GEI Consultants

Environmental Impact Study

3027 Cedar Creek Road

Ayr, Ontario

Submitted to:
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Project No. 2404321

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1st Submission EIS	March 2025	Submitted for Client Review

1. Introduction

1.1. Project Overview

GEI Consultants Canada Ltd. (GEI) has been retained by Royal Cedar Creek Holdings Inc., to complete an Environmental Impact Study (EIS) for the property located at 3027 Cedar Creek Road in Ayr, Ontario, herein referred to as the Subject Lands (**Figure 1**, **Appendix A**). The Subject Lands are generally bounded by Cedar Creek Road to the north and Highway 401 to the south, with private lands located to the east and west.

The Subject Lands consist primarily of a combination of agricultural fields, woodlands, and two provincially significant wetlands. A regulated watercourse is located along the southern boundary of the Subject Lands. Additionally, an existing single residential dwelling and garage is also located within the Subject Lands. The proposed development concept of this property includes the construction of a single slab-on-grade dry use industrial warehouse, a stormwater management pond, and a gravel parking lot and drive aisle. The future land use of the Subject Lands will be industrial, with the lands housing a warehouse and logistics facility (truck terminal).

1.2. Purpose of the Report

A Scoped EIS is required to assess the potential impacts of the proposed development on the Subject Lands on natural heritage features and their associated functions. This Scoped EIS considers applicable policies of the Province of Ontario's Provincial Policy Statement (PPS; Ministry of Municipal Affairs and Housing; MMAH 2024) and associated provincial implementation guidance contained in the Natural Heritage Reference Manual (NHRM; MNR 2010) as well as the Township of North Dumfries Official Plan (NDOP, 2018 Consolidation), the Region of Waterloo Official Plan (RWOP 2010), and the Grand River Conservation Authority's (GRCA) regulation and policies. This EIS has been prepared to support a Zoning By-Law Amendment (ZBA) for the property.

1.3. Natural heritage Legislation and Policy Context

Ecological opportunities and constraints to development were evaluated in the context of the requirements of the following regulatory agencies, local and regional municipalities, and/or legislation:

- Township of North Dumfries Official Plan Office Consolidation (NDOP; 2018);
- Region of Waterloo Official Plan (RWOP; 2015);
- Ontario Regulation 41/24: Prohibited Activities, Exemptions, and Permits under the *Conservation Authorities Act*, R.S.O. 1990, c. C.27. (2024);
- Provincial Planning Statement (MMAH; 2024);
- Provincial *Endangered Species Act* (ESA, 2007);

- *Fish and Wildlife Conservation Act* (2021 Consolidation of S.O. 1997, c. 41);
- *Migratory Birds Convention Act* (1994) and
- Federal *Fisheries Act* (2019).

The relevant portions of each of these, as they apply to the Subject Lands and the development potential are discussed in the following sections.

1.3.1. Township of North Dumfries Official Plan

The Township of North Dumfries Official Plan (NDOP) provides a policy framework to guide both public and private sector decisions regarding development, as well as the provision of community infrastructure and services.

According to Map 2 of the NDOP (2010) – *Planned Township Structure* – the eastern portion of the Subject Lands is designated as *Prime Industrial/Strategic Reserve (Un-serviced)*. This designation applies to the Highway 401/Regional Road 97 Employment Area, which is intended to support employment growth and business development, as outlined in Section 2.6.7 of the NDOP (2010).

The western portion of the Subject Lands is subject to multiple environmental and land use constraints:

- **Map 5A – Greenlands Network:** Identifies this area as containing *Core Environmental Features*.
- **Map 5B – Environmental Constraint Areas:** Designates this portion as an *Environmental Constraint Area*.
- **Map 5C – Hazard Lands:** Depicts this area as *Hazard Lands*.
- **Map 7:** Classifies this portion of the Subject Lands as *Prime Agricultural Area*.

As per Section 6.4 of the NDOP (2010), development is not permitted within Hazard Lands, and any site alteration proposed adjacent to these areas requires approval from the Grand River Conservation Authority (GRCA).

1.3.2. Region of Waterloo Official Plan

The Region of Waterloo Regional Official Plan (RWOP; 2015), outlines the goals, objectives, and policies to manage and direct physical land use change and its effects on the cultural, social, economic, and natural environment within the regional community.

According to the RWOP (2015), the western portion of the Subject Lands are designated as Core Environmental features as per Map 4 – Greenlands Network. As per **Section 7.C** of the RWOP, Core Environmental Features are those environmental features identified as being provincially significant or regionally significant. Development or site alteration is not permitted within Core Environmental Features, any application for development or site alteration will require the submission

of an EIS, to the satisfaction of the Region. Additionally, as per Map 7 – The Countryside of the RWOP, the Subject Lands are located within the Countryside and the western portion of the Subject Lands are considered Prime Agricultural Area. Lands within the Prime Agricultural Areas designation are limited to agricultural oriented lands uses.

The *Region of Waterloo Official Plan* (RWOP, 2015) outlines the goals, objectives, and policies to manage and direct physical land use change and its effects on the cultural, social, economic, and natural environment within the regional community.

According to the RWOP (2015), the western portion of the Subject Lands is designated as Core Environmental Features under Map 4 – Greenlands Network. As per **Section 7.C** of the RWOP**, Core Environmental Features** are environmental features identified as being provincially or regionally significant. Development or site alteration is not permitted within Core Environmental Features, except for:

- Forest, fish, or wildlife management and conservation;
- Flood or erosion control projects demonstrated to be in the public interest and for which no other alternative is feasible;
- Minot alterations to legal non-confirming land uses within Core Environmental Features;
- Infrastructure projects in accordance with Policies 7C.12 and 7.C.13; or
- Mineral aggregate operations in accordance with the policies in Chapter 9.

