

5.5.3.2 *Methods*

A list of SAR which have the potential to occur within the Study Area was compiled based on a review of background information as well as input provided by agency correspondence. Habitat preferences of the listed terrestrial SAR were then compared to on-site habitat characteristics to determine if the Study Area contained potential habitat for SAR. The potential for species to occur was then determined through a probability of occurrence whereby the following rankings were applied:

- Low Probability: suitable habitat for the species is not likely present within the study area;
- Moderate Probability: potentially suitable SAR habitat may be present within the study area;
- High Probability: preferred habitat conditions for SAR are likely present within the study area; and
- Confirmed: species were observed within the Study Area during field investigations.

The SAR screening was refined, where feasible, using the results of the ELC community delineation and taxa specific surveys completed during field investigations

5.5.3.3 *Results and Discussion*

A review of background information and input from agency correspondence identified 76 SAR have the potential to occur within the Study Area. Of these species, 37 species are listed as Endangered, 19 species are listed as Threatened, and 20 species are listed as Special Concern.

Based on the results of the SAR Screening, two SAR have a low probability of occurrence within the Study Area, as suitable habitat conditions are not likely present. Twelve were determined to have a moderate probability of occurrence within the Study Area as potentially suitable habitat was identified during the review of existing conditions. Of these twelve, four SAR have a high potential for occurrence within the Study Area as preferred habitat conditions were identified during the review of existing conditions. Candidate and confirmed SAR within the Study Area are summarized in Table 5.5-7 below.

ENVIRONMENTAL ASSESSMENT OF THE PROPOSED W12A LANDFILL EXPANSION CITY OF LONDON

Table 5.5-7: Potential and Confirmed Species at Risk Within the Study Area

Common Name	ESA Status	Candidate	Confirmed
Bank Swallow	THR	X	
Barn Swallow	THR	X	
Bobolink	THR		X
Eastern Meadowlark	THR		X
Eastern Wood-pewee	SC		X
Little Brown Myotis	END	X	
Eastern Small-footed Myotis	END	X	
Northern Myotis	END	X	
Tri-colored Bat	END	X	
Eastern Ribbonsnake	SC	X	
Snapping Turtle	SC	X	
Monarch	SC		X

Notes:

END – Endangered

THR – Threatened

SC – Special Concern

Six of these species were observed during field investigations. Bobolink and Eastern Meadowlark were confirmed breeding within cultural meadow habitats within the Study Area including the current Landfill property. These species are both listed as Threatened provincially and are afforded protection under the ESA. Therefore, any impacts to this species or its habitat will require further considerations under the ESA. Habitat for these species is delineated on Figure 5.5-6. Although nesting was not observed for Barn Swallow and Bank Swallow, these species were observed foraging within the Study Area during field investigations. Potential suitable habitat for Barn Swallow and Bank Swallow is present within the Study Area; however, as no nests were found in the landfill footprint, direct habitat under the General Habitat Description for each species is considered absent (MNRF 2015a; MNRF 2015b). These species are listed as Threatened provincially. These species, as well as their habitat are afforded protection under the ESA.

Eastern Wood-Pewee and Monarch were also observed within the Study Area during field investigations. These species are listed as Special Concern provincially and are therefore considered SOCC. These species do not receive habitat protection the ESA; however, their habitat is considered SWH, which should be protected in accordance with the Provincial Policy Statement, 2020 (PPS).

5.5.4 Significant Wildlife Habitat Assessment

5.5.4.1 Background

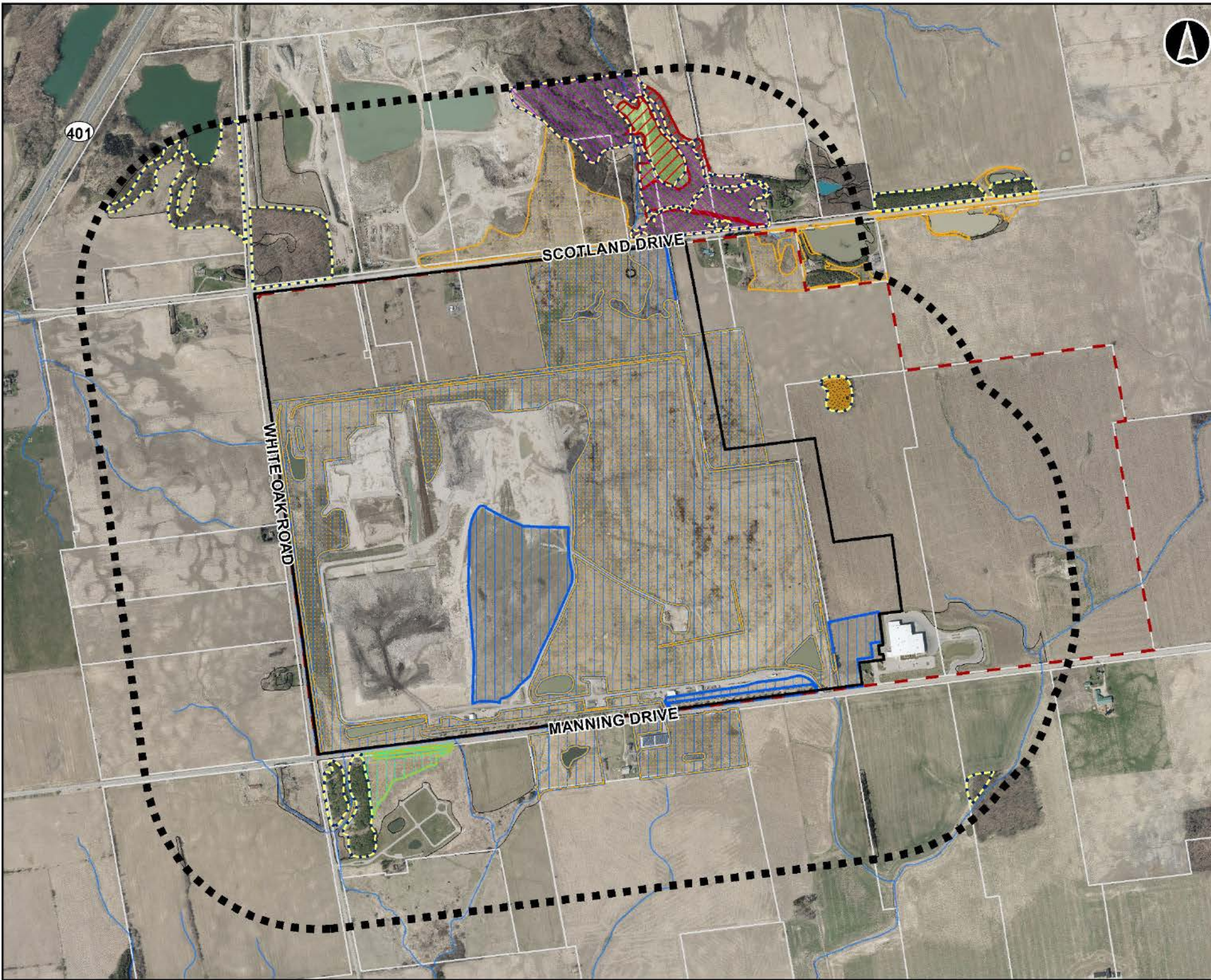
SWH is defined by the NHRM (2010) as “areas where plants, animals and other organisms live, and find adequate amounts of food, water, shelter and space needed to sustain their populations”. This includes areas where species concentrate at a vulnerable point in their life cycle or areas important for migratory species. The Significant Wildlife Habitat Technical Guide (SWHTG) (2000) which supports the NHRM provides detailed information on the identification, description and prioritization of SWH. The SWHTG (2000) divides wildlife habitat into four categories including Seasonal Concentration Areas, Rare Vegetation Communities or Specialized Habitats for Wildlife, Habitat of Species of Conservation Concern and Animal Movement Corridors. Additionally, due to Ontario’s vast size and biodiversity, the OMNRF created draft Ecoregion Criterion Schedules that support the SWHTG and provide significance criteria that are reflective of geographic differences. The Ecoregion criteria schedules provide guidance for SWH designation for the four categories of SWH outlined in the SWHTG and its appendices. The schedules provide information including descriptions of wildlife habitat, wildlife species, and the criteria required to determine SWH.

The following section outlines the methods completed to determine the presence of candidate and/or confirmed SWH within the Study Area.

5.5.4.2 Methods

An SWH screening exercise was completed using the Wildlife Habitat Ecoregion Criteria Schedule (OMNRF 2012) to determine the presence of candidate SWH within the Study Area.

The probability of occurrence of candidate SWH for all four categories was determined by comparing existing conditions determined through aerial photo interpretation and field investigations, to criterion listed in the schedules. A background review was conducted to determine the presence of SOCC within the Study Area. The potential for SWH to occur was determined through a probability of occurrence. Where feasible, the results of field investigations were used to confirm the presence of SWH within the Study Area.



Legend

- Watercourse
- Parcel Fabric
- Site Study Area
- Site-vicinity Study Area
- Waste Management Resource Recovery Area Boundary
- Ecological Land Classification (ELC)

Candidate Significant Wildlife Habitat (SWH)

- Bat Maternity Colonies
- Turtle Overwintering

Confirmed Significant Wildlife Habitat (SWH)

- Terrestrial Crayfish
- Amphibian Breeding Habitat (Woodland)
- Other Rare Vegetation Communities (S1 to S3)
- Monarch – Special Concern and Rare Species
- Eastern Wood Pewee – Special Concern and Rare Species

Species At Risk (SAR) Habitat

- Bobolink
- Bobolink & Eastern Meadowlark
- Bats

0 60 120 240 360 480
Metres

INDIVIDUAL EA OF THE PROPOSED
W12A LANDFILL EXPANSION

Species at Risk and Significant Wildlife
Habitat within the Study Area

August 2021	1:10,500 * when printed 11"x17"	Source: LIO, City of London Datum: NAD 1983 UTM ZONE 17N
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P#: 60556244

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Figure 5.5-6

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5.5.4.3 Results and Discussion

Based on the SWH screening completed for the Study Area, conditions for candidate habitat were not met for 17 habitats. Thirteen habitats had low to moderate probability of occurrence as suitable conditions are not likely present or may be present within the Study Area. Six habitats had a high probability of occurrence within the Study Area including:

- Bat Maternity Colonies;
- Turtle Wintering Areas;
- Colonially-Nesting Bird Breeding Habitat (Trees/Shrubs);
- Amphibian Breeding Habitat (Wetlands);
- Marsh Breeding Bird Habitat; and,
- Special Concern and Rare Wildlife Species.

During field investigations completed in 2018, three SWH were confirmed within the Study Area:

- Amphibian Breeding Habitat (Woodland) was identified within the Silver Swamp Locally Significant Wetland (LSW);
- Terrestrial Crayfish SWH was identified within the Silver Swamp LSW; and Terrestrial Crayfish was confirmed within the cultural thicket habitat in the north of the subject lands; and
- Special Concern and Rare Wildlife Species Habitat for Monarch was identified within cultural meadow throughout the Study Area, while habitat for Eastern Wood-pewee was identified within FOD5-5 Dry-Fresh Sugar Maple – Hickory Deciduous Forest Type north of the subject lands within the potential ESA shown on Figure 5.5-1.

The PPS states that development and site alteration is not permitted in SWH unless it has been demonstrated that there will be no negative impacts on the natural features or their ecological functions.

Two candidate SWHs were also identified within the Study Area during field investigation in 2018. Candidate habitat for Bat Maternity Colonies was identified within deciduous forest (FOD5-5) and cultural thicket (CUT) communities north of the subject lands, the cultural plantation communities northeast (CUP3-2) and southwest (CUP3) of the subject lands, and the deciduous forest (FOD2-3) community within the subject lands. Full bat habitat assessments would be required to confirm the presence of Bat Maternity Colonies. Candidate habitat for Turtle Wintering Areas was identified in the open aquatic (OAO) community within the deciduous forest community (FOD2-4) northeast of the subject lands. Locations of confirmed and candidate SWH are identified on Figure 5.5-6.

5.5.5 Significant Natural Heritage Features and Species

The following section provides a summary of significant features present within the Study Area as identified by federal, provincial and municipal evaluation and ranking systems including the Fisheries Act, the COSEWIC, the MNR, COSSARO, UTRCA, KCCA and the London Plan (2016) and the MNHSS (2014).

5.5.5.1 *Federally Recognized Features and Species*

There are no federally owned lands present within the Study Area. As such, there are no federal implications related to terrestrial SAR. Although several species discussed within this report have been designated Threatened or Endangered on Schedule 1 of the SARA, protection of these species is afforded at the provincial level.

Background data indicate that several water features (e.g., watercourses and waterbodies) support, or are likely to support fish and fish habitat that is regulated under the Fisheries Act. Therefore, future work proposed in or near these features must be assessed for the potential to result in Harmful Alteration, Disruption, or Destruction as defined by the federal Fisheries Act. If proposed work has the potential to cause serious harm, a Request for Review form must be submitted to DFO to determine permitting requirements under the Fisheries Act.

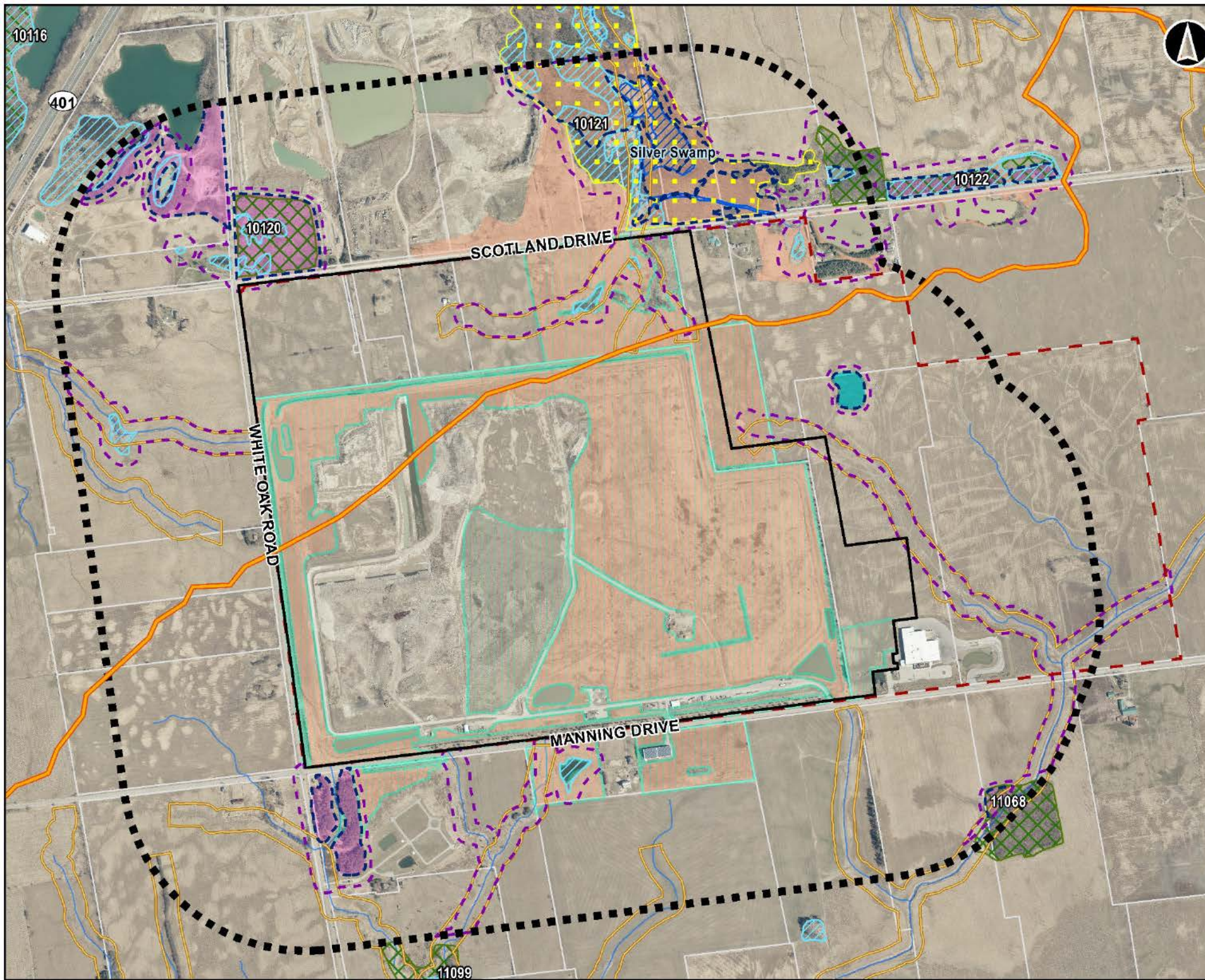
It should be noted, that although there are no federally owned lands present within the Study Area, the MBCA still applies.

