12A Landfill operation.

9.5.1.3 *The London Plan (2016)*

The London Plan (2016) shows that the Site Area and Site-vicinity Study Area contains the following designations pursuant to Map 1 (Place Types) of The London Plan:

- Waste Management Resource Recovery Area;
- Farmland;
- Green Space; and
- Environmental Review.

The existing W12A Landfill site and adjacent lands are designated Waste Management Resource Recovery Area. As set out in Policy 1254 of The London Plan, this place type was developed specifically for the W12A Landfill to provide for the continued evolution of the landfill and surrounding area as an integrated waste management centre.

Policy 1254 states that, “landfills are important to the city’s future growth and development, provide a necessary public benefit and the ability to manage the city’s solid waste. All landfills will be designed to maximize utility and minimize negative impacts. Landfills will be maintained in accordance with the *Environmental Protection Act*, the *Ontario Water Resources Act*, the EAA and all relevant federal, provincial and municipal legislation and regulations.

As stated under Policy 1256 of this Official Plan, the policies pertaining to the Waste Management Resource Recovery Area are intended to address several key objectives, including:

- Apply to lands that are either currently being used as a landfill, are being considered for expansion, or a landfill in the process of remediation;
- Facilitate the transition into productive use as a landfill; and
- Promote best practices in site selection, site design, operation, and remediation.

In accordance with Policy 1258, the following uses are generally permitted on lands designated Waste Management Resource Recovery Area:

- Landfills;
- Related uses necessary to support waste reduction, re-use, recycling, resource recovery, treatment and waste disposal; and
- Eco-Industrial Parks where industries use materials available from the Waste Management Resource Recovery Area.

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In addition to the above noted uses, it is stated in this Policy that a number of related uses are permitted through a site-specific Zoning By-law Amendment such as a Municipal waste disposal facility, community recycling drop-off depot, MRF, and other similar waste collection, processing and recovery functions provided the uses include a component of municipal use.

The London Plan also includes several policies to guide land use and development in the vicinity of the W12A Landfill site. These restrict creation of lots within the Waste Management Resource Recovery Area, discourage development of lands within 1,500 m of the Waste Management Resource Recovery Area, require the City to continue to work with property owners within a 1,500 m radius of the Waste Management Resource Recovery Area to mitigate impacts related to odour, dust, litter and traffic, and require the City to confine all municipal waste management and resource recovery uses and accessory uses to the Waste Management Resource Recovery Area Place Type.

The Project integrates a proposed vertical expansion to the existing landfill footprint, as well as an existing landfill property expansion for additional buffering and a Waste and Resource Material Drop-off Area. The Site Area would be encompassed within the existing boundaries of the defined Waste Management Resource Recovery Area.

9.5.1.4 City Zoning By-law

Figure 9.5-1 illustrates the zoning applicable to the Site Area and Site-vicinity Study Area pursuant to City Zoning By-law No. Z.-1 (Zoning By-law). As illustrated, the W12A Landfill is zoned Waste and Resource Management (WRM), which is identified in Section 9.2.15.1 of the 1989 Official Plan. Lands surrounding the landfill site within the Site-vicinity Study Area are primarily zoned:

- Agricultural (AG2) Zone;
- Environment Review (ER) Zone;
- Open Space (OS3) Zone; and
- Resource Extraction (EX) Zone.

The WRM Zone is applied to the lands identified as Waste Management and Resource Recovery Area in the 1989 City Official Plan. Section 51.1 of the Zoning By-law states that this Zone regulates a range of waste management and resource recovery uses permitted by site-specific zoning.

It is anticipated that the proposed vertical expansion of the landfill and the proposed Waste and Resource Material Drop-off Area would be permitted uses in the WRM1 Zone. It is possible that the proposed buffer would not be permitted in accordance with the agricultural use permissions of the AG2 Zone. The buffer areas may need to be rezoned to WRM1. Further review will be needed during the design phase of the Project to confirm if the intended uses of the Site Area comply with existing Zoning By-law permissions. As discussed, the proposed Waste and Resource Material Drop-off Area and expanded on-site buffer area would be consistent with existing Official Plan permissions.

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With respect to the other zones within the Site-vicinity Study Area, the existing zoning structure limits development permissions in proximity to the Site Area. Further, in light of the existing zoning structure and the associated Official Plan policy framework, it is considered unlikely that new sensitive land uses would be introduced in close proximity to the Site Area.

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With respect to the other Zones within the Site-vicinity Study Area, limited development is permitted. Accordingly, the development of new sensitive land uses that would be incompatible with landfill operations are unlikely to occur.