Any application for development or site alteration based on the conditions listed above must include an EIS to the satisfaction of the Region.

Additionally, according to Map 7 – The Countryside of the RWOP, the Subject Lands are located within the Countryside**.** The eastern portion of the Subject Lands is designated as Prime Agricultural Area, and is limited to agricultural-oriented land uses.

Woodlands that meet the criteria in accordance with the provisions of the Regional Woodland Conservation By-law 08-026 are also subject to a permit prior to removals. The Region's Tree Conservation By-law, applies to all natural forested areas that are at least one hectare or more in size with:

- 1,000 trees, of any size, per hectare;
- 750 trees, measuring over five centimetres in diameter, per hectare;
- 500 trees, measuring over 12 centimetres in diameter, per hectare;
- 250 trees, measuring over 20 centimetres in diameter, per hectare; or
- The by-law does not cover a cultivated fruit or nut orchard, or a plantation established for the purpose of producing Christmas trees.

1.3.3. Ontario Regulation 41/24: Prohibited Activities, Exemptions, and Permits

The GRCA is responsible for regulating development activities within areas described in Section 28 of the Conservation Authorities Act and Ontario Regulation 41/24, commonly referred to as Regulated Areas. These include:

- watercourses (including flood plains and meander belt);
- hazardous lands;
- wetlands (and adjacent lands up to 30 metres);
- river or stream valleys; and
- areas that are adjacent or close to the shoreline of the Great Lakes-St. Lawrence River System or to an inland lake and that may be affected by flooding, erosion or dynamic beach hazards.

Permission is required from GRCA for any work development within their regulated areas which include watercourses, flooding and erosion hazards and wetlands as well as regulated allowances adjacent to these features.

The GRCA Interactive Mapping interface shows that the Subject Lands contains a regulated watercourse on the southwestern side on the property, as well as two wetlands located on the northwestern and southeastern portions of the Subject Lands (**Figure 2**, **Appendix A**).

1.3.4. Provincial Policy Statement

The PPS (MMAH, 2024) provides direction on matters of provincial interest related to land use planning and development. It "…supports a comprehensive, integrated and long-term approach to planning…". The PPS is to be read in its entirety and land use planners and decision-makers need to consider all relevant policies and how they work together.

This report addresses those policies that are specific to Natural Heritage (section 2.1 of the PPS) with some reference to other policies with relevance to Natural Heritage and impact assessment considerations and areas of overlap (e.g., those related to Efficient and Resilient Development and Land Use Patterns, section 1.1; Sewage, Water and Stormwater, section 1.6.6; Water, section 2.2; Natural Hazards, section 5.2).

Eight types of significant natural heritage features are defined in the PPS, as follows:

- Significant wetlands;
- Significant coastal wetlands;
- Significant woodlands;
- Significant valleylands;
- Significant wildlife habitat (SWH);
- Fish habitat;
- Habitat of endangered and threatened species; and
- Significant areas of natural and scientific interest (ANSIs).

Development and site alteration shall not be permitted in significant wetlands, or in significant coastal wetlands. Development and site alteration shall not be permitted in significant woodlands, significant valleylands, SWH or significant ANSIs, unless it is demonstrated that there will be no negative impacts on the natural features or their ecological functions.

Development and site alteration shall not be permitted in the habitat of endangered and threatened species or in fish habitat, except in accordance with provincial and federal requirements. Development and site alteration may be permitted on lands adjacent to fish habitat provided it has been demonstrated that there will be no negative impacts on the natural feature or their ecological functions.

1.3.5. Ontario Endangered Species Act

The provincial Endangered Species Act (ESA), 2007 (Consolidation 2021) was developed to:

- Identify species at risk (SAR), based upon best available science;
- Protect SAR and their habitats and to promote the recovery of the SAR; and
- Promote stewardship activities that would support those protection and recovery efforts.

The ESA protects all threatened, endangered and extirpated species listed on the Species at Risk in Ontario (SARO) list (Government of Ontario 2007b). These species are legally protected from harm or harassment, and their associated habitats are legally protected from damage or destruction, as defined under the ESA.

1.3.6. Fish and Wildlife Conservation Act

The *Fish and Wildlife Conservation Act* outlines management of fishing, hunting, and trapping activities to protect and manage fish and wildlife populations. It also dictates the circumstances where wildlife may be kept in captivity, which is not applicable to this development application. Should any trapping or fishing in support of baseline, construction or post-construction activities be required, a permit will be needed from the Ministry Natural Resources and Forestry (MNRF). In addition, nests of non-migratory bird species are protected under the *Fish and Wildlife Conservation Act*, and best management practices would be required to be implemented during development activities to detect and avoid these nests.

1.3.7. Migratory Birds Conservation Act

This federal legislation protects the nests and offspring of listed migratory bird species from destruction or disturbance. In its application, it requires that best management practices be implemented to detect and avoid disturbance to active nests during development activities.

1.3.8. Fisheries Act

Fisheries and Oceans Canada (DFO) administers the federal *Fisheries Act*, 1985, which defines fish habitat as "water frequented by fish and any other areas on which fish depend directly or indirectly to carry out their life processes, including spawning grounds and nursery, rearing, food supply and migration areas" (s. 2(1)). The *Fisheries Act* prohibits the death of fish by means other than fishing (s. defined as "any temporary or permanent change to fish habitat that directly or indirectly impairs the habitat's capacity to support one or more life processes" (DFO 2019).