5.5.5.2 *Provincially Recognized Features and Species*

Methods employed in the MNHSS (2014) were utilized to identify and delineate natural heritage features within the W12A Landfill Study Area. Using Criteria outlined in Table 9 of the MNHSS (Middlesex County 2014) and criteria outlined in the NHRM (OMNRF 2010), an assessment was completed to identify natural heritage features including Significant Woodlands and SWH. Additionally, field investigations further identified habitat for species listed as Threatened under the ESA. A summary of the provincially recognized features and species that are present or have the potential to occur within the Study Area are described below.

Significant Woodlands – Where woodland cover is between 5% and 15% in the county, all woodlands > 4ha in area should be considered significant (OMNRF 2010). Similarly, where land cover is less than 15%, woodlands with any interior habitat (i.e., 100 m from the edge of the feature) should be considered Significant. Therefore, all woodlands which meet Criteria 5 were designated as Significant Woodlands within the W12A Landfill Study Area. These features include Significant Woodlands as delineated on Map 5 of the London Plan are identified on Figure 5.5-7.

Significant Wildlife Habitat – Three SWH were confirmed within the W12A Landfill Study Area: Terrestrial Crayfish Habitat, Amphibian Breeding Habitat (Woodlands) and Special Concern and Rare Species Habitat. Two species of Special Concern were observed within the Study Area during field investigations: Eastern Wood-pewee within the FOD5-5 community in Patch P02, as well as Monarch which was observed in the multiple cultural meadow communities throughout Patch P02. Terrestrial Crayfish were observed within Silver Swamp and adjacent cultural thicket within Patch P02. Additionally, Patches P01, P03, P04 and P05 have the potential to support SWH such as Bat Maternity Roosting Habitat, Turtle Overwintering Habitat or Habitat for Special Concern and Rare Species. Confirmed and Candidate Significant Wildlife Habitat can be seen on Figure 5.5-6.



Legend

- Watercourse
- Parcel Fabric
- Site Study Area
- Site-vicinity Study Area
- Waste Management Resource Recovery Area Boundary

Natural Heritage Features

11038 Vegetation Patch ID

- Subwatershed Boundary
- Valleyland
- Potential ESA
- Locally Significant Wetland
- Unevaluated Wetland
- Significant Woodland
- Confirmed Species at Risk (SAR) Habitat
- Candidate Species at Risk (SAR) Habitat
- Confirmed Significant Wildlife Habitat (SWH)
- Candidate Significant Wildlife Habitat (SWH)
- Candidate Species at Risk (SAR) Habitat and Confirmed Significant Wildlife Habitat (SWH)
- Preliminary Buffer

0 100 200 300 400 Metres

INDIVIDUAL EA OF THE PROPOSED W12A LANDFILL EXPANSION

Natural Heritage Features and Constraints

August 2021	1:10,000 <small>* when printed 11"x17"</small>	Source: LIO, City of London Datum: NAD 1983 UTM ZONE 17N
PR: 60556244		Figure 5.5-7

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Species at Risk Habitat – Bobolink and Eastern Meadowlark were confirmed breeding within the cultural meadows in Patch P02. These species are listed as Threatened under the Species at Risk in Ontario list. These species and their habitat are therefore afforded protection under the ESA. Although nesting was not observed for Barn Swallow and Bank Swallow, these species were observed foraging within the Study Area during field investigations. Potential suitable habitat for Barn Swallow and Bank Swallow is present within the Study Area; however, as no nests were found in the landfill footprint, direct habitat under the General Habitat Description for each species is considered absent (MNRF 2015a)(MNRF 2015b). Additionally, all wooded habitats provide potential suitable habitat for SAR bat species. Confirmed and Candidate SAR habitat can be seen on Figure 5.5-6.

5.5.5.3 *Municipally Recognized Features and Species*

Provincially recognized features outlined in Section 2.4.2 above are designated as Green Space Place Type within the London Plan and are shown on Map 1 of the London Plan. In addition to these features, the following section summarizes the municipally recognized features identified through a review of Map 5 of the London Plan and field investigations.

- Potential Environmentally Significant Area – The larger, contiguous natural feature located north of Scotland Drive and associated with Silver Swamp has been identified as a potential Environmentally Significant Area.
- Significant Woodlands - in addition to Significant Woodlands identified through desktop analysis, Vegetation Patches #10120, #10122 and #11068 have also been identified as Significant Woodlands as shown on Map 5 of the London Plan.
- Locally Significant Wetland – Silver Swamp LSW is present north of Scotland Drive.
- Unevaluated Wetlands – unevaluated wetlands identified on Map 5 of the London Plan as well as wetland communities identified during field investigations require an evaluation in accordance with the Ontario Wetland Evaluation System (OMNRF 2013).

These features are designated as Environmental Review Place Type on Map 1 of the London Plan and may require further study to determine their level of significance, should additional studies be required in consultation with the City. These features are delineated on Figure 5.5-7.

5.5.5.4 *Natural Heritage Features and Constraints*

Natural Heritage features identified within the Study Area, as shown on Figure 5.5-7, were based on the review of applicable background information, field investigations and desktop analysis based on technical criteria outlined in the MNRF's NHRM (OMNR 2010) and are consistent with policies set out in the PPS Natural Heritage policies (OMMAH 2020), as well as through the London Plan Natural Heritage policies. Natural Heritage features included in the Green Space Place Type and identified within the Study Area include:

- Locally Significant Wetlands – Silver Swamp;
- Significant Woodlands;
- Significant Wildlife Habitat; and
- Species at Risk Habitat.

These natural heritage components pose various degrees of environmental constraint to development, including landfill expansion. Environmental constraints generally refer to areas where development is precluded or limited, based on the significance or sensitivity of the natural heritage features(s) and/or their functions. In some cases, the constraint to development is absolute (no development or site alteration is permitted); in other cases, development may be permitted if it can be demonstrated that the proposed development will not have a significant negative impact on the feature, and or, its functions. In the latter case, permitting with associated mitigation or compensation may be required.

5.5.5.5 *Development Constraints for Natural Heritage Features and Adjacent Lands*

Development within and adjacent to natural heritage features identified within the W12A Landfill Study Area should be consistent with the policies outlined in the London Plan (2016) which adhere to the PPS (2020). The level of protection required for natural heritage features identified within the Study Area includes preliminary buffer requirements and the development distance from a natural feature that would trigger an Environmental Impact Study (EIS) as outlined in the London Plan and its associate Environmental Management Guidelines. As it is not common practice for a municipality to complete an EIS for a landfill or landfill expansion, the City will determine whether an EIS will be required further to the completion of the EA. Additional details on these development constraints are provided in Volume IV Appendix D.05.

Natural heritage features identified as part of the Green Space Place Type, through background review and field investigations are delineated on Figure 5.5-7. Recommended preliminary buffers are based on standard practices for each natural heritage feature.

Natural heritage features which are included in the Environmental Review Place Type designation and that are found within the Study Area include unevaluated wetlands, valleylands and Potential Environmental Significant Areas.

These features designations are considered to be interim in nature until the significance of these patches can be confirmed through further investigations and the application of evaluation criteria. Some of these unevaluated features could not be evaluated due to lack of property access. Nevertheless, these features are well outside of the proposed expansion area and will not be affected by the proposed expansion. Evaluation of these patches is, therefore, not required.

5.6 Land Use

This section of the EASR provides a summary of existing land use in the area within which the W12A Landfill property is located and surrounding lands. The determination of the existing land use was carried out as described in the approved Amended ToR (Volume II). The report providing additional details on the existing land use and planning environment is contained in Volume IV Appendix D.06.

The following summarizes the land uses surrounding the existing W12A Landfill within the Site Study Area and Site-vicinity Study Area. For the purposes of describing land use and subsequently for impact assessment, the Site-vicinity Study Area includes an area with a radius of 500 m around the Site Study Area. The Site Study Area encompasses the existing

ENVIRONMENTAL ASSESSMENT OF THE PROPOSED W12A LANDFILL EXPANSION CITY OF LONDON

W12A Landfill site and adjacent lands potentially required for the proposed landfill expansion (refer to Figure 5.6-1). The Site Area refers to the lands that will comprise the expanded landfill.

Based on analysis of aerial photography and site visit observations, the general character of the Site Area and Site-vicinity Study Area has been defined to inform this land use assessment. Figure 5.6-1 illustrates the general land uses in the vicinity of the W12A Landfill site

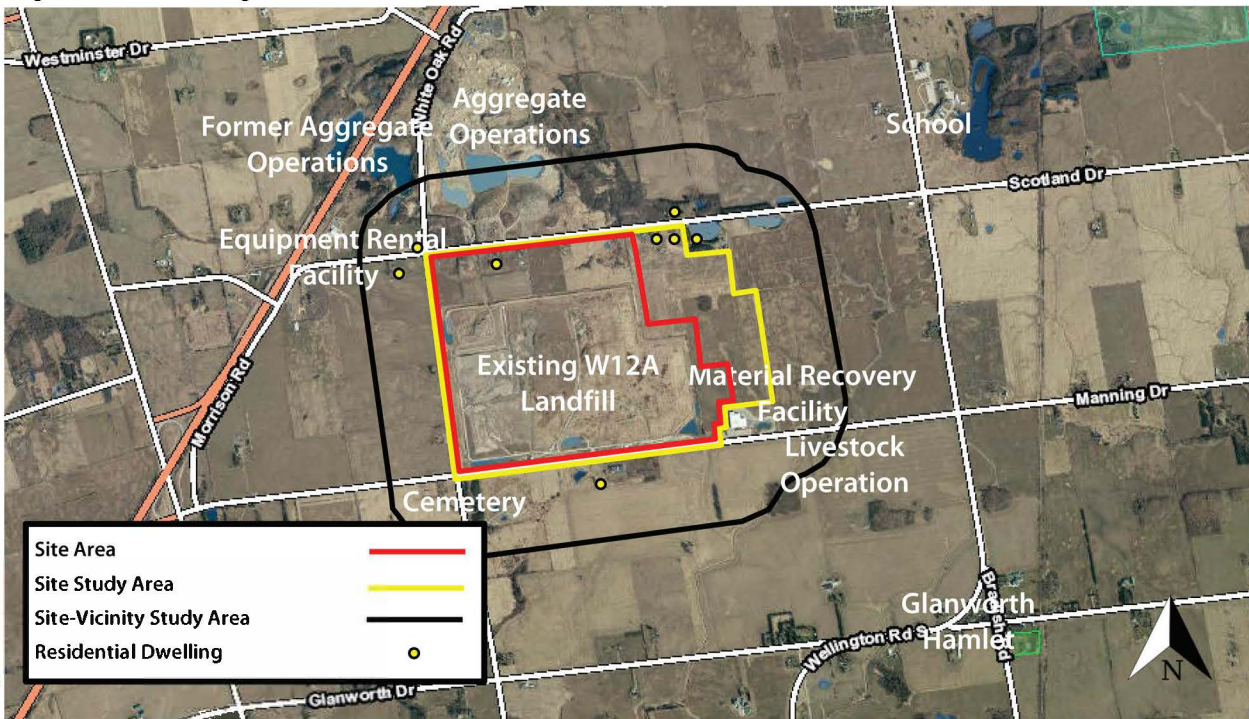
The following provides a characterization of land uses in the vicinity of the existing W12A Landfill site:

North: A portion of the land base between the existing landfill berm and Scotland Drive is actively cultivated for cash crop production (soybeans). The remaining lands are considered fallow with hilly topography observed between the berm and Scotland Drive. These lands do not appear to have been used for agricultural production. Westcliff Pit, operated by AAROC Aggregates, and the Bre-Ex Gravel Pit, operated by Brekelmens Holdings, are located on the north side of Scotland Drive (gravel pit). Soybean and corn production were also observed on the north side of Scotland Drive. Further, storage for non-agricultural activities was visible at 3405 Scotland Drive, and rural residential dwellings are located at that property, as well as 3465, 3561, and 3801 Scotland Drive. The property at 3405 Scotland Drive includes a large pond; the property at 3465 Scotland Drive includes a demolished barn.

East: Lands east of the proposed landfill expansion are under active cultivation for conventional cash crop production (corn, soybeans, wheat rotation). There is a vacant industrial storage building at the intersection of Scotland Drive and Wellington Road South. In terms of crops, typical cash crops (corn and soybeans) are found along Wellington Road South. A rural residential dwelling at 5751 Wellington Road South shows evidence of a previous farmstead (bank barn foundation and roofless silo). Rural residential dwellings are also located at 5595, 5615 and 5751 Wellington Road South.

South: A livestock operation (beef) is located at 3243 Manning Drive, approximately 400 m southeast of the MRF, which is situated at 3438 Manning Drive. The house on the property is vacant. Large agricultural parcels were in conventional cash crop production (corn). There is also an agricultural operation located at 3691 Manning Drive, which includes a large driving shed with solar panels, a bank barn, roofless silo and rural residential dwelling surrounded by cash crop production (corn). Livestock was not visible at this location. The Islamic Cemetery of London (6100 White Oak Road) is also located south of the existing landfill.

Figure 5.6-1 Existing Land Use



Source: City of London Maps, 2020

West: There is a dilapidated barn/storage building located at 4025 Manning Drive. Large agricultural parcels were in cash crop production (soybeans). There is evidence of a farmstead at 5861 White Oak Road (treeline, foundation of buildings). There is also an existing farmstead at 4067 Scotland Drive, which includes a small barn, Quonset hut, ancillary structures and a rural residential dwelling. This property appears to be used for storage rather than active agricultural production. A rural residential dwelling is located at 5435 White Oak Road with evidence of a previous farmstead (stand-alone silo, barn foundation).

In general, the lands surrounding the W12A Landfill within the Site Area and Site-vicinity Study Area are characterized by a mix of agricultural uses, with some rural residential uses. 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. With respect to other sensitive land uses, the Islamic Cemetery of London is located to the south of the landfill, as noted above. A large aggregate extraction operation is also located to the north of the Site Area (north of Scotland Drive). Additionally, there is a variety of natural heritage and open space areas dispersed throughout the Site-vicinity Study Area (e.g., drainage corridors, woodlots).

The W12A Landfill is designated “Agricultural” in the City’s Official Plan (1989). The area surrounding the Landfill is designated “Agricultural” with some areas identified as “Open Space” and “Environmental Review”. 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’ and Section 17.4 ‘Operating and Closed Landfill Sites’ of this Official Plan. Section 9.2.15 specifically pertains to the Waste Management Resource Recovery Area that encompasses the W12A Landfill site and the lands generally located within the block bounded by Wellington Road South, Manning Drive, White Oak Road and Scotland Drive. In accordance with Section 9.2.15.1, properties addressed as 3137 and 3405 Scotland Drive and 5529, 5595, 5615, 5751 and 5879 Wellington Road South, which are located within this City block, do not form part of this specific policy area. Section 9.2.15.2 addresses the planned function of the W12A Landfill and the adjacent MRF site:

“The City of London recognizes the importance of the existing W12A landfill and the suitability of the existing location to minimize environmental and social impact while providing the important economic function of waste management. The adjacent site is also a suitable location for landfill expansion and the development of an integrated Resource Recovery Centre for municipally managed waste reduction, waste disposal, waste diversion and waste processing, using principles of sustainability which are socially, environmentally and fiscally responsible.”