9.5.2 Assessment of Effects on Current Land Uses

Section 5.1.1 of Guideline D-4 (Land Use On or Near Landfills and Dumps) itemizes sensitive land uses for landfills currently in operation that include the following within the Site-vicinity Study Area.

- A permanent structure used in animal husbandry;
- Agricultural land used for pasturing livestock;
- A permanent structure where: a person sleeps, or a person is present on a full time basis (but not including food or motor vehicle service facilities adjacent to a highway, utility operations, scrap yards, heavy industrial uses, gravel pits, quarries, mining or forestry activities); and
- Cemeteries.

The following uses within the Site-vicinity Study Area in proximity to the existing W12A Landfill were identified:

North: Seven residential dwellings; aggregate extraction operation

West: Agricultural land

East: City's MRF; agricultural land

South: Islamic Cemetery of London; agricultural land; farm and associated dwelling; cattle farm

As previously described in Section 9.5.1, a variety of studies were completed to assess impacts to surrounding uses. Of particular relevance to the assessment of impacts to sensitive land uses in the Site Area and Site-vicinity Study Area is the noise, odour and air assessments. Generally, it is concluded in these associated reports that the proposed landfill expansion is expected to meet all Provincial criteria with respect to noise, odour and air quality and is not expected to result in impacts in excess of these criteria to the public. Mitigation and monitoring programs are recommended in these reports to help minimize potential impacts associated with landfill operations following implementation of the Project.

The proposed landfill expansion does not result in the limits of waste being extended towards any of the sensitive land uses identified above. A residential dwelling is currently located to the north of the existing landfill on lands addressed as 3801 Scotland Drive. This residence is situated within the proposed expanded landfill property. In conjunction with the landfill expansion process, this dwelling will be removed to facilitate additional on-site buffering.

One livestock operation was also identified within the Site-Vicinity Study Area. As identified in Section 9.5.1.1, MDS calculations do not apply to landfills pursuant to OMAFRA

Publication 853. Considering the Project consists of a proposed vertical landfill expansion, that supporting transportation, noise, and dust mitigation measures are implemented, and MDS does not apply, the project is not expected to have any impact on the livestock operation's ability to operate or expand in the future.

The Shore Creek Drain is identified within the Site-Vicinity Study Area, and portions of the drain also traverse the Site Study Area. As part of the Project, lands within the expansion area would be seeded and kept fallow, and as such, no impacts are expected to agricultural drainage in the Site-Vicinity Study Area. The expansion lands are also not expected to impact any access points to individual parcels. A crossing of the Shore Creek Drain is located within the Site-Vicinity Study Area; however, the buffer lands will not limit use of the crossing or access to the adjacent fields.

In light of the above, provided the recommended impact mitigation is implemented, the proposed expansion is not expected to have significant adverse impacts on these uses. Further, in light of the intended use of the Site Area, it is determined that the landfill expansion would be compatible with the existing land uses within the Site-Vicinity Study Area.

9.5.3 Assessment of Effects on Planned Future Land Use

There are no current development applications within the Site-vicinity Study Area. Additionally, given the policy framework described above, it is not anticipated that sensitive land uses would be constructed in the vicinity of the W12A Landfill site within the 2035 planning horizon defined for the City's new Official Plan. This perspective on future land use in proximity to the landfill site is based, in part, on the following considerations:

- As provided under Section 17.4.3 of the 1989 Official Plan, notwithstanding the land uses designated on Schedule "A" of this Plan and any associated policies, future development is not permitted on or in the vicinity of operating landfill sites unless it is determined that the development satisfies the provisions of the Environmental Protection Act, and the development complies with any other provincial and municipal guidelines, as applicable.
- Under Policy 1273 of The London Plan Policy 1273 it is stated that within the Farmland Place Type, the City will discourage new official plan and/or zoning by-law amendments to allow the development of new residential uses or other sensitive land uses within a 1,500 m radius of the Waste Management Resource Recovery Area Place Type to provide appropriate separation distance to mitigate impacts.

In addition, the City owns a majority of the parcels within the Site-vicinity Study Area to the east of the Site Area, as well as a number of parcels to the west and north of the Site Area. In certain situations, sensitive land uses on these properties have been restricted (e.g., farm decommissioning), and several residential dwellings have been removed from these properties.

It is anticipated that any future development in the Site-vicinity Study Area within the 2035 planning horizon would be compatible with the uses planned for the Site Area. In this respect, given the planning framework applicable to Site-vicinity Study Area, it is unlikely

that new sensitive uses would be established in close proximity to the W12A Landfill site. Accordingly, it is determined that the Project should not adversely impact on future land uses within the Site-vicinity Study Area.