1.3.9. Migratory Birds Convention Act

This federal legislation protects the nests and offspring of listed migratory bird species from destruction or disturbance. In its application, it requires that best management practices be implemented to detect and avoid disturbance to active nests during development activities.

2. Summary of Data Collection Methods

2.1. Background Review

GEI reviewed existing background information to gather data on the Subject Land's existing natural heritage features included reported SAR and species of conservation concern in the area. Information sources reviewed included the following:

- Ministry of Natural Resources and Forestry's (MNRF) Natural Heritage Information Centre (NHIC) database (2024);
- MNRF's Land Information Ontario (LIO) database (2024);
- Bird Studies Canada's Atlas of the Breeding Birds of Ontario (BSC et al. 2007);
- Ontario Nature's Reptile and Amphibian Atlas (2020);
- Toronto Entomologists' Association's (TEA) Ontario Butterfly and Moth Atlases (2023, 2020);
- Fisheries and Oceans Canada's (DFO) Aquatic Species at Risk (SAR) Map (2024);
- West Humber River Fisheries Management Plan (MNR and TRCA, 2005); and
- Online Citizen Science databases (e.g., eBird).

The results of this review are briefly described in the following sections.

2.1.1. Natural Heritage Information Centre

The NHIC database (MNRF 2024) was searched for records of provincially significant plants, vegetation communities and wildlife on and in the vicinity of the Subject Lands. The database provides occurrence data by 1 km^2 area squares, with two squares overlapping at least a portion of the Subject Lands (17NH4397 and 17NH4396).

A total of six species were recorded in the atlas squares that overlap with the Subject Lands (although given the size of the atlas squares this does not necessarily imply these species have been recorded on or within 120 m of the Subject Lands), with the following species of interest noted:

- Species listed as Threatened or Endangered on the SARO list:
  - Eastern Meadowlark (*Sturnella magna*) – Threatened; and
  - Bobolink (*Dolichonyx oryzivorus*) – Threatened.
- Species listed as Special Concern on the SARO list or identified as an S1-S3 species:
  - Eastern Wood- Pewee (*Contopus virens*) – Special Concern; and
  - Barn Swallow (*Hirundo rustica*) – Special Concern.

Detailed investigations will confirm whether suitable habitat is present and/or if these species are present within the Subject Lands.

2.1.2. Ontario Breeding Bird Atlas

The Ontario Breeding Bird Atlas (OBBA) contains detailed information on the population and distribution status of Ontario birds (Cadman et al. 2007). The data is presented on 100 km^2 area squares with one squares overlapping a portion of the Subject Lands (17TNH49). It should be noted that the Subject Lands may be a small component of the overall bird atlas squares, and therefore it is unlikely that all bird species are found within the Subject Lands. Habitat type, availability and size are all contributing factors in bird species presence and use.

A total of 114 species were recorded in the atlas squares that overlap with the Subject Lands. The following species of interest are noted:

- Species listed as Threatened or Endangered on the SARO list:
    - Chimney Swift (*Chaetura pelagica*) – Threatened;
    - Least Bittern (*Botaurus exilis*) – Threatened;
    - Bank Swallow (*Riparia riparia*) – Threatened;
    - Cerulean Warbler (*Setophaga cerulea*) – Threatened;
    - Eastern Meadowlark – Threatened; and
    - Bobolink – Threatened.
- Species of Conservation Concern (i.e., listed as Special Concern on the SARO list, or identified as an S1-S3 species):
    - Blue-winged Teal (*Spatula discors*) – S3B;
    - Ruddy Duck (*Oxyura jamaicensis*) – S3B;
    - Common Gallinule (*Gallinula galeata*) – S3B;
    - American Coot (*Fulica americana*) – S3B;
    - Eastern Wood-Pewee – Special Concern;
    - Wood Thrush – Special Concern;
    - Barn Swallow (*Hirundo rustica*)- Special Concern; and
    - Grasshopper Sparrow (*Ammodramus savannarum*) – Special Concern.

2.1.3. Ontario Reptile and Amphibian Atlas Results

The Ontario Reptile and Amphibian Atlas contains detailed information on the population and distribution status of Ontario herpetofauna (Ontario Nature 2019). The data is presented on 100 km^2 area squares with one square overlapping the Subject Lands (17TNH49). It should be noted that the Subject Lands are a small component of the overall atlas square, and therefore it is unlikely that all herpetofauna species are found within the Subject Lands. Habitat type, availability and size are all contributing factors in herpetofauna species presence and use.

A total of 29 species were recorded in the atlas square that overlaps with the Subject Lands, of which eight a salamander species, nine are frog and toad species, four are turtle species and eight are snake species. Of these species, the following species is of interest were noted:

- Species listed as Threatened or Endangered on the SARO List:
    - Jefferson Salamander (*Ambystoma jeffersonianum*) – Endangered;

    - Unisexual Ambystoma (*Ambystoma laterale – texanum*) – Endangered;
    - Blanding's Turtle (*Emydoidea blandingii*) – Threatened; and
    - Queensnake (*Regina septemvittata*) – Endangered.
- Species of Conservation Concern (i.e., listed as Special Concern on the SARO List or identified as an S1–S3 species):
    - Snapping Turtle (*Chelydra serpentina*) – Special Concern; and
    - Northern Ribbonsnake (*Thamnophis saurita*) – Special Concern.

The last observations of the Queensnake occurred in 1988. Detailed investigations will confirm whether suitable habitat is present and/or if these species are present within the Subject Lands.