Further, this Section identifies a set of objectives for the use of land within the Waste Management and Resource Recovery Area. 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

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disposal facilities, as well as other waste disposal facilities such as material recovery facilities, yard waste composting facilities, and source separated organic composting facilities.

In addition to the policy direction provided in Section 9.2.15, Sections 17.4 and 17.5 provide additional policies relating to operational landfills and other waste management facilities, respectively. Section 17.4.3 is of particular relevance; this policy sets out criteria for development in proximity of the existing landfill:

“Notwithstanding the land uses designated on Schedule “A” of this Plan and any associated policies, future development will not be permitted on or in the vicinity of operating landfill sites, closed landfill sites and other sites which produce gases similar to those found in landfill areas, 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.” (emphasis added).

The W12A Landfill is designated “Waste Management Resource Recovery Area” in the City’s new Official Plan, called The London Plan (2016). 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. The area surrounding the Landfill is mostly designated “Farmland” with some areas identified as “Green Space” and “Environmental Review”.

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

- 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 place type:

- 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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Similar to the 1989 Official Plan, The London Plan also contains a number of policies to guide land use and development within and within 1,500 m of the vicinity of the Waste Management Recourse Recovery Area place type.

The W12A Landfill is zoned “Waste and Resource Management (WRM) Zone 1”. This zoning permits the waste management facility that currently operates on the site, as well as the MRF adjacent to the east side of the landfill. Neighbouring properties (within 1 km) are zoned as described below. A zoning map is provided on Figure 5.6-2. Other zoning in the Site-vicinity Study Area includes:

- Agricultural (AG) Zone, which permits a variety of agricultural uses including livestock facilities, forestry uses, farm market, greenhouse farm, nursery, conservation lands, aquaculture, manure storage facility, mushroom farm, compost facility, among others;
- Environmental Review (ER) Zone, which permits conservation lands and works, passive recreational uses, managed woodlot, and agricultural uses;
- Open Space (OS) 3, which permits cemeteries; and,
- Resource Extraction (EX) Zone, which permits resource extraction operations, farms, wayside pits and forestry uses.

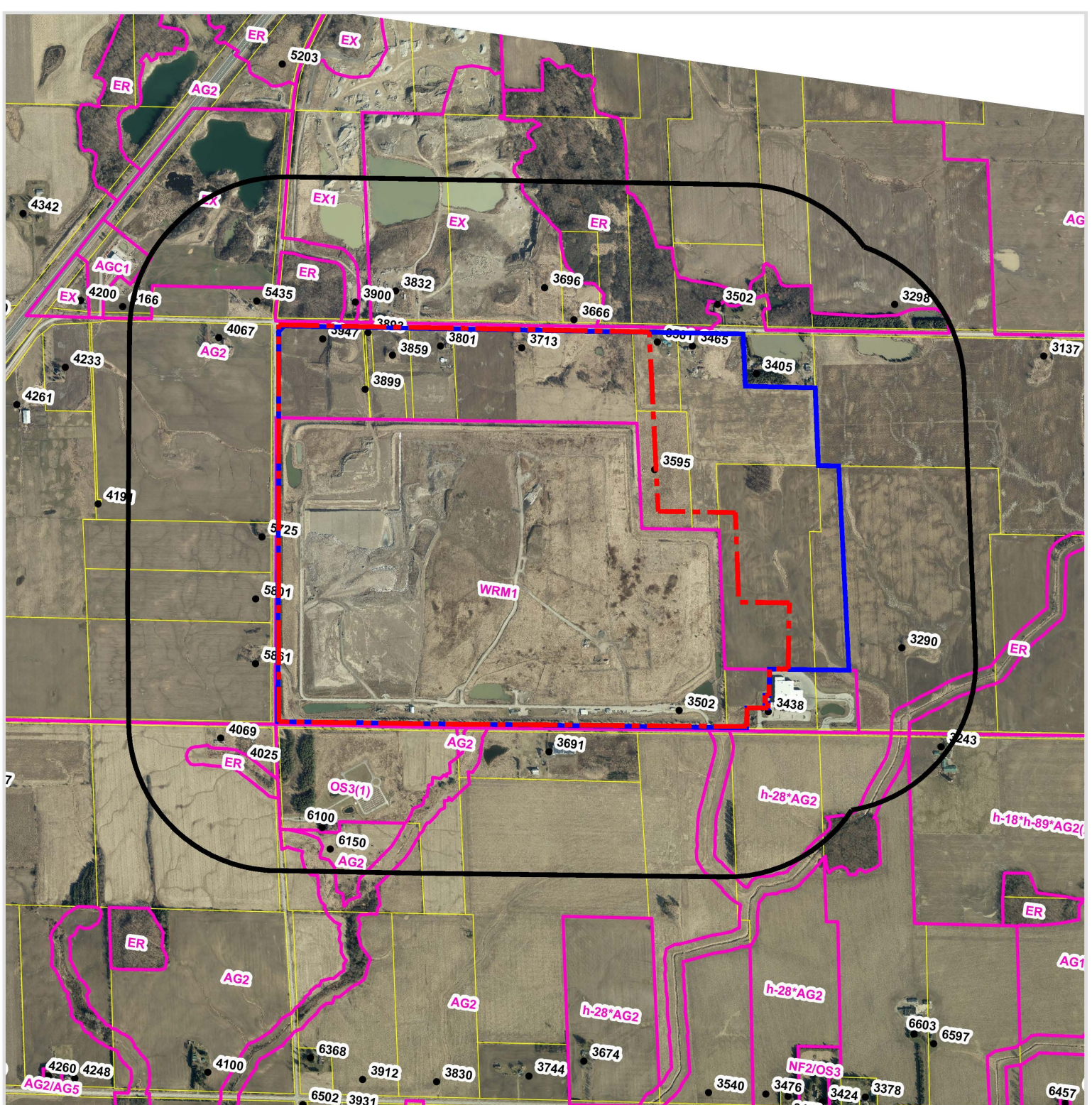


Figure 5.6-2:
Zoning Map
City of London

Legend

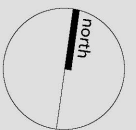
- Site Area
- Site Study Area
- Site-Vicinity Study Area
- Parcel Fabric
- Zoning

DATE: Dec. 3, 2020

SCALE: 1:18,000

FILE: 08227L

DRN: JB



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5.7 Agriculture

This section of the EASR provides a summary of the existing agricultural setting within which the W12A Landfill property is located and surrounding lands. The determination of the existing agricultural conditions was carried out as described in the approved Amended ToR (Volume II). The report providing additional details on the existing agricultural environment is contained in Volume IV Appendix D.07.

The following summarizes the land uses surrounding the existing W12A Landfill within the Site Study Area and Site-vicinity Study Area. For the purposes of describing land use and subsequently for impact assessment, the Site-vicinity Study Area includes an area with a radius of 500 m around the Site Study Area. The Site Study Area encompasses the existing W12A Landfill site and adjacent lands potentially required for the proposed landfill expansion (refer to Figure 5.7-1). The Site Area refers to the lands that will comprise the expanded landfill.

5.7.1 Agricultural Setting

Based on a field survey undertaken by vehicle (i.e., “windshield survey”) on October 8, 2019, an examination of aerial imagery, and discussions with the City, the characterization of the agricultural uses surrounding the existing W12A Landfill within the Site-vicinity Study Area is described as follows, and is illustrated on Figure 5.7-1:

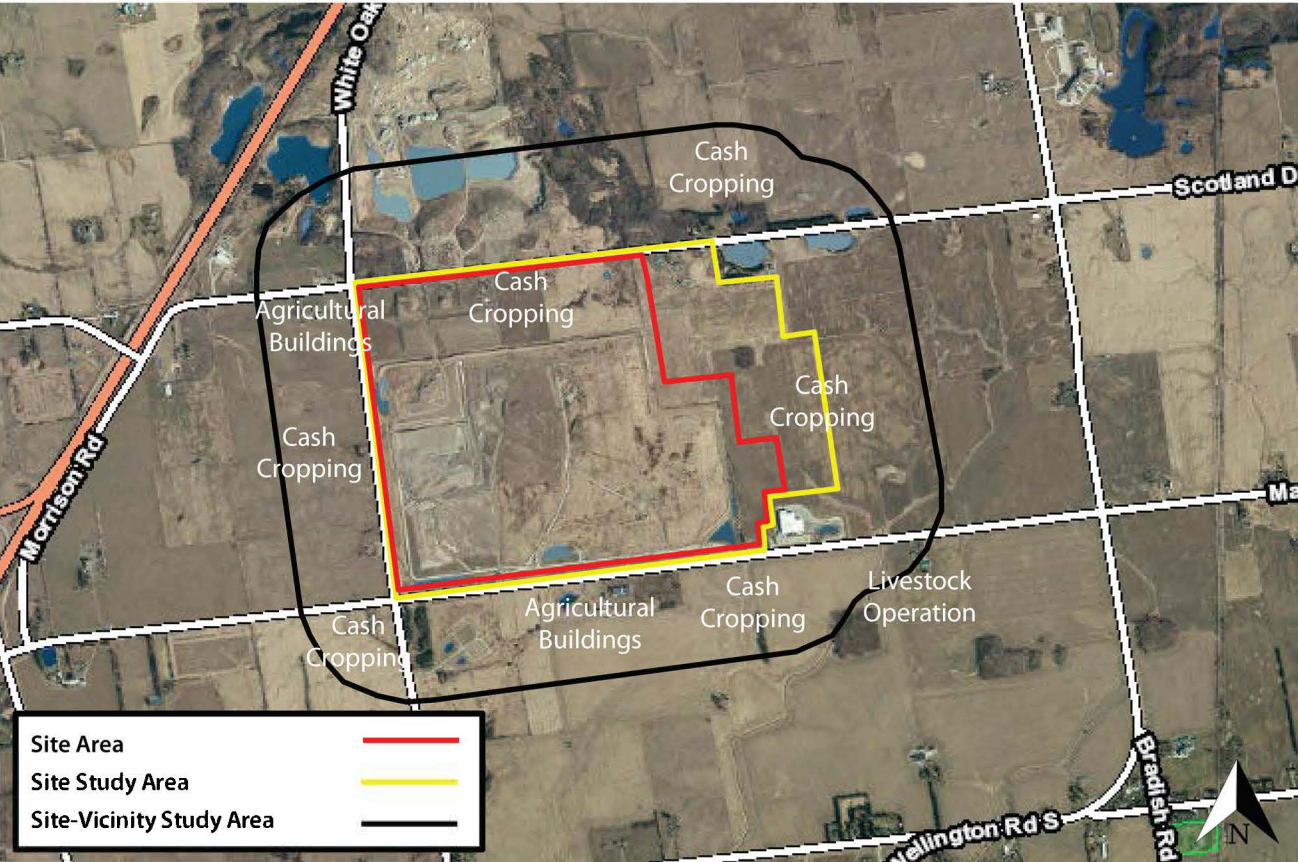
North: A portion of the land base between the existing landfill berm and Scotland Drive is actively cultivated for cash crop production (soybeans). The remaining lands are considered fallow with hilly topography observed between the berm and Scotland Drive. These lands do not appear to have been used for agricultural production. Soybean and corn production were also observed on the north side of Scotland Drive. The property at 3465 Scotland Drive includes a demolished barn.

East: Lands east of the proposed landfill expansion are under active cultivation for conventional cash crop production (corn, soybeans, wheat rotation). In terms of crops, typical cash crops (corn and soybeans) are found along Wellington Road South. A rural residential dwelling at 5751 Wellington Road South shows evidence of a previous farmstead (bank barn foundation and roofless silo).

South: A livestock operation (beef) is located at 3243 Manning Drive, approximately 400 m southeast of the MRF, which is situated at 3438 Manning Drive. Large agricultural parcels were in conventional cash crop production (corn). There is also an agricultural operation located at 3691 Manning Drive, which includes a large driving shed with solar panels, a bank barn, roofless silo and rural residential dwelling surrounded by cash crop production (corn). Livestock was not visible at this location.

West: There is a dilapidated barn/storage building located at 4025 Manning Drive. Large agricultural parcels were in cash crop production (soybeans). There is evidence of a farmstead at 5861 White Oak Road (treeline, foundation of buildings). There is also an existing farmstead at 4067 Scotland Drive, which includes a small barn, Quonset hut, ancillary structures and a rural residential dwelling. This property appears to be used for storage rather than active agricultural production. A rural residential dwelling is located at 5435 White Oak Road with evidence of a previous farmstead (stand-alone silo, barn foundation).

Figure 5.7-1: Existing Agricultural Setting



Source: City of London Maps, 2020

In summary, the Site-vicinity Study Area is largely comprised of conventional agricultural production (e.g., cash crop production, livestock operations). A review of census of agriculture data (2016) confirms that the characterization of the Site-vicinity Study Area is consistent with regional and provincial agricultural production practices, as nearly half (47%) of recorded farms are oilseed and grain operations.

5.7.2 Provincial Policy Statement

The following summarizes Ontario's policy framework from an agricultural perspective. The Provincial Policy Statement (PPS) (MMAH 2020) defines prime agricultural areas as:

"areas where prime agricultural lands predominate. This includes areas of prime agricultural lands in associated Canada Land Inventory Class 4 through 7 Lands, and additional areas where there is a local concentration of farms which exhibit characteristics of ongoing agriculture. Prime agricultural areas may be identified by the Ontario Ministry of Agriculture and Food using guidelines developed by the Province as amended from time to time. A prime agricultural area may also be identified through an alternative agricultural land evaluation system approved by the Province."

Further, the PPS defines prime agricultural land as:

"specialty crop areas and / or Canada Land Inventory Class 1, 2 and 3 lands, as amended from time to time, in this order of priority for protection."

A review of the Site-vicinity Study Area's soil capability confirms that surrounding agricultural lands are identified as prime agricultural lands, comprised predominantly of class 2 and 3 soils. Class 5 and unclassified soils are also identified within the southern and northern portions of the Site-vicinity Study Area, respectively (refer to Soil Mapping provided in Volume IV Appendix D.07).

The PPS defines specialty crop areas as:

"areas designated using guidelines developed by the province, as amended from time to time. In these areas, specialty crops are the predominantly grown, such as tender fruits (peaches, cherries, and plums), grapes, other fruit crops, vegetable crops, greenhouse crops, and crops from agriculturally developed organic soil, usually resulting from:

- a) Soils that have suitability to produce specialty crops, or lands that are subject to special climatic conditions, or a combination of both;
- b) Farmers skilled in the production of specialty crops; and,
- c) A long-term investment of capital in areas such as crops, drainage, infrastructure and related facilities and services to produce, store, or process specialty crops."

The Site Area and Site-vicinity Study Area have not been identified or designated as a specialty crop area by the province or the municipality and do not exhibit characteristics of a specialty crop production as defined by the PPS.

Section 2.3.3.3 of the PPS states that new land uses shall comply with the Minimum Distance Separation (MDS) formulae developed by the province. These setbacks are used to separate uses to reduce incompatibility concerns about odour from livestock facilities. However, Guideline No. 3 of the Province's guidelines (Publication No. 853) (Ontario 2020) confirms that minimum distance separation setbacks are not required for landfills.

5.8 Archaeology

This section of the EASR provides a summary of the existing archaeological resource conditions surrounding the W12A Landfill site. The following section provides a summary of the regional and site history, followed by a description of the site's archaeological environment. The information presented in this section has been compiled from more detailed information contained in Volume IV Appendix D.08.

5.8.1 Existing Conditions

5.8.1.1 *Regional and Pre-European Indigenous Occupation*

Human occupation of the London area, known as the Paleo Period, dates back 11,000 years, when this area was inhabited by Indigenous groups that had been living south of the Great Lakes.