Given that no significant impacts or adverse effects are expected with respect to the surrounding land uses, no mitigation or monitoring is required at this time from a land use perspective. Notwithstanding, the measures recommended in conjunction with this EA should be implemented to mitigate any potential impacts to land uses proximate to the existing landfill facility. In this respect, project planning should have regard for (1) any mitigation required to protect surrounding land uses from noise, odour and dust impacts and (2) mitigation measures recommended to protect natural heritage features and functions.

9.6 Agriculture

This section provides the assessment of impacts from the proposed expansion of the W12A Landfill (as described in Section 8) on agriculture. The details of the impact assessment are provided in Volume IV Appendix D.07; a summary is provided below.

9.6.1 Methodology

For the purposes of the agricultural assessment, the Site-vicinity Study Area includes an area with a radius of 500 m around the Site Area, noting that the Site Area is the existing W12A Landfill site, located at 3502 Manning Drive and adjacent lands required for the proposed landfill expansion.

The assessment of impacts on agricultural land and operations within the Site-vicinity Study Area was based on the Province's draft Agricultural Impact Assessment Guidelines (released March 2018) (OMAFRA 2018).

The considerations used in the assessment include: the degree of investment and agricultural infrastructure (e.g. tile drainage and fencing); soil capability; and potential impacts on agricultural land, surrounding uses and the wider agricultural system. These considerations were used to assess the potential loss of agricultural lands and production, as well as the proposed landfill expansion's impact on the broader agricultural system.

Predicted impacts on agricultural lands were based on a site visit, which occurred on October 8, 2019, to identify and verify existing conditions and analysis of the following data sources:

- Relevant provincial land use plans (Provincial Policy Statement, 2020 [Ontario 2020]);
- Municipal planning documents and land use maps (The London Plan, 2019 [City of London 2019]);
- OMAFRA's constructed and agricultural artificial drainage mapping (OMAFRA Agricultural Information Atlas [OMAFRA 2016]);
- Soil and Canada Land Inventory (CLI) Capability mapping (OMAFRA Agricultural Information Atlas [OMAFRA 2016a]);
- Aerial imagery (historic and recent);

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- Agricultural crop statistics (Statistics Canada, 2016 Census of Agriculture [StatsCan 2016]); and
- Parcel mapping from the City.

The EA process also included several consultation events with surrounding landowners and City of London staff. Additionally, City staff consulted with the City's Agricultural Advisory Committee (AAC) throughout this process. The AAC, which is made up of residents with links to the agriculture community, provides liaison between agricultural and rural communities and the Municipal Council and helps to ensure that the City of London maintains a secure, economically viable agricultural industry. A summary of the AAC consultation is provided in Volume IV Appendix D.07.

9.6.2 Agricultural Lands and Operations

Based on the characterization of the agricultural uses within the Site Area and Site-vicinity Study Area as described in Section 5.7 of this EASR, agricultural uses within this defined area are characterized by conventional agricultural production that is in keeping with regional and provincial trends (e.g., cash crop production, livestock operations).

With respect to the existing level of investment and infrastructure associated with the agricultural lands in the Site Area and Site-vicinity Study Area, the proposed expansion incorporates a vertical expansion over the existing 106.3 ha landfill footprint with no expansion of the landfill area. The Site Area boundary is proposed to be expanded to accommodate additional on-site buffering and a Waste and Resource Material Drop-off Area. Given the intent to implement vertical landfill expansion and the nature of the activities planned for the Site Area, with the exception of additional perimeter fencing, in the short term the Project is not anticipated to generate a significant increase in the existing level of investment and infrastructure servicing of agricultural lands in the Site-vicinity Study Area. Additionally, no substantive long-term capital investments are anticipated to service the lands intended for buffering purposes or for the Waste and Resource Material Drop-off Area.

Similar to the above, given that no additional lands are required for the landfill component of the Project, the proposed Site Area expansion is not expected to have an adverse impact on the soil capability within either the Site Area or the Site-vicinity Study Area. Additionally, the activities planned for the Site Area extension (i.e., buffering, Waste and Resource Material Drop-off Area) should not adversely impact on the capability of Class 2 and 3 soils located within these delineated areas.