2.1.4. Ontario Butterfly and Moth Atlases Results

The Ontario Butterfly and Moth Atlases (Toronto Entomologists' Association 2020, 2023) contain detailed information on the population and distribution status of butterflies and moths in Ontario. The database provides occurrence data by 10 km x 10 km squares. The Subject Lands are located within the atlas square (17TNH49), which was used to determine a potential butterfly and moth species list for the area. The Subject Lands are a small component of the overall atlas square, and therefore all the butterfly and moth species listed for this atlas square may not be found within the Subject Lands. Habitat type, availability and size are all contributing factors in butterfly and moth species presence and use.

A total of 86 species including 69 butterfly species and 23 moth species were recorded in atlas square. Of these species, the following species is of interest were noted:

- Species of Conservation Concern (i.e., listed as Special Concern on the SARO List or identified as an S1–S3 species):
    - Black Dash (Euphyes conspicua) – S3;
    - Hackberry Emperor (Asterocampa celtis) – S3;
    - Tawny Emperor (Asterocampa clyton) – S3; and
    - Monarch (Danaus plexippus) – Special Concern.

Detailed investigations will confirm whether suitable habitat is present and/or if these species are present within the Subject Lands.

2.1.5. Aquatic SAR Distribution Mapping Results

The DFO Aquatic SAR Map (2025) was reviewed to identify any known occurrences of aquatic SAR, including fish and mussels, in the regulated watercourse located within the Subject Lands. No species of note were identified within the regulated watercourse. Critical Habitat of Silver Shiner (*Notropis photogenis*) and Black Redhorse (*Moxostoma duquesnei*) is found within Ninth River, located approximately 2.2 km southwest of the Subject Lands. These species are listed as Threatened in Ontario.

Detailed investigations will confirm whether suitable habitat is present and/or if these species are present within the Subject Lands.

2.1.6. Online citizen science databases

2.1.6.1. eBird

The eBird (2025) database is a large citizen science-based project with a goal to gather bird diversity information in the form of checklists of birds, archive it, and share it to power new data-driven approaches to science, conservation and education. As the observations can be submitted by anyone, and the records are not officially vetted, the data obtained from this tool should not be used as a clear indicator of species presence, and species may be filtered out based on habitat and target survey efforts.

This online database was examined to identify observations made within the Subject Lands. The following species of interest are noted:

- Species of Conservation Concern (i.e., listed as Special Concern on the SARO list, or identified as an S1-S3 species):
    - Barn Swallow - Special Concern.

2.1.6.2. iNaturalist

The iNaturalist (2025) database is a large citizen science-based identification and data collection app. It allows any citizen to submit observations to be reviewed and identified by other naturalists and scientists to help provide accurate species observations. As the observations can be submitted by anyone, and the records are not officially vetted, the data obtained from this tool should not be used as a clear indicator of species presence, and species may be filtered out based on habitat and target survey efforts.

No significant observations were recorded.

2.2. Ecological Field Investigations

The following ecological field investigations have been completed to inform this EIS:

- Ecological Lands Classification (ELC) and three-season botanical inventories (spring, summer, and fall);
- Breeding bird surveys (two rounds);
- Amphibian call count surveys (three rounds);
- Bat habitat survey (one survey) and acoustic survey (one survey);
- Headwater Drainage Feature Assessments (HDFA; three rounds); and
- Aquatic habitat assessment (one survey).

2.2.1. Botanical Inventory and Ecological Land Classification Methods

Vegetation communities were first identified on aerial imagery and then verified in the field where access was provided. Vegetation community types were confirmed, sampled and revised, if necessary, using the sampling protocol of the ELC for Southern Ontario (Lee at al. 1998). Vegetation communities of at least 0.5 ha in size were mapped; where appropriate, distinct communities smaller than this were also mapped. Where a suitable ELC classification code was not available in the 1998 manual, codes from the unpublished 2008 ELC 2nd Approximation (Lee, H. T. 2008) were used. Scientific names primarily follow nomenclature from the Database of Vascular Plants of Canada (Brouillet et al. 2010+). The provincial status of all plant taxa and vegetation communities is based on NHIC (2024; 2021).

2.2.2. Breeding Bird Survey Methods

Breeding bird surveys were conducted following protocols set forth by the Ontario Breeding Bird Atlas (Cadman et al., 1998; Cadman et al., 2007). Surveys were conducted between dawn and five hours after dawn with suitable wind conditions, no thick fog or precipitation (Cadman et al., 2007). Eight Point count stations were combined with area searches to help determine the presence, variety and abundance of bird species.

Point count stations were surveyed for 10 minutes for birds within 100 m and outside 100 m. All species recorded on a point-count were mapped to provide specific spatial information and were observed for signs of breeding behaviour. Surveys were conducted at least 10 days apart. No third survey was required if grassland breeding bird use could be confirmed in rounds 1 and 2, or where there was no habitat suitable for grassland breeding birds at the time. A third-round breeding bird survey is typically required to confirm whether grassland bird habitat may be present (including Bobolink and Eastern Meadowlark) unless the first and second round result in sufficient evidence to confirm breeding. Structures that appeared suitable for Barn Swallow nesting locations were examined during both rounds of the breeding bird surveys. These inspections were conducted to confirm breeding locations in the Subject Lands, particularly when individuals were noted in flight near potential nesting structures and no other evidence was observed.

Both the Natural Heritage Information Centre (NHIC 2024) database and the SARO list (O. Reg. 230/08) were reviewed to determine the current provincial status for each bird species.

2.2.3. Amphibian Call Count Survey Methods

These surveys followed standard protocols outlined in the Great Lakes Marsh Monitoring Program (BSC 2003). Survey station locations were determined through an assessment of orthophotography, existing vegetation communities and ground observations. A total of 5 stations were selected for survey within the Subject Lands. Call count station locations are shown on **Figure 4, Appendix A**.