The current understanding of Early Paleo settlement patterns suggests that small bands, which consisted of probably no more than 25 to 35 individuals, followed a pattern of seasonal mobility extending over large territories. Given their placement in locations conducive to the interception of migratory mammals such as caribou, it has been suggested that they may represent communal hunting camps. There are also smaller Early Paleo camps scattered throughout the interior of southwestern Ontario, usually situated adjacent to wetlands.

Within the limits of London there are at least four known Early Paleo sites, of which three are isolated find spots of the distinctive fluted points or channel flakes. One site, located near Dingman Creek, appears to represent a possible occupation area with the potential for contributing to our knowledge of this period (Keron 1979 and 2016; Golder 2017). To date, all of the known Early Paleo sites in Middlesex are located south of the Main and South branches of the Thames River.

During the succeeding Early Archaic Period (8000-6000 BC), the jack and red pine forests that characterized the Late Paleo environment were replaced by forests dominated by white pine with some associated deciduous trees (Ellis, Kenyon and Spence 1990:68-69). Notable technological changes during this period include the appearance of side- and corner-notched projectile points not found during the previous Paleo times, and the introduction of ground stone tools such as celts and axes, which suggest woodworking was increasing in importance. In addition to the introduction of new tools, there may have been some reduction in the degree of seasonal movement of groups, although it is still suspected that population densities were quite low, and band territories large.

During the Middle Archaic Period (6000-2500 BC) the trend towards more diverse toolkits continued, as the presence of net-sinkers and fishing weirs suggest that fishing was becoming an important aspect of the subsistence economy. It was also at this time that

"bannerstones" were first manufactured. Bannerstones are carefully crafted ground stone devices that may have served as a counterbalance for "atlatls" or spear-throwers. However, during the Middle Archaic, groups inhabited smaller territories that often did not encompass a source of high-quality raw material. In these instances, it appears that lower quality materials that had been deposited by the glaciers in the local till and river gravels were utilized more regularly. The apparent reduction in territory size may be linked to gradual region-wide population growth which led to the infilling of the landscape and a reorganization of

During the Late Archaic (2500-950 BC) the trend towards decreased territory size and a broadening subsistence base continued. Late Archaic sites are far more numerous than either Early or Middle Archaic sites, and it seems that the local population had expanded. It is during the Late Archaic that the first true cemeteries appear. These cemeteries are often located on heights of well-drained sandy/gravel soils adjacent to major watercourses such as the Thames River.

This suggestion of increased territoriality is also consistent with the regionalized variation present in Late Archaic projectile point styles. It was during the Late Archaic that distinct local styles of projectile points appear. Also, during the Late Archaic the trade networks that had been established during the Middle Archaic continued to flourish. Native copper from northern Ontario and marine shell artifacts from as far away as the Mid-Atlantic coast are frequently encountered as grave goods. Other artifacts such as polished stone pipes and banded slate gorgets also appear on Late Archaic sites. One of the more unusual and interesting of the Late Archaic artifacts is the "birdstone". Birdstones are small, bird-like effigies usually manufactured from green banded slate. While the function of these artifacts is presently poorly understood, they are especially common in the London area.

The Early Woodland Period (950 – 400 BC) is distinguished from the Late Archaic Period primarily by the addition of ceramic technology. While the introduction of pottery provides a useful demarcation point for archaeologists, it may have made less difference in the lives of the Early Woodland peoples.

The trade networks, which were established in the Middle and Late Archaic, also continued to function, although there does not appear to have been as much traffic in marine shells during the Early Woodland Period. During the last 200 years of the Early Woodland Period, projectile points manufactured from high quality raw materials from the American Midwest begin to appear on sites in the London area.

In terms of settlement and subsistence patterns, the Middle Woodland (400 BC – 900 AD) provides a major point of departure from the Archaic and Early Woodland Periods. While Middle Woodland peoples still relied on hunting and gathering to meet their subsistence requirements, fish became an even more important part of the diet.

It is also at the beginning of the Middle Woodland Period that rich, densely occupied sites appear on the valley floor of major rivers. While the valley floors of floodplains had been utilized by earlier peoples, Middle Woodland sites are significantly different in that the same location was repeatedly occupied over several hundred years. Because this is the case, rich deposits of artifacts often accumulated.

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The Late Woodland Period began with a shift in settlement and subsistence patterns involving an increasing reliance on corn horticulture (Fox 1990:185; Smith 1990; Williamson 1990:312). Corn may have been introduced into southwestern Ontario from the American Midwest as early as 600 AD. However, it did not become a dietary staple until at least three to four hundred years later.

The first agricultural villages in southwestern Ontario date to the 10th century AD. Unlike the riverine base camps of the Middle Woodland Period, these sites are located in the uplands, on well-drained sandy soils. Categorized as "Early Ontario Iroquoian" (900 – 1300 AD), many archaeologists believe that it is possible to trace a direct line from the Iroquoian groups that inhabited southwestern Ontario at the time of first European contact, to these early villagers.

Village sites, dating between 900 and 1300 AD, share many attributes with the historically reported Iroquoian sites, including the presence of longhouses and sometimes palisades. However, these early longhouses were actually not all that large, averaging only 12.4 m in length (Dodd et al 1990:349; Williamson 1990:304-305).

Judging by the presence of carbonized corn kernels and cob fragments recovered from sub-floor storage pits, agriculture was becoming a vital part of the Early Ontario Iroquoian economy. However, it had not reached the level of importance it would in the Middle and Late Ontario Iroquoian Periods. There is ample evidence to suggest that more traditional resources continued to be exploited and comprised a large part of the subsistence economy. Seasonally occupied special purpose sites relating to deer procurement, nut collection, and fishing activities, have all been identified. While beans are known to have been cultivated later in the Late Woodland Period, they have yet to be identified on Early Ontario Iroquoian sites.

The Middle Ontario Iroquoian Period (1300 – 1400 AD) witnessed several interesting developments in terms of settlement patterns and artifact assemblages. Changes in ceramic styles have been carefully documented, allowing the placement of sites in the first or second half of this 100-year period. Moreover, villages, which averaged approximately 0.6 ha in extent during the Early Ontario Iroquoian Period, now consistently range between one and two hectares.

The lay-out of houses within villages also changes dramatically by 1300 AD. During the Early Ontario Iroquoian Period, villages were haphazardly planned at best, with houses oriented in various directions. During the Middle Ontario Iroquoian Period, villages were organized into two or more discrete groups of tightly spaced, parallel aligned, longhouses.

Initially at least, the Late Ontario Iroquoian Period (1400 – 1650 AD) continues many of the trends that have been documented for the preceding century. For instance, between 1400 and 1450 AD house lengths continued to grow, reaching an average length of 62 m. One longhouse excavated on a site southwest of Kitchener stretched an incredible 123 m (Lennox and Fitzgerald 1990:444-445). After 1450 AD, house lengths began to decrease, with houses dating between 1500 – 1580 AD averaging only 30 m in length.

Village size also continued to expand throughout the Late Ontario Iroquoian Period, with many of the larger villages showing signs of periodic expansions. The Late Middle Ontario

Iroquoian Period and the first century of the Late Ontario Iroquoian Period was a time of village amalgamation. Late Ontario Iroquoian village expansion has been clearly documented in the London area. The ongoing excavations at the Lawson site, a large Late Iroquoian village located on the grounds of the Museum of Ontario Archaeology, has shown that the original village had expanded by at least twenty percent to accommodate the construction of nine additional longhouses (Anderson 2009).

The Ontario Iroquoian and Western Basin are two archaeological traditions that characterize pre-contact Indigenous Communities living in the Middlesex County area of southwestern Ontario from about AD 500 to 1650. Peoples of the Western Basin Tradition lived throughout the southwestern-most portion of the province, from the present-day Sarnia/Windsor area to about London. Iroquoian peoples, on the other hand, appear to have lived from the present-day Chatham area east to Toronto. Each of these traditions are divided into distinct temporal phases defined by material cultural attributes, and settlement and subsistence patterns that exhibit a shift towards larger and more permanent villages due to an increasing reliance on cultivated plants such as corn, beans, squash, sunflower, and tobacco (Dodd et al. 1990; Foreman 2011; Fox 1990; Lennox and Fitzgerald 1990; Murphy and Ferris 1990).

After 1525 AD, communities of pre-contact Indigenous peoples of the Late Ontario Iroquoian Period who had formerly lived throughout southwestern Ontario as far west as the Chatham area moved further east to the Hamilton area. During the late 1600s and early 1700s, the French explorers and missionaries reported a large population of Iroquoian peoples clustered around the western end of Lake Ontario. They called these people the "Neutral", because they were not involved in the ongoing wars between the Huron and the League Iroquois located in upper New York State.

5.8.1.2 Regional Post-Contact Indigenous Period

The post-contact Indigenous occupation of southern Ontario was heavily influenced by the dispersal of various Iroquoian-speaking peoples, such as the Huron and closely related Petun, by the New York State Iroquois and the subsequent arrival of Algonkian-speaking groups from northern Ontario at the end of the 17th century and beginning of the 18th century (Schmalz 1991).

The nature of their settlement size, population distribution, and material culture shifted as European settlers encroached upon their territory. However, despite this shift, "written accounts of material life and livelihood, the correlation of historically recorded villages to their archaeological manifestations, and the similarities of those sites to more ancient sites have revealed an antiquity to documented cultural expressions that confirms a deep historical continuity to Iroquoian systems of ideology and thought" (Ferris 2009:114). First Nation peoples of Southern Ontario have left behind archaeologically significant resources throughout Southern Ontario that show continuity with past peoples, even if they have not been recorded in historical Euro-Canadian documentation.

Portions of southwestern Ontario were also occupied by Algonkian-speaking groups who also exhibited cultural influence from Iroquoian-speaking groups, both before and after European contact. Generally, the pre-contact Indigenous presence in much of southern Ontario reflects occupation by northern Iroquoian speakers. During and following the Iroquois Wars of the mid-17th century and the dispersal of the Iroquoian-speaking Huron-Petun and Neutral, a

considerable reduction in the extent of territory occupied by Algonkian speakers occurred in southern Ontario. Beginning about 1690, northern Algonkian speakers from northern Ontario began to move southwards and southern Iroquoian speakers began to push southern Algonkian speakers further west (Ferris 2009; Schmalz 1991).

5.8.1.3 Post Contact Euro-Canadian Occupation

Middlesex County

Following the Toronto Purchase of 1787, today's southern Ontario was within the old Province of Quebec and divided into four political districts: Lunenburg, Mecklenburg, Nassau, and Hesse. These became part of the Province of Upper Canada in 1791, and renamed the Eastern, Midland, Home, and Western Districts, respectively. The Site Area was within the former Hesse District, then later the Western District, which originally included all lands west of an arbitrary line running north from the end of Long Point on Lake Erie to the southernmost point of Georgian Bay. Each district was further subdivided into counties and townships.

Official interest in the area dates to 1792 and 1793, when Lieutenant-Governor for Upper Canada John Graves Simcoe and his wife Elizabeth visited the Forks of the Thames during an overland journey from Niagara to Detroit and back (Macleod 1972:155). For Simcoe, the area was naturally strategic and an administrative centre for the colony; equidistant from Detroit and Niagara and well inland from the hostile US border, it could support nearby naval bases on three of the Great Lakes and be easily defended in the event of American attack (Macleod 1972:156). He subsequently ordered the lands of the Thames River basin be surveyed for European habitation and with the Chippewa Nation negotiated a land surrender called London Township Treaty No. 6.

Two years later, London District was formed from parts of the Home and Western Districts, with the district town established at what is now Turkey Point and Middlesex County formed from Suffolk County.

In 1801, Simcoe's former private secretary Colonel Thomas Talbot sold his commission to promote British settlement of the area, and hired surveyor Colonel Mahlon Burwell, who began his work in 1810 (Brunger 2019; Gentilcore and Donkin 1973). Both the surveys and settlement would be disrupted by the War of 1812, which came to the London area in 1813. After advancing up the Thames, American forces faced a combined British regular, militia, and First Nation force at Moraviantown, near Chatham. In the ensuing Battle of the Thames, the widely respected Shawnee leader Tecumseh was killed, and the British force was routed (Troughton and Quinlan 2009:43-44). During the 1814 campaign season, the Americans again met the British on the Thames, and the latter were again defeated at a skirmish on the Longwoods Road, also known as "Battle Hill" (Troughton and Quinlan 2009:44).

After the war, settlers began arriving in Middlesex County in numbers, concentrating first in Delaware Township, before spreading into Westminster Township and London Township.

Westminster Township

The first land patents for Westminster Township were issued as early as 1812, shortly after the initial surveys in 1809 and 1810 (Brock and Moon 1972). Settlement began in the southwest corner of the township along North Branch of the Talbot Road and followed by later settlements along Commissioners Road, with the southeast portion of the township being settled last. The township by 1817 had 107 houses and 428 people, including two schoolhouses, one grist mill and one sawmill (Brock and Moon 1972: 566). In 1842, the township now contained four grist and two sawmills while the population had grown to 3,376 (Smith 1846), while at mid-century the population was 4,525 residents with three grist mills, two carding machines, and a fulling mill (Brock and Moon 1972:566).

The London and Port Stanley Railway line, which runs north-south through the township, was fully operational by 1856 (Brock and Moon 1972: 566). Several small hamlets also developed within the township, including Byron, Lambeth, Hall Mills, Pond Mills, and Glanworth; these communities were settled over the course of the 19th century (Brock and Moon 1972: 577-581).

The growing City, however, would soon expand into the township. London South in Westminster Township was annexed by the City in 1890, and in 1961 a large portion of the township was annexed. In 1988 the Town of Westminster was established in an attempt to remain autonomous from London, but it too was annexed on January 1, 1993 (Tourism London 2019; Meligrana 2000).

5.8.2 Archaeological Potential

An archaeological assessment was completed to identify known archaeological resources on and in the Site Study Area as well as assess the archaeological potential of the site. The evaluation consisted of background historical research and site visits. Historical studies and studies completed for the EA are summarized below.

In 2005, Archaeologix Inc. conducted a Stage 1 Archaeological Assessment and built heritage assessment of a 397 ha area of study from Scotland Drive to Manning Drive between White Oak Road and Wellington Road. This Stage 1 assessment, which included the current Site Study Area, determined areas within the area of study to have archaeological potential and recommended that those areas be subject to Stage 2 archaeological assessment should they be developed (Archaeologix 2005). One of the properties examined from a built heritage perspective, 3713 Scotland Drive, falls within the current Site Study Area. This was a one-and-a-half storey frame house built around 1895. It was determined in the Stage 1 to have lost most of its historical detail through renovations and lacks significant historical associations (Archaeologix 2005). Based on aerial imagery, this house was demolished in 2017.

In 2010, Golder conducted a Stage 1 and 2 Archaeological Assessment for a 12-acre property located at 3438 and 3290 Manning Drive for a proposed regional materials recovery facility. This Stage 2 assessment consisted of pedestrian survey and did not identify any archaeological sites (Golder 2010).

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In 2018, Golder conducted a Stage 1 and 2 Archaeological Assessment for a 30-ha portion of the City's W12A Landfill site located at 3502 Manning Drive, within part of Lot 20, Concession 6. The study area for this Stage 1-2 assessment included two proposed cells (Cells 9 and 10) in the northwest corner of the landfill for future waste disposal, as well as a proposed laydown area to be used to temporarily stockpile soil during cell construction immediately north of the W12A Landfill, which overlaps with the current Site Study Area. The Stage 1 background study determined that portions of the Site Study Area had archaeological potential and, as such, would require Stage 2 Archaeological Assessment to identify archaeological sites that may be present. The Stage 2 assessment involved a combination of pedestrian survey at 5 m intervals and shovel test pit survey at 5 m intervals, and resulted in the identification of seven archaeological locations, six of which, Locations 1-6, lie in the current Site Study Area (Golder 2018a). The findings from each of the six locations are presented below.