In terms of potential effects of the agricultural land base within the Site Area, the landfill footprint will not be expanded; however, additional lands beyond the existing footprint will be required for buffering and other uses. Land in the southeast corner of the Site Area (between the existing landfill and the MRF) will be used for a new small vehicle Waste and Resource Material Drop-off Area. North of this, the landfill's eastern buffer will be expanded from 30 m to 100 m, which will incorporate 70 m of agricultural land. At this time, no infrastructure is planned for this land other than a fence on the new landfill boundary. In light of the intended use of the lands contained within the proposed landfill boundary, the

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potential interim and permanent impacts of the Project on the agricultural land base are expected to be minor.

Studies have been completed to assess potential impacts of the landfill expansion on existing land uses within the Site-vicinity Study Area, including identified sensitive land uses. Of particular relevance to this assessment are the noise, odour and air assessments completed, as discussed in other sections of this EASR. In particular, 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). Mitigation and monitoring programs are recommended to minimize potential impacts associated with landfill operations following implementation of the expansion. Provided the recommended impact mitigation is implemented, the Project should have minimal impacts on existing agricultural activities and other sensitive uses in the Site-vicinity Study Area. Additionally, based on the applicable planning framework for the W12A Landfill site and the adjacent agricultural area, the Project would not constrain agricultural activities in the vicinity of this landfill facility.

A traffic impact study was also completed to evaluate the potential impacts of the Project on the local transportation network. This study did not identify any concerns with the safe and efficient movement of agricultural vehicles within the Site-Vicinity Study Area following completion of the landfill expansion. Further, through consultation, the AAC did not identify any existing or potential concerns with the movement of farm vehicles in the vicinity of the W12A Landfill or along its designated haul routes.

In terms of potential impacts on the wider agricultural system, the expansion area associated with the Project would take a limited amount of agricultural land out of active production to accommodate additional on-site buffering and a proposed Waste and Resource Material Drop-off Area. These lands are currently within City of London ownership and are encompassed with the Waste Management Resource Recovery Area permissions of the 1989 Official Plan and The London Plan. Moreover, with the exception of boundary fencing, no additional investment or infrastructure is planned for those lands intended for buffering purposes.

With respect to the site-specific impacts of this project, the removal of agricultural land from production for buffering purposes is not expected to result in a noticeable economic loss based on regional cropping practices. Additionally, there should be no substantive impacts to agricultural infrastructure (drainage, agricultural-related uses) in the area. The expansion area is also designated for waste management purposes, and therefore the Project would not remove designated farmland from production and should not contribute to the further fragmentation of agricultural operations.

The potential cumulative impacts of the Project on the agricultural system were also evaluated in conjunction with this assessment, and with consideration for the findings of EA studies and public consultation. As discussed, the Site-Vicinity Study Area is largely comprised of conventional agricultural production (e.g., cash crop production, livestock operations). With consideration for the findings of studies and public consultation completed in conjunction with the EA process, in our opinion, the establishment of non-agricultural operations within this area, including the W12A Landfill, have not resulted in substantive impacts to the viability of the local agricultural land base. Given the scale and characteristics of this Project as outlined above, it is also our opinion that the proposed landfill expansion would not generate any significant incremental impacts to farm operations in the Site-Vicinity Study Area or the regional agricultural system. Moreover, as outlined in the Land Use Assessment Report, the existing planning framework limits the potential that agricultural activities in the Site-Vicinity Study Area will be impacted by new non-agricultural uses in the foreseeable future. In light of these considerations, in our opinion, the Project should not result in, or contribute to, significant cumulative impacts to the local or regional agricultural systems.

Given these considerations, the proposed expansion to the Site Area should not compromise, or constrain, agricultural operations within the Site-vicinity Study Area and should not result in the further fragmentation of agricultural lands in this area. Accordingly, has been assessed that the Project is expected to generate minimal adverse impacts on the wider agricultural system.

In conclusion, the proposed landfill expansion (1) is not expected to have any significant interim or permanent impacts on existing agricultural land and/or operations within the Site-vicinity Study Area and (2) should not adversely impact on the wider agricultural system.

As an outcome of the agricultural impact assessment, the Project is expected to generate minimal land use impacts on agricultural land and/or operations in the Site-vicinity Study Area. Notwithstanding, mitigation and monitoring programs associated with the expanded landfill operations recommended in conjunction with this EA should be implemented to minimize any potential impacts on local agricultural activities and the larger agricultural system.

9.7 Archaeology

This section provides the assessment of impacts on potential archaeological resources, as described in Section 5.8 of this EASR, associated with the proposed expansion of the W12A Landfill. The details of the impact assessment are provided in Volume IV Appendix D.08; a summary is provided below.