Surveys were conducted on warm nights with little wind. Surveys commenced approximately 30 minutes after sunset and were completed before midnight. Typically, each station is surveyed three times (once in April, once in May and once in June) during optimal weather conditions (low wind levels, no heavy rain). Minimum night air temperatures at time of survey of 5°C, 10°C and 17°C are to be

applied to each of the respective survey periods. Visits should be at least 15 days apart as per protocols. If noise from plane, road traffic and/or trains was present, monitoring was delayed and began during a quiet period.

The stations were surveyed for three minutes, and a three-level call category system was used to identify the level and type of frog activity.

The standard call levels are:

1) Individual calls do not overlap and calling individuals can be discreetly counted;
2) Calls of individuals sometimes overlap but number of individuals can still be estimated; and
3) Overlap among calls seems continuous (full chorus) and a count estimate is impossible.

Anurans were recorded as "within the stations" if they were within 100 m. All other species were recorded as incidental records heard outside the stations. The provincial and global statuses of species identified on the Subject Lands were obtained from the Natural Heritage Information Centre (NHIC 2024) and the SARO list.

2.2.4. Bat Habitat Assessment

Two types of bat surveys were completed within the Subject Lands to determine (1) whether candidate habitat may be present to support SAR and SWH bat species and (2) what bat species are using these candidate habitats. Bat acoustic surveys were targeted within areas where high densities of candidate bat habitat (snags) were recorded and/or in wooded habitats.

Bat Habitat Assessment

As of January 31, 2025, seven bat species are listed on the SARO list as Endangered: Eastern Small-footed Myotis (*Myotis leibii*), Little Brown Myotis (*Myotis lucifugus*), Tri-coloured Bat (*Perimyotis subflavus*), Northern Myotis (*Myotis septentrionalis*), Eastern Red Bat (*Lasiurus borealis*), Horay Bat (*Lasiurus cinereus*), and Silver-haired Bat (*Lasionycteris noctivagans*). The habitat for these species is protected under the Endangered Species Act, 2007 (ESA).

Bat Maternity Colonies for Big Brown Bat (Eptesicus fuscus) and Silver-haired Bat are an indicator of SWH to be considered under the PPS (MMAH 2024).

The SWH Criteria Schedules for Ecoregion 6E (MNRF 2015) and the Significant Wildlife Habitat Technical Guide (MNR 2000) consider deciduous and mixed forests and swamps (i.e., ELC communities FOD and SWD) that include trees at least 25 cm diameter-at-breast-height (DBH) potentially suitable bat maternity colony habitat. With respect to SAR bats, coniferous, deciduous or mixed wooded ecosites, including treed swamps and cultural woodlands, that includes trees at least 10 cm DBH should be considered suitable maternity roost habitat. Habitat assessments were also completed along hedgerows as recent correspondence with MECP suggests that they consider any treed areas potentially suitable for SAR bats.

One bat habitat assessment survey was completed during leaf-off season using a transect approach. All trees greater than or equal to 10 cm DBH were visually inspected using binoculars to document any cavities that may or may not be present along the trunk or large branches. Each tree containing suitable cavities or peeling bark (preferred by the Tri-coloured Bat), had the following information recorded: UTM, species, DBH, height class, and snag attributes (i.e., peeling bark, decay class, presence of cavities, etc.).

Bat Acoustic Monitoring

Survey methods were developed based on professional experience and using a combination of MNR survey guidelines as outlined in "Bats and Bat Habitats: Guidelines for Wind Power Projects (MNR 2011)", "MNRF Survey Protocols for Species at Risks Bats within Treed Habitats: Little Brown Myotis, Northern Myotis, and Tri-Coloured Bat (20)" and MECP's Maternity Roost Surveys (Forest/Woodlands) briefing note (2022). Surveys to detect bat species were carried out in June 2024 and were completed using Wildlife Acoustics Song Meter SM4BAT recording devices over a duration of ten consecutive evenings.

The locations of acoustic detectors were positioned in areas where high density of candidate bat habitat (snags) was identified and/or within candidate to representatively cover the Subject Lands.

Passive acoustic recorders were programmed to begin recording at sunset and to end recording at sunrise. In addition, the SM4BAT passive recorder microphones were elevated approximately 2 m above the ground to reduce background noise and echo. All ultrasonic recordings were filtered to eliminate recordings with high levels of noise or with no bat calls and then further analyzed using SonoBat's auto-classification tool. Any calls with a positive identification were manually vetted by a wildlife ecologist with training in bat species identification by sonogram.

All species of bats can make calls that range in frequencies and sonogram characteristics, depending on the behaviour at the time of call recording (i.e., social calls, foraging calls, feeding buzzes). Calls recorded during a bat's search phase are the most reliable for an accurate species identification, and these calls were used preferentially to identify recorded species from the Subject Lands.

Calls can be classified as not identifiable by the program due to the high level of confidence needed when classifying recordings, quality of the calls, overlap of multiple bat calls and/or too much environmental background noise. High frequency calls that were not identifiable to species were manually reviewed by a wildlife ecologist with training in bat species identification by sonogram to identify those calls with characteristics of SAR bats (i.e., calls with frequencies greater than 40kHz).

2.2.5. Headwater Drainage Feature Assessment Methods

All drainage features within the Subject Lands were reviewed to determine whether they should be classified as watercourses or headwater drainage features (HDFs). The assessment was primarily based on the definition of "watercourse" from O. Reg. 41/24 (Prohibited Activities, Exemptions and Permits)

under the Conservation Authorities Act, which defines a watercourse as “a defined channel, having a bed and banks or sides, in which a flow of water regularly or continuously occurs”. Per the requirements of the HDFA Guidelines, GEI completed three site visits to assess HDFs on the Subject Lands within early spring, late spring and summer.