Location 1 (AfHh-928) consisted of one Late Archaic Innes projectile point and one piece of lithic debitage. The isolated nature of these artifacts suggests they are related to transient use of the area by Indigenous peoples that occurred during the Late Archaic Period. Given the isolated and non-diagnostic nature of the finds, Location 1 (AfHh-928) is concluded to have no further CHVI and has been sufficiently documented. No further archaeological assessment is required.

Location 2 consisted of four pieces of lithic debitage, while Locations 3, 5, and 6 are each represented by a single chert flake. The isolated nature of these artifacts suggests they are related to transient use of the area by Indigenous peoples that occurred during an unknown time period. Given the isolated and non-diagnostic nature of the finds, Locations 2, 3, 5, and 6 are concluded to have no further CHVI and have been sufficiently documented. No further archaeological assessment is required.

Location 4 (White Oak 1 Site, AfHh-926) consisted of six pre-contact Indigenous artifacts in an area measuring approximately 23 m east-west by 20 m north-south, including one projectile point, one scraper, and four pieces of lithic debitage. The quantity of the cultural material identified at Location 4 (AfHh-926) suggests that it may represent a campsite that was occupied during the Late Archaic Period and that lithic tool production and maintenance were carried out at this site. Based on the size and nature of the assembly, Location 4 (AfHh-926) is concluded to have further CHVI and further archaeological assessment is required.

In 2018, Golder conducted a Stage 3 Archaeological Assessment of the White Oak 1 Site (AfHh-926), a pre-contact Indigenous site located within part of Lot 20, Concession 6 in the former geographic Township of Westminster, Middlesex County, now City of London, Ontario (Golder 2018b). The White Oak 1 site (AfHh-926) was previously identified by Golder during a Stage 2 survey of the Study Area and subsequently recommended for Stage 3 assessment (Golder 2018a).

The Stage 3 Archaeological Assessment of White Oak 1 consisted of the hand excavation of 28 one-metre square test units across an area measuring approximately 30 m east-west by 25 m north-south and resulted in the recovery of 126 pre-contact Indigenous artifacts and 62 historical Euro-Canadian artifacts.

ENVIRONMENTAL ASSESSMENT OF THE PROPOSED W12A LANDFILL EXPANSION CITY OF LONDON

Based on the results of the Stage 3 Archaeological Assessment, the White Oak 1 site (AfHh-926) is interpreted as a small Late Archaic campsite that meets provincial criteria or has sufficient cultural heritage value or interest to require Stage 4 mitigation prior to development impacts. This conclusion is based on the identification of four Stage 3 test units that produced 10 or more pre-contact Indigenous artifacts.

In 2018 and 2019, Golder conducted a Stage 2 Archaeological Assessment of the remaining 78 ha of land within the potential landfill expansion site study area that had not had a previous Archaeological Assessment. The Stage 2 assessment, which involved a combination of pedestrian survey at 5 m intervals and shovel test pit survey at 5 m intervals, resulted in the identification of six artifact-producing locations.

Location 1 was identified during pedestrian survey in the northwest corner of the Study Area. The Controlled Surface Pick-up Location 1 resulted in the recovery of one biface fragment manufactured from Onondaga chert. The biface fragment measures 4.62* mm long (*incomplete), 19.73 mm wide, and is 5.27 mm thick.

Location 2 was identified during pedestrian survey in the northwest corner of the Study Area, approximately 65 m northeast of Location 1. The Controlled Surface Pick-up of Location 2 resulted in the recovery of two biface thinning flakes of Onondaga chert.

Location 3 was identified during test pit survey in the north-central portion of the Study Area, on higher ground overlooking a natural drainage approximately 50 m west of a farm laneway. The test pit intensification, including excavation of eight cardinal test pits and one test unit (see Section 2.1.2 above) resulted in the recovery of one flake fragment of Selkirk chert.

Location 4 (AfHh-945) was identified during test pit survey in the northern central portion of the Study Area, adjacent to the west and south of the footprint of the house that was demolished in 2017 at 3713 Scotland Drive. The test pit survey and intensification resulted in the recovery of 488 Euro-Canadian artifacts and 23 faunal elements from 21 positive test pits and four 1 m² test units across an area measuring approximately 65 m north-south by 25 m east-west. Test units were excavated in the vicinity of the test units yielding the highest numbers of mid-19th century artifacts, such as machine-cut nails, refined white earthenware, and yellowware, in order to obtain as much additional information about the nature of the site as possible, as per advice from the MHSTCI and The Archaeology of Rural Historical Farmsteads (Government of Ontario 2014). The Euro-Canadian artifact assemblage from Location 4 (AfHh-945) includes 186 structural-related artifacts (36.40% of total assemblage), 107 artifacts with a food and beverage function (20.94% of total assemblage), 103 artifacts with an indeterminate function (20.16% of total assemblage), 45 artifacts with miscellaneous functions (8.81% of total assemblage), 42 tools and equipment-related artifacts (8.22% of total assemblage), four personal/societal related artifacts (0.78% of total assemblage), and one artifact relating to arms and ammunition (0.20% of total assemblage). A total of 23 faunal elements (4.50% of total assemblage) were recovered from Location 4 (AfHh-945), including 22 mammal bones and one cow tooth. The mammal bones include one metapodial condyle from a cow and nine calcined bones.

Location 5 (AfHh-946) was identified during test pit survey in the northeast corner of the Study Area, adjacent to the east of the house at 3465 Scotland Drive. The test pit survey of Location 5 (AfHh-946) resulted in the recovery of 47 Euro-Canadian artifacts from eleven positive test pits across an area measuring approximately 45 m north-south by 15 m east-west. The Euro Canadian artifact assemblage from Location 5 (AfHh-946) includes 23 artifacts with a food and beverage function (48.94% of total assemblage), ten structural-related artifacts (21.28% of total assemblage), nine artifacts with an indeterminate function (19.15% of total assemblage), and five artifacts with miscellaneous functions (10.64% of total assemblage). Three faunal elements were recovered from Location 5 (AfHh-946), all of which are mammal bones that show signs of butchering, including one cow bone.

Location 6 was identified during test pit survey in the northeastern corner of the Study Area, on higher ground overlooking a natural depression in the topography. The test pit survey and intensification, including excavation of eight cardinal test pits and one test unit resulted in the recovery of one biface thinning flake of Onondaga chert.

Based on the results of the Stage 2 Archaeological Assessments completed in 2019, Location 4 (AfHh-945) was considered to have cultural heritage value or interest and was recommended for Stage 3 Archaeological Assessment if further development in this area is anticipated, while Locations 1, 2, 3, 5 (AfHh-946), and 6 were not considered to have cultural heritage value or interest, and no further assessment was recommended.

5.9 Built Heritage Resources and Cultural Heritage Landscapes

This section of the EASR expands on the existing archaeological resource conditions described in Section 5.8 and provides a summary of built heritage resource conditions surrounding the W12A Landfill site as well as a summary of the site's cultural environment. The information presented in this section has been compiled from more detailed information contained in Volume IV Appendix D.09.

To identify all built heritage resources and cultural heritage landscapes potentially impacted by the proposed expansion of the W12A Landfill, a Cultural Heritage Study Area (CH Study Area) was defined that included all parcels within, and adjacent to, the Site Study Area. This CH Study Area in most cases matches the extent of a Site-vicinity Study Area of 500 m. An inventory of all known and potential built heritage resources was identified in the CH Study Area based on the Ministry of Heritage, Sport, Tourism and Culture Industries *Checklist*, supplemented by field investigations, and analysis of aerial imagery, historical mapping, and architectural style or construction methods. Properties with buildings or structures 40 or more years old were field documented and evaluated as having potential cultural heritage value or interest (CHVI) if they met one or more of the criteria prescribed in *Ontario Heritage Act Regulation 9/06* (Ontario, 1990b).

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In the approved Amended ToR, two sub-components were identified for the Cultural Heritage component; cultural heritage landscapes and built heritage resources. After completion of the assessment of existing conditions, it was initially determined that the Site-vicinity Study Area did not contain any cultural heritage landscapes. However, upon further review since 2006 all cemeteries in the City have been included on the *Register of Cultural Heritage Resources*. As such, although not an old cemetery, the Islamic Cemetery of London is considered to be a cultural heritage landscape.

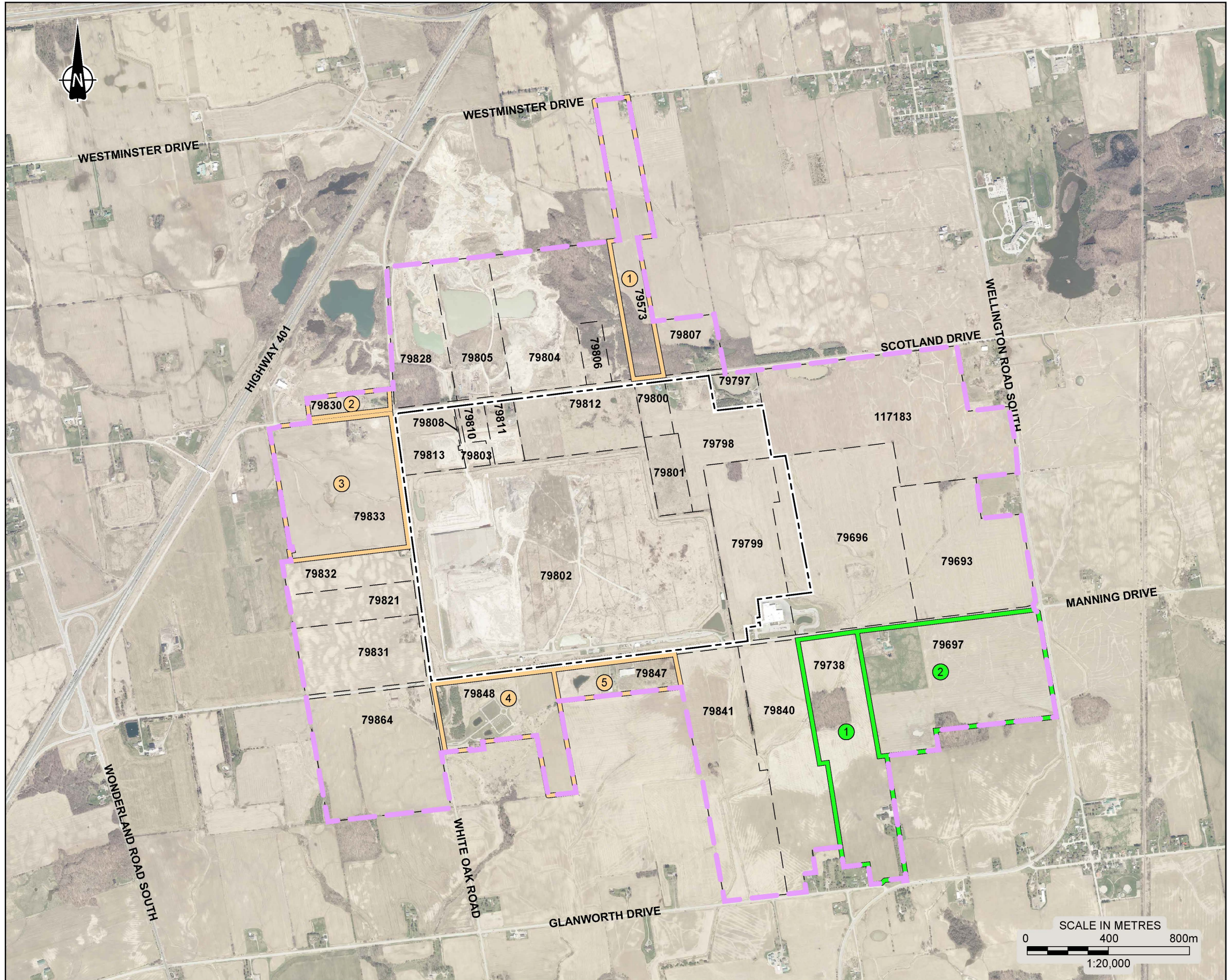
Field investigations were conducted on August 29 and October 29, 2019, and January 14, 2020. The initial review of potential built heritage resources in the vicinity of the existing W12A Landfill included the following:

- Six properties inventoried on the City's *Register of Cultural Heritage Resources* and/ or the Heritage Parcels Geographic Information System (GIS) layer;
- Twenty properties that were adjacent to properties inventoried on the *Register of Cultural Heritage Resources* and/or the City Heritage Parcels GIS layer;
- Seven properties with buildings or structures 40 or more years old; and
- Seven properties that contain structures with unknown cultural heritage value or interest.

After defining the scope for this HIA and the CH Study Area, the following known and potential cultural heritage resources were identified. The property locations are shown on Figure 5.9-1.

- Four properties (3583 Westminster Drive, 5435 White Oak Road, 4067 Scotland Drive, 3691 Manning Drive) with built heritage resources listed (not designated) on the City *Register of Cultural Heritage Resources*;
- One (6100 White Oak Road) potential cultural heritage landscape listed (not designated) on the City *Register of Cultural Heritage Resources*; and
- Two properties (6601/6603 Wellington Road, 3243 Manning Drive) with buildings or structures 40 or more years old with potential CHVI that meet at least one criterion prescribed in O. Reg 9/06 (Ontario, 1990b).

One additional property with buildings or structures 40 or more years old was also identified but evaluated to not meet at least one criterion for CHVI prescribed in O. Reg 9/06 (Ontario 1990b).



LEGEND

- APPROXIMATE LOCATION OF SITE STUDY AREA
- APPROXIMATE LOCATION OF CULTURAL HERITAGE STUDY AREA
- CULTURAL HERITAGE STUDY AREA PARCEL

1 LISTED HERITAGE PROPERTY

ID	Description
1	3583 Westminster Dr
2	5435 White Oak Rd
3	4067 Scotland Dr
4	6100 White Oak Rd
5	3691 Manning Dr

1 PROPERTY OF POTENTIAL CHVI

ID	Description
1	6601/6603 Wellington Rd S
2	3243 Manning Dr

REFERENCE

DRAWING BASED ON CITY OF LONDON, 2019 OPEN DATASET

NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.
ALL LOCATIONS ARE APPROXIMATE.

PROJECT

TITLE

INDIVIDUAL EA OF THE PROPOSED W12A LANDFILL EXPANSION LONDON, ONTARIO

SITE AND SITE-VICINITY STUDY AREAS: KNOWN AND POTENTIAL CULTURAL HERITAGE RESOURCES

PROJECT No. 1648176
CADD DCH/ZJB Feb 22/21
CHECK

FILE No. 1648176-6000-
SCALE AS SHOWN REV.

FIGURE 5.9-1

5.10 Socio-economic

This section of the EASR provides a summary of the existing socio-economic setting within which the W12A Landfill property is located and operates. The determination of the existing socio-economic conditions was carried out as described in the approved Amended ToR (Volume II). The report providing additional details on the existing socio-economic environment is contained in Volume IV Appendix D.10.

The socio-economic environment considers those features that may be affected by landfill operations from the proposed landfill expansion such as residences, indoor and outdoor recreational facilities such as parks, trails and community centres, businesses (particularly ones with an outdoor component), community facilities such as schools, hospitals and emergency services, traffic and commute times, as well as municipal revenues and expenditures.

Secondary sources were used to characterize the existing environment in the vicinity of the proposed landfill expansion. This included Google maps, business and municipal websites and available reports on the existing landfill site. For the purposes of this EA, a radius of approximately 500 m from the Site Area was used for characterization of relevant features (identified as the Site-vicinity Study Area). Other notable features beyond that radius within the Wider Study Area have been noted where relevant, to give a more fulsome picture of the surrounding socio-economic environment.

5.10.1 Demographic Profile

The Project is located within the City of London, Middlesex County. The 2016 census provides the following demographic profile of the area and provides data for Ontario as a whole for comparison in Table 5.10-1.