The results of the Stage 3 Archaeological Assessments identified the presence of one site with archaeological potential in the Site Area (White Oak 1 site [AfHh-926]), located on the north side of the western portion of the existing landfill footprint. The site appears to represent an occupation dating to the Late Archaic Period (ca. 1500 – 500 B.C.). The limited quantity of the cultural material identified at the site suggests that it represents a small, briefly occupied, campsite. The lithic tools and debitage suggest latter stage tool production and maintenance were carried out at this site.

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The presence of high artifact-yielding test units (e.g., ≥ 10 artifacts) indicates that the White Oak 1 site (AfHh-926) has further cultural heritage value or interest and will require Stage 4 mitigation prior to development. This conclusion is consistent with Section 3.4.1, Standard 1a of the Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI's) *Standards and Guidelines for Consultant Archaeologists* (MHSTCI 2011).

As per Section 4.1.1 of the *Standards and Guidelines for Consultant Archaeologists* (MHSTCI 2011) the avoidance and protection strategy for the White Oak 1 site (AfHh-926) will involve the establishment of a “no-go” zone consisting of a 10 m protective buffer around the extent of the site as defined by the results of the Stage 3 assessment. A temporary fencing barrier will be erected to clearly delineate the 10 m protective buffer around the site. A construction monitoring schedule will be required whereby a licensed archaeologist would be present to monitor any construction activities (excavation, placement of stockpiles) that extend to the edge of the protected area, if that occurs. The protected area and the location of the temporary barrier will be shown on all contract drawings and be labeled as a “no-go” zone where construction activities will not be permitted. Instructions will be provided to all construction staff to stay outside of this area and to ensure, if the activity requires, that it is appropriately monitored by a licensed archaeologist during any construction which takes place within 10 m of the protected area. After completion of construction, the area will be inspected and the effectiveness of the monitoring and avoidance strategy for the site will be reported on by the licensed consultant archaeologist. If any archaeological resources turn up during monitoring and construction, the archaeologist must be permitted sufficient time to assess these resources and mitigate as required.

Plans for the avoidance and long-term protection of the White Oak 1 site (AfHh-926) have been developed for this project; refer to Volume IV Appendix D.08. These plans include a commitment that any ground alterations will avoid the archaeological site and its protective buffer area. As well, if the City or any other future land owner determines at a later date that the White Oak 1 site (AfHh-926) will be altered in any way, either temporarily or permanently, then Stage 4 mitigation will be required. This includes even minor forms of soil disturbance such as tree removal, minor landscaping, and utilities installation.

There are no further concerns for impacts to archaeological sites in the remainder of the Site Study Area outside the 10 m buffer. The MHSTCI reviewed the results and recommendations presented in the Stage 3 Archaeological Assessment Report (Volume IV Appendix D.08) and accepted this report into the Provincial Register of archaeological reports, and issued a standard letter of compliance with the Ministry's 2011 *Standards and Guidelines for Consultant Archaeologists* and the terms and conditions for archaeological licensing.

Based on the results of the Stage 2 Archaeological Assessment (Golder 2020), Location 4 (AfHh-945) is considered to have cultural heritage value or interest, while Locations 1, 2, 3, 5 (AfHh-946), and 6 are not considered to have cultural heritage value or interest. Given these findings Location 4 (AfHh-945) should be subject to Stage 3 Archaeological Assessment prior to any impacts following Standards 1 and 2 of Table 3.1 in the MHSTCI's 2011 *Standards and Guidelines for Consultant Archaeologists* (Government of Ontario

2011:51). It is noted that the preferred landfill expansion design, as outlined in Section 8.0, does not provide for any development on or near Location 4 (AfHh-945) and as such no further action is presently required.

No further assessment is required for Locations 1, 2, 3, 5 (AfHh-946), and 6.

9.8 Built Heritage Resources and Cultural Heritage Landscapes

This section provides the assessment of impacts on potential built heritage resources identified in Section 5.9 of this EASR by the proposed expansion of the W12A Landfill. The details of the impact assessment are provided in Volume IV Appendix D.09; a summary is provided below.

Seven properties in the CH Study Area were identified as requiring cultural heritage assessment to determine if any of the properties had cultural heritage value or interest (CHVI) in accordance with *Ontario Heritage Act Regulation 9/06*. The assessment of impacts resulting from the Proposed Expansion is presented in Table 9.8-1. It is noted that there is no standard approach or threshold for assessing construction or traffic vibration impact to historic buildings but work within 60 m of a historic building is generally accepted to require precondition surveys, regular monitoring of the structures for visible signs of vibration damage, and traffic or construction separation (Carman et al., 2012).