Where drainage features were identified as HDFs (i.e., features without a defined channel with bed and banks or sides) they were evaluated using the CVC and TRCA’s 2014 “Evaluation, Classification and Management of Headwater Drainage Features Guidelines” (herein referred to as the HDFA Guidelines). These evaluations include a management recommendation based on criteria created by the HDFA Guidelines and were summarized in a table for easy reference.

It is important to acknowledge that as with any guidelines, the HDFA Guidelines are intended to have flexibility to best reflect additional considerations regarding the site-specific nature of features, such as historical straightening for agricultural purposes, impairment related to surrounding agriculture, the replication of Redside Dace contributing habitat functions and compatibility with land uses. As such, there are situations where recommendations are made for an alternative management recommendation based on site specific understanding of these additional factors. Where recommendations vary from the HDFA Guideline, additional rationale is provided. All management recommendations are based off of GEI’s technical experience.

2.2.6. Aquatic Assessment Methods

Aquatic Habitat Assessment (AHA) was completed in 2024 for the drainage features located within the Subject Lands to help assess their ecological value. The AHA consisted of a visual survey of existing in-stream and riparian habitat conditions along and adjacent to the features.

The assessment will record the following information:

- Hydrology (e.g., flowing or standing water);
- General watercourse morphology;
- Wetted width;
- Water temperature;
- Bed substrate;
- Instream habitat (e.g., woody debris, aquatic vegetation, undercut banks);
- Presence of obstructions to fish movement (e.g., culverts, debris dams);
- Evidence of groundwater inputs (e.g., seeps or springs, iron flocculation/staining); and
- Riparian habitat.

The purpose of completing an AHA is to understand whether fish habitat may be present, and if so, understand the availability of spawning, rearing, feeding, resting and overwintering area would be present.

3. Environmental Setting and Characteristics

3.1. Physical Environment

The Subject Lands are generally located within an agricultural area; with the exception of an industrial truck yard located east adjacent to the Subject Lands.

The Subject Lands are located in the broad physiographic region known as the Waterloo Hills and is comprised of Kame Moraines (Chapman and Putnam, 1984).

Geotechnical and hydrogeological investigations were completed by MTE Consultants Inc., (MTE). As summarized within MTE's Geotechnical Investigation (2024), the Subject Lands are underlain by glaciofluvial outwash deposits consisting of sand and gravel. Superficial geology beneath the northern portion of the Subject Lands was determined to be sand deposits while the southern portion of the Subject Lands consisted of gravel deposits. Borehole findings from their investigations found, fill material ranging from depths of 0.1 to 0.4 m, followed by a mixture of native sands and glacial tills. Based on OGS mapping, bedrock in the area is a part of the Salina formation and consists of limestone, dolostone, shale, and sandstone, and is generally be found at a depth of approximately 84 m below ground surface throughout the Subject Lands.

MTE's Hydrogeological Investigation (2024) identified that the groundwater elevation ranged on site between 307.7 m amsl to 305.2 m amsl with a suggested flow direction southwesterly towards Eden Creek.

3.2. Biological Environment

The Subject Lands occur within the Great Lakes-St. Lawrence Forest Zone, which corresponds to Ecoregion 6E as designated by the Province. This ecoregion represents a transitional zone between the deciduous forests of the south and the boreal forests to the north, resulting in a diverse mix of tree species. Dominant upland forest communities in this region include a combination of broadleaved and coniferous species, such as Sugar Maple (*Acer saccharum*), Red Oak (*Quercus rubra*), American Beech (*Fagus grandifolia*), Eastern Hemlock (*Tsuga canadensis*), White Pine (*Pinus strobus*), and Yellow Birch (*Betula alleghaniensis*) (Rowe, 1972). The relatively moderate climate and varied topography of Ecoregion 6E support a rich assemblage of flora and fauna, making it a key component of Ontario's natural heritage.

Figure 2 (**Appendix A**) depicts the broader landscape and potential movement and linkage corridors surrounding the Subject Lands for abiotic and biotic movement of organisms, matter and energy. As previously noted, the Subject Lands were are located within a primarily agricultural landscape. North, south, and west of the Subject Lands are a mixture of agricultural and vacant fields, while east of the Subject Lands is a industrial property. Highway 401 is located south adjacent of the Subject Lands, which would act as a barrier to movement within the landscape for terrestrial species.

A tributary to Eden Creek appears to traverse the southernmost part of the Subject Lands, exciting the Subject Lands on the south western most portion and travelling west through agricultural fields to connect with Eden Creek.

Nearby road networks are assumed to facilitate the localized movement of small to medium sized wildlife (e.g., amphibians, reptiles, small to medium sized mammals, fish) provided that there are no perched or blocked culverts.

3.3. Terrestrial Ecology

3.3.1. Vegetation Communities

The vegetation surveys consisted of spring, summer, and fall vascular plant inventories, and the application of the Ecological Land Classification (ELC) system. The purpose of these surveys was to document natural and anthropogenic vegetation features on the Subject Lands and determine their provincial and local significance.