Table 5.10-1: Demographic Profile – City of London, 2016

	City of London	Ontario
Population change (2011-2016)	4.8%	4.6%
Average Age	40.5	41
Gender	51% Male, 49% Female	48% Male, 52% Female
Average Household Income	\$43,976	\$49,571
Labour Force Participation Rate	63.2%	64.7%
Unemployment rate	7.9%	7.4%

In 2016 the City had a population of 383,822, which represented an increase of 4.8% compared to 2011. This is similar to the provincial average. The average age of residents is 40.5 years, which is only slightly younger than the average for Ontario as a whole. The average household income is lower than the Ontario average and the labour force participation rate was also slightly lower. The unemployment rate is not significantly different to the province wide rate (Statistics Canada, 2016).

5.10.2 Existing Socio-economic Landscape

The socio-economic environment surrounding the W12A Landfill site is predominantly rural with few residential properties and farms in the Site-vicinity Study Area, a number of which are owned by the City itself. The hamlet of Glanworth is the closest residential area to the Site Area (approximately 1.7 km away to the southeast) as well as the Shaver Subdivision, located approximately 2.0 km to the northeast.

Aerial imagery shows mostly agricultural land and properties with small scale industrial type operations (e.g., auto works). In terms of businesses (excluding farms), there are few in the area. The most notable feature is the Westcliff Pit, operated by AAROC Aggregates, and the Bre-Ex Gravel Pit, operated by Brekelmens Holdings, both located on the north side of Scotland Drive, just north of the existing landfill and the Site Area. There is also a heavy equipment sales (Hyde Park Equipment) located on Scotland Drive to the northwest of the Site Area, as well as a general contractor (Ron Murphy Contracting) located on Manning Drive to the west of the landfill. The City's MRF, separate from the landfill, is located just to the east of the Site along Manning Drive. There are no schools, hospitals or other emergency service facilities in the Site-vicinity Study Area. The above businesses are unlikely to have outdoor elements that are essential to their patronage. The Islamic Cemetery of London is located to the south of the Site Area and is the only notable cultural feature in the area; this facility hosts outdoor ceremonies as well as having regular visitors to grave sites. These could potentially be affected by noise, odour or dust from landfill operations and construction activities.

Figure 5.10-1 below shows the existing socio-economic environment in the Site-vicinity Study Area and Wider Study Area.

5.10.3 Existing Landfill Site Operations

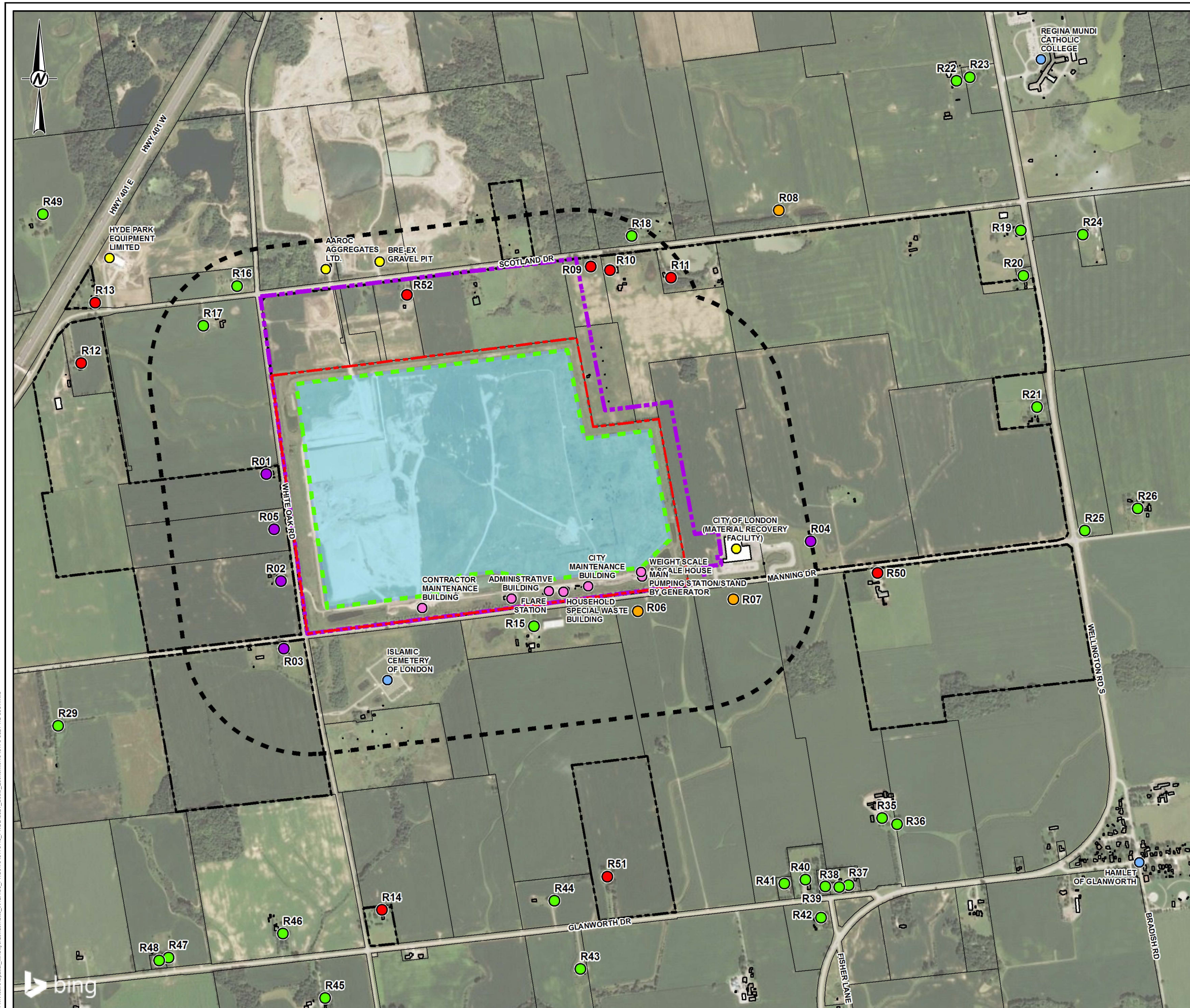
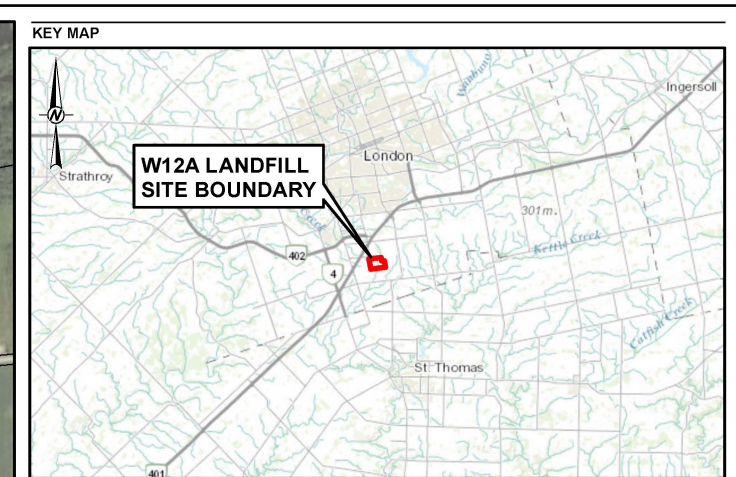
The W12A Landfill received approximately 304,000 tonnes of waste in 2019 (City of London, 2020). There is also a HSW facility and a public drop off depot for household garbage, appliances, Blue Box recyclables, brush, yard waste, cardboard, electronics, scrap metal, tires and wood.

In 2019 the landfill component of the activities employed 11 full time and 2.1 full time equivalent seasonal staff working for the City directly, and about 4 to 5 full time equivalent staff working for a contractor at the landfill. In 2019, a total of 58 odour complaints were made by local residents; the majority of these complaints were in the evening between 6:00 pm and midnight. Complaints in recent years included 19 in 2014, 21 in 2015, 17 in 2016, 34 in 2017 and 60 in 2018 (City of London, 2020). Verified complaints in 2020 were 19, with only 3 in the second half of the year likely as a direct result of increased LFG collection. There have been

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no complaints since October 2020. The landfill's operating costs in 2019 were approximately \$4.5 million and revenues were approximately \$6.4 million.

Existing noise in the area will likely come from agricultural operations, limited industry and traffic as well as from the existing landfill site. Odour sources are related to agricultural practices and the landfill. Vermin such as gulls are present at landfill sites but can be reduced through good site maintenance (e.g., litter control program, hawk program, etc.); no complaints were received regarding vermin or litter from the site in 2019 (City of London, 2020). Existing traffic around the landfill operates at manageable levels. The existing landfill is visible to nearby residences.



SCALE 1:750,000

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

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5.11 Visual

This section of the EASR provides a summary of the existing visual setting of the W12A Landfill site. The determination of the existing visual conditions was carried out as described in the approved Amended ToR (Volume II). The report providing additional details on the existing visual environment is contained in Volume IV Appendix D.11.

In comparison to other large municipal landfills, the W12A Landfill is relatively flat (covers a larger area relative to its height). Nevertheless, the existing W12A Landfill is an anomaly rising approximately 9 to 12 m above an otherwise generally flat to gently sloping landscape.

The existing landfill is located on a surface water divide between the Dingman Creek and Dodd Creek Subwatersheds, with the ground sloping away from the landfill to the southwest at approximately 1 percent and to the north at typically 1-2 percent. The existing landfill can be seen from a distance up to five km from the south and east, three km from the west and one km from the north. Most people who see the existing landfill are at least one km away on main traffic routes (e.g., Highway 401 and Wellington Road).

Closer views of the existing landfill are mainly seen by local residents and truck drivers on the landfill haul routes. Perimeter berms with trees are present around the south, west, north and a portion of the east side of the site to visually screen the existing landfill when in closer proximity. These berms are effective in screening the view of the existing landfill from the road immediately beside the landfill when travelling on Manning Drive and White Oak Road, but not from Scotland Drive or Wellington Road South. Figure 5.11-1 shows a typical screening berm with trees.

Depending on the location from which the W12A Landfill is viewed, features in the immediate landscape (foreground) such as landscaping and buildings can take visual precedence over the landfill. This draws the viewer's attention away and thereby reduces the potential visual impact of the landfill. Factors such as seasonal changes to foliage and the type of agricultural crops present can affect the degree to which the landfill feature is visible and/or noticed.



Figure 5.11-1: Example of a Planted Screening Berm

5.12 Transportation

This section of the EASR provides a summary of the existing transportation conditions related to the W12A Landfill site, along the designated haul routes within the City. The work was carried out as described in the approved Amended ToR (Volume II) The report providing additional details on the transportation aspect of the environment is provided in Volume IV Appendix D.12.

Figure 5.12-1 illustrates W12A Landfill designated haul routes along both Wonderland Road (Highway 4) and Wellington Road.



Figure 5.12-1: Site-Vicinity (Haul Route) Study Area

Following is a description of the main components of the designated haul routes associated with the W12A Landfill.

Wonderland Road (Highway 4) is classified as an arterial road within the Site-vicinity Study Area and is under the jurisdiction of the City. In 2018, the City and Ministry of Transportation, Ontario (MTO) agreed to sign and designate Wonderland Road as Highway 4 north of Highway 401 through the City, although no changes were made from a jurisdictional standpoint. Wonderland Road (Highway 4) runs in a north-south direction to the west of the W12A Landfill site. Wonderland Road (Highway 4) also connects to both Highway 401 and Highway 402 with full movement interchanges.

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In 2018, Wonderland Road (Highway 4) was upgraded to the north of Highway 401 to incorporate wider travel lanes, paved shoulders and turning lanes at intersections. Wonderland Road (Highway 4) is one of the two designated haul routes for W12A Landfill truck traffic. Within the Site-vicinity Study Area, the roadway has a two-lane cross-section with turning lanes at intersections and a posted speed limit of 80 km/h.

Wellington Road is classified as an arterial road within the Site-vicinity Study Area and is under the jurisdiction of the City. Wellington Road primarily has a rural two-lane cross-section that extends to the north and south to the east of the W12A Landfill site. To the north of Westminster Drive, Wellington Road expands to a rural four-lane roadway. Wellington Road operates as a major carrier for vehicle traffic between the City of St. Thomas and the City. Within the Site-vicinity Study Area, the posted speed limit is 80 km/h to the south of Scotland Drive and 70 km/h north of Scotland Drive. The Highway 401 Emergency Detour Route (EDR) travels along Wellington Road south of Highway 401 to Manning Drive.

Manning Drive is classified as an arterial road within the Site-vicinity Study Area and is under the jurisdiction of the City. Manning Drive extends in an east-west direction to the immediate south of the current W12A Landfill. The road primarily has a two-lane rural cross-section featuring gravel shoulders. No curbs or sidewalks are present along the corridor. Manning Drive serves as a designated access route to the existing landfill site and primarily serves landfill-related activities. Manning Drive also serves local access to adjacent properties not associated with the landfill. Manning Drive has a posted speed limit of 70 km/h to the west of the landfill entrance and 80 km/h to the east of the landfill entrance. With the addition of the Highway 401 and Wonderland Road (Highway 4) interchange, Manning Drive serves as the EDR for Highway 401 between the Wonderland Road (Highway 4) and Wellington Road interchanges.

W12A Landfill Access consists of two accesses to Manning Drive and two accesses to White Oak Road. The two accesses to Manning Drive serve the following functions: the easterly access is the primary access and egress for the landfill, while the westerly access is the secondary egress in the southbound (outbound) direction only, which is used by visitors using the HSW depot. Significant haul vehicle activity occurs at the easterly (primary) access only.

The two accesses to White Oak Road serve the following functions: the northerly access provides access to an existing SWM pond, while the southerly driveway functions as an emergency access. Both accesses are gated and seldom used.

MRF Access consists of two accesses to Manning Drive found to the east of the W12A Landfill driveways. The easterly access is the primary access and egress for the MRF while the westerly access is the secondary access and egress for staff and visitors. Significant haul vehicle activity occurs at the easterly (primary) access only.

The intersections on Wellington Road at both Dingman Drive and Manning Drive have signalized control; all other roadway intersections and access from the W12A Landfill and MRF have stop signs.

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Before 2015, vehicles entering/exiting the W12A Landfill and MRF from the City traversed along the Wellington Road haul route only. After the addition of the Highway 401 and Wonderland Road (Highway 4) interchange in 2015, a second haul route was added along Wonderland Road (Highway 4) extending across Highway 401 north to Decker Drive.

The waste management facilities on Manning Drive are accessed via four driveways: two driveways provide access to the MRF and two driveways provide access to the landfill facility. Turning Movement Count (TMC) data at each of the four driveways were collected and analyzed. In addition, annual vehicle data for the W12A Landfill and MRF have been provided by the City. Table 5.12-1 summarizes the 2018 traffic data for the landfill related accesses on Manning Drive.

Table 5.12-1: 2018 Data for the W12A Landfill

Type of Vehicle	Tonnage	Tonnage	# of Vehicles	# of Vehicles
	Landfill	% by Vehicle Type	Landfill	% by Vehicle Type
Municipal Waste Collection Vehicles	162,400	42.6%	17,370	24.4%
Private Waste Collection Vehicles	173,700	45.4%	15,800	22.2%
Inbound Operating Supplies ¹	41,700	10.9%	1,950	2.7%
Outbound Materials	500	0.1%	100	0.1%
Small Vehicle – Staff ²	0	0%	5,800	8.1%
Small Vehicle – Public ³	2,690	1.0%	30,200	42.4%
Total	380,990	100%	71,220	100%

Notes:

¹ Landfill weigh scale data

² Landfill staff trips based on 25 vehicles/day for 165 days (Monday - Friday) and six vehicles/day for 38 days (Saturday) for spring/summer/fall and staff 16 vehicles/day for 85 days (Monday - Friday) and six vehicles/day for 14 days (Saturday) for winter.

³ Landfill tonnage for small vehicles based on weigh scale data. Landfill public trips based on weigh scale tickets and HSW vehicle count (12,000).

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In 2018, a total of 71,220 vehicles accessed the W12A Landfill. Of that total, approximately 51% were small vehicles and 49% were heavy vehicles. Heavy vehicles were typically a mix of waste collection trucks, dump trucks and tractor-trailers.

TMC data was collected along the haul routes at nine intersections surrounding the W12A Landfill site and the site driveways to the W12A Landfill and MRF (four total). Traffic volumes were surveyed between the peak periods of 7:00 a.m. and 10:00 a.m. as well as 3:00 p.m. and 6:00 p.m. The intersection-specific a.m. and p.m. peak hour periods, and corresponding a.m. and p.m. peak hour turning movement volumes were then determined based on the traffic data collected. Based on the hourly, seasonal and yearly differences of the TMCs, some traffic balancing was undertaken. In addition, the traffic data collected in 2017 had their base traffic volumes increased by a 1% annual growth factor to reflect existing (2019) traffic volumes.

Average daily traffic (ADT) volumes as provided by the City mapping system have been summarized in Table 5.12-2.

Table 5.12-2: Average Daily Traffic Volumes

Roadway	Segment	2013 Average Daily Traffic Volume (nearest 500 vehicles)
Wonderland Road (Highway 4)	Scotland Drive – Decker Drive	3,000
	Decker Drive – Manning Drive (across Highway 401)	4,000
Manning Drive	Wonderland Road (Highway 4) – White Oak Road	500
	White Oak Road – Wellington Road	1,000
Wellington Road	Dingman Drive – Westminster Drive	16,000
	Westminster Drive – Scotland Drive	14,000
	Scotland Drive – Manning Drive	13,500

The ADT values presented are based on 2013 traffic volumes. At that time the Wonderland Road (Highway 4) and Highway 401 interchange had not yet opened. Given this, it is anticipated that ADT volumes along Wonderland Road (Highway 4) will have increased beyond the values provided in Table 5.12-2.

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Intersection operational analyses were completed using Trafficware's Synchro software (version 10), which is based on the methodology prescribed within the Highway Capacity Manual (HCM). The analyses reflect the existing lane configurations at each intersection and current traffic signal timings obtained from the City.

At signalized intersections, the volume-to-capacity (v/c) ratio, average vehicular delay, level of service (LOS) and 95th percentile queue were noted for each individual movement, and the average delay and level of service were noted for the intersection as a whole. LOS definitions are provided in Appendix C of Volume IV Appendix D.12.

At unsignalized (stop-controlled) intersections, the v/c ratio, delay, LOS and 95th percentile queue were noted for any stop-controlled movements and/or left-turning lanes (when present).

At each intersection, critical movements, if any, were identified. As per the City Transportation Impact Assessment Guidelines, an individual movement or lane group is considered to be "critical" when its v/c ratio is at or above 0.90 or when its LOS is at LOS E or LOS F.

The existing (2019) intersection operations on the transportation network surrounding the W12A Landfill site are presented in Table 5.12-3.

The two signalized intersections within the Site-vicinity Study Area are found along Wellington Road where it meets Dingman Drive and Manning Drive. The signalized intersections operate at a good to a reasonable LOS (LOS A to LOS D) both overall and for all movements during the a.m. and p.m. peak hours with the existing traffic volumes and signal timing plans. All movements and overall operations for the two signalized intersections during both peak hours are operating well beneath capacity.

The remaining 11 intersections and site accesses within the Site-vicinity Study Area operate under a stop-control condition. These stop-controlled intersections generally operate at an excellent to reasonable LOS (LOS A to LOS D) during both the a.m. and p.m. peak hours, except for the eastbound approaches to Wellington Road on both Scotland Drive and Westminster Drive during the p.m. peak hour (LOS E). Even though they operate with higher vehicle delays, these approaches operate well below capacity (v/c = 0.14 and 0.25, respectively). All measured queues at these unsignalized intersections are less than 35 m in length, with no movements found to exceed their available storage.

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Table 5.12-3: Existing (2019) Intersection Operations along the Haul Routes

Intersection	Movement	a.m.	peak	hour	95 th %ile queue (m)	p.m.	peak	hour	95 th %ile queue (m)
		v/c	LOS	Delay (s/veh)		v/c	LOS	Delay (s/veh)	
Wonderland Road (Hwy 4) and Decker Drive	EB approach NB left	0.12	C	17.1	4	0.16	C	19.1	5
		0.01	A	8.1	0	0.04	A	8.8	1
Wonderland Road (Hwy 4) and WB Highway 401 Ramps	WB approach SB left	0.06	C	16.7	1	0.38	D	32.9	14
		0.08	A	9.0	2	0.14	A	9.0	4
Wonderland Road (Hwy 4) and EB Highway 401 Ramps / Manning Drive	EB approach	0.63	D	33.4	32	0.48	D	34.3	19
	WB approach	0.04	B	11.6	1	0.03	B	11.9	1
	NB left	0.01	A	8.3	0	0.28	A	8.7	1
	SB left	0.02	A	8.5	0	0.00	A	0.0	1
Manning Drive and Morrison Road	SB approach	0.01	A	9.2	0	0.01	A	8.8	0
Manning Drive and White Oak Road	EB approach	0.02	A	7.5	- ¹	0.02	A	7.5	-
	WB approach	0.02	A	7.3	-	0.02	A	7.2	-
	NB approach	0.09	A	7.4	-	0.05	A	7.5	-
	SB approach	0.03	A	7.4	-	0.11	A	7.6	-
	Overall	-	A	7.4	-	-	A	7.5	-

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Intersection	Movement	a.m.	peak	hour	95 th %ile queue (m)	p.m.	peak	hour	95 th %ile queue (m)
		v/c	LOS	Delay (s/veh)		v/c	LOS	Delay (s/veh)	
Manning Drive and W12A Landfill Secondary Access	SB approach	0.00	A	8.6	0	0.00	A	8.4	0
Manning Drive and W12A Landfill Primary Access	SB approach	0.01	A	9.6	0	0.01	A	9.2	0
Manning Drive and MRF Staff/Visitor Access	SB approach	0.00	B	8.7	0	0.02	A	8.7	0
Manning Drive and MRF Primary Access	SB approach	0.04	A	9.5	1	0.05	A	9.4	1
Manning Drive and Wellington Road	EB left	0.09	C	24.6	7	0.06	C	24.9	6
	EB through/right	0.03	C	21.6	4	0.08	B	18.5	7
	WB left ²	0.00	C	24.0	1	-	-	-	-
	WB through/right	0.10	B	19.5	7	0.04	C	22.0	5
	NB through/left	0.51	A	5.4	89	0.32	A	3.4	39
	NB right	0.00	A	0.00	0	0.00	A	0.0	0
	SB through/left	0.18	A	3.1	22	0.52	A	5.2	89
	SB right	0.02	A	0.06	1	0.01	A	0.0	0
	Overall	-	A	5.3	-	-	A	5.0	-
Wellington Road and Scotland Drive	EB approach	0.04	D	27.2	1	0.14	E	37.2	4
	WB approach	0.09	C	18.9	2	0.05	C	24.0	1

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Intersection	Movement	a.m.	peak	hour	95 th %ile queue (m)	p.m.	peak	hour	95 th %ile queue (m)
		v/c	LOS	Delay (s/veh)		v/c	LOS	Delay (s/veh)	
Wellington Road and Westminster Drive	EB approach	0.27	D	26.3	9	0.25	E	37.7	7
	WB approach	0.20	D	25.9	6	0.17	C	20.7	5
	NB left	0.01	A	8.7	0	0.21	A	0.0	0
	SB left	0.03	B	10.4	1	0.04	A	8.6	1
Wellington Road and Dingman Drive	EB through/left	0.65	D	53.8	41	0.64	D	54.2	41
	EB right	0.25	B	17.2	13	0.29	B	17.2	16
	WB through/left	0.12	D	35.1	12	0.26	D	38.9	22
	WB right	0.15	B	12.4	8	0.14	B	12.4	8
	NB left	0.10	A	5.7	8	0.11	A	5.9	7
	NB through/right	0.38	A	6.3	50	0.21	A	4.9	26
	SB left	0.04	A	5.5	3	0.09	A	5.3	8
	SB through/right	0.24	A	5.2	26	0.37	A	5.7	51
	Overall	-	B	10.5	-	-	B	10.6	-

Notes:

- 1 Synchro analyses for all-way stop conditions did not provide queue lengths for the all way stop-controlled intersection at Manning Drive and White Oak Road. During both peak hours, all approaches are operating at LOS A.
- 2 Within the available traffic count data, no westbound vehicles on Manning Drive were recorded making the left turn during the p.m. peak hour.
- 3 EB = East Bound SB = South Bound WB = West Bound NB = North Bound

5.13 Design and Operations

The Design and Operations component comprises the design and operation of the landfill and the site. The design of the W12A Landfill and the operations at the site are approved under ECA No. 042102. As described in Section 1.3, the W12A Landfill has been operational since 1977 and currently accepts solid non-hazardous waste generated within the City, the Municipality of Thames Centre, Lake Huron and Elgin Area Water Treatment Plants and the TRY Recycling Construction and Demolition Recycling Facility located just north of the City. In addition to the landfill, facilities at the site are inbound and outbound weigh scales, a scalehouse, a small vehicle drop off area, maintenance buildings, an administration building, a HSW facility and a LFG blower and flare compound. The following material is diverted from the landfill: MHSW, appliances, Blue Box recyclables, yard waste, cardboard, electronics, scrap metal, tires and wood.

The landfill is approved to accept 650,000 tonnes of waste per year, but over the past 10 years typically received between 200,000 and 340,000 tonnes of waste per year. On a tonnage basis, the landfill typically receives approximately 30 to 35 percent residential waste, approximately 15 to 20 percent from municipal operations and 40 to 45 percent IC&I waste (including CR&D process residuals). A more detailed breakdown of the waste received on an annual basis is provided in Volume III Appendix C Updated Residual Waste Projections and Landfill Capacity Assessment.

The site is operated and open to receive material Monday through Friday from 7 a.m. to 4 p.m. and Saturday from 8 a.m. to 3 p.m., except statutory holidays which is within the operating hours within the ECA. The landfill typically receives approximately 100 to 125 waste collection vehicles a day.

The W12A Landfill site has an approved 107 ha fill area and is located on a 142 ha property. The landfill has buffers beyond the limit of the waste footprint area of 92 m to the south and west and 46 m to the north and east. The overall final designed shape of the landfill is generally rectangular. The design of the side slopes ranges from 4H:1V (horizontal to vertical) to 6H:1V and the top is sloped at approximately 1% from the south to a peak elevation of the final cover of 293 metres above sea level (masl) near the north end of the landfill. The final cover design consists of 0.85 m of compacted clay soil and 0.15 m of topsoil. The average height of the landfill above ground surface is about 9 to 12 m. In summary, the currently approved W12A Landfill can be described as having a large footprint area and a low height above grade. The W12A Landfill has an approved airspace of 12,500,000 cubic metres (m³) for waste, daily cover and interim cover.

As of January 2020, the remaining approved airspace in Phase 2 is approximately 1.5 million m³, which is equivalent to approximately 1.26 million tonnes of disposal capacity.

Over the first 25 years of operation between 1977 and 2002, approximately 5 million tonnes of waste were deposited at the W12A Landfill in the first six cells that comprise Phase 1. These Phase 1 cells cover 59.3 ha and occupy the eastern portion of the landfill footprint (see Figure 1.3-1). The Phase 1 cells are labelled Cells 1, 2, 3, 4, 5 East and 5 West, as shown on Figure 1.3-1. Landfilling in Phase 1 is complete. A soil final cover was constructed

progressively during waste placement in Phase 1 to the approved final contours and a landfill gas extraction well system installed.

The remainder of the landfill covers 47.7 ha and has been designed to accommodate approximately another 5.5 million tonnes. The area is referred to as Phase 2 as shown on Figure 1.3-1. Phase 2 is divided into eight cells labelled on Figure 1.3-1 as Cells 6 South South Half, South North Half, North South Half and North North Half, and Cells 7 through 10. Cells 6, 7 and 8 have been filled and landfilling is currently ongoing in Cell 9; construction of Cell 10 is underway in 2020.

Phase 1 has six cells that were excavated to an average depth of 3 m below grade. The landfill design approach considered the low-permeability nature of the natural clay till soils below the landfill that hinder the potential downward migration of landfill leachate. The native clay till deposit provides a natural liner.

There are two approaches to leachate collection. Leachate within Phase 1 is collected by a perimeter LCS consisting of 200 millimetre (mm) diameter perforated pipe placed in gravel around the north, east and south perimeter of Phase 1 of the waste footprint. There is a leachate mound within the Phase 1 landfill area.

Phase 2 of the landfill has eight cells, of which seven have been constructed. Phase 2 was designed with a full underdrain LCS consisting of 200 mm diameter perforated pipes spaced 90 m apart within a clear stone blanket and covered with a geotextile filter and 0.2 m thick protective sand layer. The base of Phase 2 is graded to convey leachate into the perforated pipes and with an overall fall from north to south to a low point at an elevation of 270 m above sea level (masl). The collected leachate from both phases is stored in holding tanks before it is pumped via a pumping station located near the scalehouse through a forcemain along Manning Drive to the Dingman Creek Pumping Station and eventually to the Greenway WWTP for treatment.

In summary, the existing landfill consists of the following major components (shown on Figure 1.3-1):

- **Fourteen landfill cells** divided into two waste disposal fill areas known as Phases 1 and 2.
- **Four SWM ponds** that provide flow control (to prevent flooding) and quality control (sediment removal) of drainage from the landfill received by a series of ditches located along the perimeter of the landfill as well as along the access road.
- **A perimeter LCS** for Phase 1 of the landfill and an **underdrain LCS** for Phase 2 of the landfill.
- **A LFG collection system and flare** consisting of 46 active LFG extraction wells and more than 5 kilometres (km) of piping that collect the LFG and carry it to the flare for combustion. This system reduces GHG and odour emissions from the landfill.
- **HSW Depot** that accepts hazardous and special wastes from residents and small businesses for off-site recycling/disposal.

- **Public Drop-off Depot** that accepts household garbage, appliances, blue box recyclables (e.g., paper products, plastics, aluminum and steel containers, glass bottles and jars), yard waste, oversized cardboard, electronics, scrap metal, tires and wood for recycling.

Perimeter berms are present around the south, west and north sides of the site to visually screen the landfill from view along the adjacent roadways.

As described in Section 1.3.3, the W12A Landfill has had groundwater, surface water, leachate, water well and LFG monitoring programs since 1976 the year before the landfill opened. A summary of the results of the 2019 monitoring programs is provided in Section 1.3.3. In summary, the landfill monitoring programs indicate that the landfill is performing acceptably and in accordance with provincial requirements in terms of potential effects of leachate on groundwater and surface water, as well as in terms of LFG migration in the subsurface.

6.0 Description of the 'Alternative Methods' of Landfill Expansion

This section describes the 'Alternative Methods' for expansion of the W12A landfill site. 'Alternative Methods' are different ways that the proposed expansion of the W12A Landfill could be implemented to gain an additional 25 years of disposal capacity. As described in the approved Amended ToR, because of the physical constraints associated with the configuration of the existing waste footprint and geometry on the existing landfill site property, the 'Alternative Methods' are limited to vertical expansion above the existing waste footprint and/or lateral expansion to the north and/or east within the Site Study Area (see Figure 5.1-1).

During the preparation of the ToR, preliminary design concepts for the 'Alternative Methods' were developed to illustrate possible ways that the landfill site could be expanded to provide an additional 13,600,000 m³ of airspace, with these concepts to be refined and confirmed during the EA to provide the expansion alternatives for purposes of comparative evaluation and identification of the preferred alternative.