SURVEY TYPE	DATE	TIME
Spring Botanical Inventory & Preliminary ELC	May 29, 2024	12:00 to 4:30
Summer Botanical Inventory and ELC	July 22, 2024	9:30 to 4:30
Fall Botanical Inventory & ELC Refinements	September 18, 2024	10:00 to 3:00

3.3.2. Vascular Plants

Botanical inventories completed on the Subject Lands recorded a total of 228 species (i.e., taxa, inclusive of subspecies, varieties, and hybrids). Of these, 68% are native to Ontario and 32% are exotic. Most of the native plants (92%) are ranked S5 (secure in Ontario), while 12 species (8%) are ranked S4 (apparently secure in Ontario). A complete list of species documented from the Subject Lands is provided in **Table 3** (**Appendix B**).

3.3.2.1. Species at Risk Plants

Species at Risk (SAR) have an assigned designation (e.g., Endangered) based on assessments by the Committee on the Status of Species at Risk in Ontario (COSSARO) and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Species designated as extirpated, endangered or threatened are protected under section 9(1)(a) of the Endangered Species Act (ESA, 2007). Species listed as special concern (and their associated habitat) are not protected under the ESA.

GEI field surveys confirmed the presence of one Species at Risk plant on the Subject Lands:

- Black Ash (*Fraxinus nigra;* S4; Endangered). A single tree was observed along the edge of the cattail / bur-reed organic shallow marsh (MAS3-1/MAS3-7). The tree, located along the west edge of the Subject Lands, was young and in poor health.

An NHIC search was completed for the Subject Lands using the MNRF Make a Map: Natural Heritage Areas mapping application. Results of this search show that no rare or protected plants have been historically documented on or adjacent to the Subject Lands.

3.3.2.2. Provincially Rare Plants

In addition to Species at Risk, the NHIC maintains a database of all known distributions of rare plants in Ontario (i.e., species with S-ranks of S1 (critically imperiled), S2 (imperiled) or S3 (vulnerable)). These plants are generally known from fewer than 80 populations in the province (Oldham et al., 2009).

No provincially rare plants were observed during field surveys.

3.3.2.3. Locally Rare Plants

Local plant rarity is generally based on the number of population occurrences for a given area. Based on the species list for Waterloo Region (Richardson et al. 1999), GEI documented nine regionally rare plants.

- Common Hackberry (*Celtis occidentalis;* R*)
  - Infrequent in the Fresh – Moist Sugar Maple – Hardwood Deciduous Forest (FOD6-5)
- Black Walnut (*Juglans nigra*; R+*)
  - Infrequent in the Dry - Moist Old Field Meadow (CUM1-1)
- Large-Thorned Hawthorn (*Crataegus macracantha*; R*)
  - Occasional in the Mineral Cultural Woodland (CUW1a)
- Common Prickly-Ash (*Zanthoxylum americanum*; R*)
  - Infrequent in the Mineral Cultural Woodland (CUW1b)
- Eastern Cottonwood (Populus deltoides ssp. deltoides; R+)
  - Infrequent in the Dry - Moist Old Field Meadow (CUM1-1)
- Northern Watermeal (*Wolffia borealis*; R*)
  - Occasional in the Cattail / Burreed Organic Shallow Marsh (MAS3-1 / MAS3-7) and abundant in the Duckweed Mixed Shallow Aquatic (SAM1-2)
- Columbia Watermeal (*Wolffia Columbiana*; R*)
  - Occasional in the Cattail / Burreed Organic Shallow Marsh (MAS3-1 / MAS3-7) and abundant in the Duckweed Mixed Shallow Aquatic (SAM1-2)
- Short-beaked Sedge (*Carex brevior*; R)
  - Small population in the residential backyard
- Burreed Sedge (*Carex sparganioides*; R*)
  - Small population in the residential backyard
  - Infrequent in the Fresh – Moist Sugar Maple – Hardwood Deciduous Forest (FOD6-5)

The rarity codes are defined as:

R = Rare in the Regional Municipality of Waterloo.

R+ = Significant but only if demonstrably indigenous; most populations in Waterloo are thought to be of non-indigenous origin.

R* = Significant but future distribution monitoring may demonstrate the species is too common to be considered rare.

3.3.2.4. Potentially Sensitive Plants

Potential sensitivity of native plants is determined based on coefficient of conservatism (CC) values, as assigned by Oldham et al. (1995). This CC value, ranging from 0 (low) to 10 (high), is based on a species tolerance of disturbance and/or fidelity to a specific natural habitat. Species with a low CC value tend to have little or no fidelity to pristine or unique natural ecosystems and can be found in a variety of natural or anthropogenic habitats. Species with a CC value of 9 or 10 have the highest sensitivity to habitat alteration as they tend to have a consistent fidelity to high-quality or unique ecosystems.

No potentially sensitive plants were documented on the Subject Lands.

3.3.2.5. Invasive Species

Invasive plants are those that can become (or presently are) a serious problem within a defined location. These plants reproduce and spread aggressively, reducing the local biodiversity and threatening ecological function. Depending on existing conditions, some invasive species can outcompete all other species.

Urban Forest Associates (2002) provides a categorical ranking system for plants known to be invasive in southern Ontario. Of the 73 exotic species observed on the Subject Lands, 10 are ranked as Category 1 by Urban Forest Associates.

Category 1 plants are deemed to be the most invasive and can dominate a site indefinitely. These are a threat to natural areas wherever they occur because they have very effective reproduction and dispersal mechanisms. The 10 Category 1 plants observed on the Subject Lands are:

- Canada Thistle (*Cirsium arvense*);
- Dame's Rocket (*Hesperis matronalis*);
- Showy Fly Honeysuckle (*Lonicera* x *bella*);
- Garlic Mustard (*Alliaria petiolata*);
- Purple Crown-Vetch (*Securigera varia*);
- White Mulberry (*Morus alba*);
- Glossy Buckthorn (*Frangula alnus*);
- European Buckthorn (*Rhamnus cathartica*);
- Manitoba Maple (*Acer negundo*); and
- European Reed (*Phragmites australis ssp. australis*).