As described in Section 2.0 of this EASR, the projected residual waste from both the existing service area and the proposed regional service area over the 25 year planning period has been confirmed. The corresponding airspace is 13,800,000 m³, slightly more than described in the ToR. The design of the 'Alternative Methods' of expansion will therefore consider 13,800,000 m³ of additional airspace for waste and daily cover.

In the development of the landfill expansion alternatives, site-specific factors were considered, consisting of: 1) site design requirements as set out in O. Reg. 232/98 Landfill Standards; 2) existing leachate and LFG control and management systems, and SWM system; 3) conceptual mitigation measures for the landfill expansion; and 4) engineered system requirements. These are discussed further in Section 6.1.

6.1 Design of Expansion Alternatives

The following factors were considered in designing the expansion alternatives:

- The existing landfill has a narrow buffer along the north and east sides between the existing approved limit of waste and the landfill site property boundary. For the expansion alternatives, a minimum buffer width of 100 m (as recommended in O. Reg. 232/98) will be provided to accommodate perimeter landfill-related infrastructure, i.e., perimeter road, perimeter leachate collection, leachate and/or LFG forcemain, SWMS components, contingency measures. It is noted that the City owns the land between the current north landfill site property boundary and Scotland Drive and within the Special Policy Area to the east; as such, the City will not have to acquire property for the expansion. See Figure 1.1-2.
- The geometry of the landfill expansion is to follow the requirements of O. Reg. 232/98, i.e., landfill sideslopes of 4H:1V or flatter, landfill top area slopes not flatter than 20H:1V (5 %), and below grade sideslopes not steeper than 3H:1V. It is noted that the existing approved landfill top slope is approximately 1.3 to 2 %.

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- As described in Section 5.13 of this EASR, the existing Phase 1 landfill disposal area rests directly on the low permeability clay till and currently has a perimeter LCS around its north, east and south exterior sides to control the migration of leachate away from the landfill in the shallow subsurface groundwater and to capture perimeter leachate seeps. It is proposed to continue to utilize a perimeter LCS around Phase 1 for leachate migration control for the vertically expanded Phase 1 area; in view of the age of the existing perimeter LCS, consideration will be given to replacing some or all of this system in conjunction with implementing the expansion. For horizontal expansion areas to the north and/or east of Phase 1 that will use the native clay till as the natural low permeability liner and incorporate an underdrain LCS meeting the requirements of O. Reg. 232/98, this will replace sections of the perimeter LCS or the new LCS will provide a point for the upstream section of the perimeter LCS to discharge to.
- The quantity of excavated soil from horizontal expansion areas will be managed by the City by placing it appropriately on City-owned lands, that may include some or all of areas of the 100 m wide buffer within the landfill property, for construction of perimeter and/or screening berms, for regrading of areas of the landfill and on portions of the Special Policy area lands to the east. It is envisaged that this fill will be re-used in future for construction of the landfill's final cover.
- In view of the existing leachate mound within the Phase 1 disposal area and the potential for the mound to rise higher in conjunction with vertical expansion, it is anticipated that it will be necessary to construct granular finger drains around (depending on the expansion alternative) all or portions of the exterior perimeter of the Phase 1 area to capture / control leachate seepage and connect it to the perimeter LCS.
- The existing Phase 2 of the landfill uses the native clay till to provide a natural low permeability liner. The existing LCS for the Phase 2 disposal area consists of a continuous granular drainage blanket above the clay till base, with the base shaped into a series of ridges and valleys such that the leachate flows to a series of perforated pipes located in the valleys that drain by gravity from north to south. The piping connects into a header and manhole to remove the leachate from the cell for subsequent off-site treatment. As described above, it is proposed that a similar design approach will be used to manage and remove leachate from new horizontal expansion areas.
- The leachate from the expanded landfill that is collected by the LCSs is expected to continue to be conveyed off-site by the existing forcemain to the Dingman Pumping Station, where it mixes with sewage and then utilizes the sanitary sewer system to reach the Greenway WWTP for treatment prior to discharge. As per the approved Amended ToR the capability of the WWTP to continue to receive the leachate generated from the preferred landfill expansion alternative will be evaluated in the EA (refer to Section 8.1.2).

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- The City will consider options to provide temporary leachate storage on the W12A site during storm events of significant magnitude that could result in discharge of the mixed leachate/sewage to Dingman Creek or the Thames River if the WWTP is in a by-pass situation. Although the W12A leachate represents only a small percentage of the total flow within the sewer system, the objective would be to minimize the discharge of untreated leachate to these water courses.
- To reduce the contaminating lifespan of the landfill and to remain in compliance with the Reasonable Use Guideline groundwater requirements, it is anticipated that a permeable final cover design approach will be used. This final cover would consist of 600 mm of soil and 150 mm of topsoil to support vegetation, as set out in O. Reg. 232/98.
- Stormwater runoff from the expanded landfill will be managed by a SWMS. This system is expected to consist of the existing network of ditches and stormwater ponds modified as required for the expansion and possibly some added components to the system. These stormwater features will discharge via existing outlets from the site to the south, west and possibly north; be designed to handle the design storms as per O. Reg. 232/98 and to remove total suspended solids (TSS) as per the MECP Guidelines; control post-expansion discharges from the site for the design storm events to pre-expansion rates; and their sizing will consider potential effects of climate change.
- As required by O. Reg. 232/98, the expanded W12A Landfill will be provided with an active LFG collection and control system, envisaged to consist of a series of vertical gas extraction wells and horizontal collector pipes connected to a blower and flare. For the preferred expansion alternative, the capacity of the existing LFG management infrastructure (which consists of vertical wells, blower and flare) will be assessed to determine what, if any, upgrading / increased capacity may be needed.
- In terms of operation of the expanded landfill, the City would like to consider having a cell area identified for disposal of non-putrescible wastes, with the objective that that this cell would not need an active LFG system. These waste types are comprised of sewage sludge ash, street sweepings, water treatment plant (WTP) process residuals and contaminated soil and total an estimated 1.56 million tonnes for the 25 year planning period. It is considered that there will not be a requirement to apply daily cover to these types of disposed waste materials. Assuming a tonnage to volume conversion factor of 1.5 tonnes per m³ for these types of materials (which are more dense than typical municipal solid waste), this corresponds to approximately 1.05 million m³ of airspace. It is envisaged that there could be a cell area designated specifically for this material, separate from the main active waste disposal area, such that there would be two operational areas at the same time; in the end, the two will blend in together within the overall landfill shape. It is anticipated that this designated area for non-putrescible waste could be over a portion of the older Phase 1 LF area since the oldest waste is there, the waste is relatively thin and gas collection from this area is less than optimum because of the leachate mound. Also, as described below, all the expansion alternatives involve vertical expansion over some or all of the existing Phase 1 area, and it would be desirable to be able to start filling in the non-putrescible area without having to construct new footprint / horizontal expansion area.

6.2 ‘Alternative Methods’ for Landfill Expansion

Based on the above factors, three ‘Alternative Methods’ for expansion of the W12A Landfill were developed. These alternatives are referred to as:

- Alternative 1 – Vertical Expansion Over Existing Footprint;
- Alternative 2 – Horizontal Expansion to the North and Vertical Expansion Over Part of the Existing Footprint;
- Alternative 3 – Horizontal Expansion to the East and Vertical Expansion Over Part of the Existing Footprint.

The subsections below describe each of the landfill expansion alternatives, which each provide the required 13.8 million m³ of airspace for waste and daily cover. Unless stated otherwise, the elevations referred to are with regards to the top of waste and do not include the final cover (which as described previously is expected to be 0.75 m thick). Site plans and cross sections for each of Alternatives 1, 2 and 3 are shown on Figures 6.2-1, 6.2-2 and 6.2-3, respectively. Table 6.2-1 provides a comparative summary of the ‘Alternative Methods’ of landfill expansion, as well as information on the currently approved landfill.

6.3 Alternative 1 – Vertical Expansion Over Existing Footprint

Alternative 1, shown on Figure 6.2-1, consists of vertical expansion over the whole of the existing 107 ha landfill footprint, with a peak waste elevation of 317.65 masl along a west to east ridge in the south-central part of the footprint. Allowing 0.75 m for the final cover, this maximum elevation corresponds to a peak elevation that is approximately 43 m higher than the average ground surface elevation. The design provides 4H:1V sideslopes upward from the existing sideslopes and a 5 % top slope; it is noted that a large portion of the waste footprint area (about 60 %) will be at the gradual 5 % top slope. With this alternative, it is proposed to move the northern property line of the landfill site to Scotland Drive, creating a north buffer width of approximately 300 m (noting that this land is all currently owned by the City).

6.4 Alternative 2 – Horizontal Expansion to the North and Vertical Expansion Over Part of the Existing Footprint

Alternative 2, shown on Figure 6.2-2, consists of a 200 m wide horizontal expansion to the north, increasing the waste footprint area from 107 to 134 ha. This will involve 2,040,000 m³ of excavation to form the cell and management of the excavated soil. To provide the required airspace, this alternative has a peak waste elevation of 309.8 masl along a west to east ridge in the central part of the footprint. Allowing 0.75 m for the final cover, the maximum peak elevation corresponds to a height above average ground surface elevation of about 35 m, some 8 m lower than Alternative 1. The design provides 4H:1V sideslopes on the north side and upward from the existing sideslopes on much of the east and west sides, and a 5 % top slope on the area of vertical expansion above the existing footprint area. This design also results in the location where the southern 5 % top slope meets the existing top elevation being approximately 200 to 250 m north of the existing south limit of waste. This southern top portion has about a 2 % slope (less than the 5 % required by the LF Standards); it may be

possible to leave this area as is using ongoing maintenance to provide an adequate slope for continued surface drainage.

Because of the irregularity in ground surface along the north limit of the horizontal expansion, it will be necessary to construct sections of perimeter berm across the topographic depressions at the northwest and northeast corner areas to create the cell base and contain leachate in these areas – these are shown on Figure 6.2-2 in plan view and on Section D-D'. The berm top width is shown as 11 m to accommodate a toe ditch, access road and a leachate forcemain.

For Alternative 2, the perimeter LCS on the north side of Phase 1 will no longer be required. There are currently cleanout pipes at the north end of the Phase 2 area to allow access for equipment to the Phase 2 LCS pipes for inspection and cleaning. When the northern expansion area is developed and the waste fill covers the area of these cleanout pipes, equipment access to the north end of the Phase 2 LCS should be maintained; this could be achieved by providing cleanout towers or a similar feature that are constructed initially when the northern expansion is developed and then raised vertically and protected in conjunction with placement of waste.

As described previously, consideration will be given to replacing the perimeter LCS on the east and south sides of Phase 1. In addition to finger drains connecting into the perimeter LCS along the east and south sides of Phase 1, it may also be necessary in design to provide mound seepage control where the southern 5 % slope of the vertical expansion meets the existing top slope about 200 to 250 m north of the south limit of waste.

6.5 Alternative 3 – Horizontal Expansion to the East and Vertical Expansion Over Part of the Existing Footprint

Alternative 3, shown on Figure 6.2-3, consists of a 300 to 550 m wide horizontal expansion to the east, increasing the waste footprint area from 107 to 135 ha. This will involve about 821,400 m³ of excavation to form the cell and management of the excavated soil. To provide the required airspace, this alternative has a peak waste elevation of 311.80 masl along a west to east ridge in the north end of the footprint, with the majority of the fill area having a 5 % top slope. Allowing 0.75 m for the final cover, this maximum elevation corresponds to a height above average ground surface elevation of about 37 m, between Alternative 1 (higher) and Alternative 2 (lower). The design provides 4H:1V sideslopes on the horizontal expansion area and upward from the existing sideslopes on the north side and much of the east and west sides, and a 5 % top slope on the area of vertical expansion above the existing footprint. Similar to Alternative 2, this design also results in the location where the southern 5 % top slope meets the existing top elevation being approximately 200 to 250 m north of the existing south limit of waste. This southern top portion has about a 2 % slope (less than the 5 % required by the LF Standards); it may be possible to leave this area as is using ongoing maintenance to provide an adequate slope for continued surface drainage.

The ground surface in the area of the eastern horizontal expansion slopes downwards from north/northeast to south. To provide approximately 2.5 m of cell height along the perimeter above the proposed base subgrade elevation, it will be necessary to construct a berm along the east side and a small portion of the south side, as shown on Figure 6.2-3. The proposed cell base elevation in the horizontal expansion area is below the elevation of the existing Phase 1 east perimeter leachate collection pipe.

The perimeter LCS on the east side of Phase 1 will no longer be required. The north side perimeter LCS will discharge into the north end of the LCS beneath the eastern horizontal expansion area. Similar to Alternative 2, in addition to finger drains connecting into the perimeter LCS along the north and south sides of the Phase 1 area, it may also be necessary in design to provide mound seepage control where the southern 5 % slope of the vertical expansion meets the existing top slope about 200 to 250 m north of the south limit of waste.

With this alternative, as with Alternative 1, it is proposed to move the northern property line of the landfill site to Scotland Drive, creating a north buffer width of approximately 300 m (nothing that this land is all currently owned by the City).

6.5.1 Summary of Alternative Methods

A summary of the key features of Alternatives 1, 2 and 3, as well as those for the existing approved landfill, are provided in Table 6.5-1 below. The following terminology and definitions have been used:

- Waste Footprint Area – Proposed licensed disposal area where waste will be landfilled;
- Site Area or Property Area – Total land to be included in the ECA that includes the waste footprint area and on-site buffer; and
- Site Development Area – Area to be used in the operation of the landfill. This includes waste footprint area plus land needed for landfill-related infrastructure (e.g., roads, SWM ponds, buildings, etc.).

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Table 6.5-1: Summary of W12A Landfill Expansion Alternative Methods

Design Concept	Existing Landfill	Alternative 1	Alternative 2	Alternative 3
Description	-	Vertical expansion over existing footprint	Horizontal expansion to the north with vertical expansion over part of the existing footprint	Horizontal expansion to the east with vertical expansion over part of the existing footprint
Site/Property Area (ha)	142	189	189	223
Waste Footprint Area (ha)	107	107	134	135
Site Development Area	142	151 ^a	189	185 ^a
Peak Waste Elevation (masl)	292	317.65	309.80	311.80
*Height of Peak above Average Ground Elevation (m)	17	43	36	38
Horizontal Expansion Area Bottom Elevation (masl)	-	-	274 south to 272 north	274 north sloping down to 269.5 south end
Volume of Excavation (m ³)	0	0	2,040,000	821,400
**Total Additional Airspace (m ³)	-	13,800,000	13,800,000	13,800,000

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Design Concept	Existing Landfill	Alternative 1	Alternative 2	Alternative 3
Comments	<ul style="list-style-type: none"> Currently approved airspace for waste and daily cover is ~12.5 million m³. 	<ul style="list-style-type: none"> No excavation. Perimeter LCS remains around exterior of Phase 1. Highest landfill expansion above grade. 	<ul style="list-style-type: none"> Perimeter LCS remains in place on east and south sides of Phase 1. Largest excavation volume; lowest landfill height above grade compared to Alternative 1 and Alternative 3. Vertical expansion blends into currently approved top surface north of the south slope crest 	<ul style="list-style-type: none"> Phase 1 north and south perimeter LCS remain in place, with north side LCS draining into east expansion LCS. Smaller excavation volume than Alternative 2; lower landfill height above grade than Alternative 1 and higher than Alternative 2 Vertical expansion blends into currently approved top surface north of the south slope crest.

Notes:

^a Excludes northern buffer zone of approximately 300 metre width north of the existing landfill (38 ha area). New landfill-related infrastructure in this area expected to be limited to berms for screening adjacent to the White Oak Road and Scotland Drive road allowances and SMW. Land in the western portion of this northern buffer zone area is currently used for stockpiling soil; this will continue with the expansion.

* Includes allowance for 0.75 m of final cover thickness above top of waste

** Airspace for waste and daily cover, not including final cover