3.3.3. Ecological Land Classification

The Subject Lands consist of rolling upland, tableland, and bottomland topographic features. The rolling upland and bottomland features contain primarily natural vegetation communities, while most of the tablelands are actively farmed. Twelve ELC community types were documented and classified to vegetation type, while one was classified to ecosite (i.e., Mineral Cultural Woodland); ecosite codes were generally used where the species assemblage did not match any available vegetation type codes.

ELC mapping of the Subject Lands is shown on **Figure 3** (**Appendix A**). A description of each ELC type is provided in **Table 2** (**Appendix B**). No provincially rare vegetation communities were present on the Subject Lands (NHIC, 2021).

3.3.4. Wetlands

Identification of wetlands generally relies on the '50/50 rule', where features having over 50% relative cover of wetland plants are classified as wetland. Based on this, wetland is present on the Subject Lands, collectively occupying approximately 3 ha. These consisted of five wetland types:

- Meadow Marsh;
- Shallow Marsh;
- Shallow Aquatic;
- Thicket Swamp; and
- Deciduous Swamp.

The boundaries of each wetland were delineated based on a combination of ground verification spot checks and imagery interpretation. Wetlands were also noted on adjacent lands, some of which were contiguous with wetland on the Subject Lands.

The Land Information Ontario (LIO) database was accessed to determine if any MNR-identified wetlands have been mapped on or in the vicinity of the Subject Lands. Such wetlands could include Provincially Significant Wetlands (PSW), MNR evaluated wetlands (i.e., non-PSW), or unevaluated wetlands. Results show that two unevaluated wetland units identified by the MNR overlap with the Subject Lands, occupying approximately 2.7 ha. These wetlands generally overlap with wetlands identified by GEI. The wetland boundaries mapped by GEI should be used for constraints mapping since they are based on current, ground verified observations.

3.3.5. Wildlife

3.3.5.1. Breeding Bird Surveys

Two rounds of Breeding Bird Surveys (BBS) were completed in 2024 within the Subject Lands. All species observed on the Subject Lands are listed in **Table 4** (**Appendix B**), and all stations are illustrated on **Figure 4** (**Appendix A**).

A total of 30 bird species was observed within the Subject Lands. Of this total, one species is confirmed, 15 are probable, and 11 are possible breeders on the Subject Lands. The remaining three bird species are considered non-breeders, flyovers, or migrants. No additional species were observed only on surrounding lands within 120 m. The observed breeding bird species are discussed in the sections below.

A total of 27 (100 %) of the confirmed, probable, or possible breeders are provincially ranked S5 (common and secure), S4 (apparently common and secure) or SNA (species not native to Ontario). No bird species are considered provincially rare (S1-S3; NHIC 2024).

The following Species at Risk were observed on the Subject Lands:

- **Eastern Wood Pewee ; Special Concern in Ontario;** probable breeding evidence was observed at point count 2. Singing males in suitable breeding habitat were observed over seven days apart in the same location indicating probable breeding according to the Ontario Breeding Bird Atlas protocols of breeding evidence.
- **Barn Swallow; Special Concern in Ontario;** up to three foraging individuals flying over the open row crop were observed during surveys. No suitable structures for nesting were detected during field visits and therefore no breeding evidence was present on the Subject Lands.

3.3.5.2. Amphibian Call Count Surveys

A total of three amphibian species were heard calling within the Subject Lands during the three rounds of call count surveys (**Table 7**, **Appendix B**). Station locations are shown on **Figure 4** (**Appendix A**). The species heard calling were the American Toad (*Anaxyrus americanus*), Gray Treefrog (*Hyla versicolor*), and Green Fog (*Lithobates clamitans*). All of these species are provincially ranked S5 (common and secure) or S4 (apparently common and secure).

3.3.5.3. Bat Habitat and Acoustic Surveys

Bat Habitat Assessments

Bat habitat assessments are used to determine whether identified features are to be considered candidate SWH, or if the habitat provides conditions favourable for SAR bats. The presence of snags is considered an indicator of high-quality bat maternity roost habitat, and these surveys are required as the first step in confirming presence of bat maternity colony SWH (as per the PPS). Snags may also indicate the presence of high-quality SAR bat habitat.

As previously discussed, the majority of treed features within the Subject Lands are to be retained. The forested ecosites to be retained are assumed to provide suitable habitat for both bat maternity SWH and SAR bat habitat due to their classification as forest ELC communities (e.g., CUW, FOD, SWD) and their connectivity within the landscape.

All treed vegetation within the draft development footprint was assessed in the field for the presence of bat habitat, including all hedgerows. The location of candidate snags were identified, and the results of the qualitative assessment are presented in **Table 5** (**Appendix B**).

With respect to bat maternity colony SWH, only Polygon A (associated with the CUW1b vegetation community) meets the density to be considered candidate SWH minimum density criteria for significance (>10 suitable roosting trees/ha), however, this vegetation communities are not considered habitat under SWH guidelines based on the ELC ecosite code (MNRF 2015). All other surveyed areas did not meet the requirements to support bat SWH.

The presence of suitable snags within the surveyed vegetation communities suggests that there is candidate habitat for SAR bat habitat within the Study Area. Acoustic monitoring was recommended to confirm presence/absence of these species to inform requirements under the Endangered Species Act. These acoustic results are summarized further below.

Bat Acoustic Monitoring

A total of three bat acoustic recorders were deployed throughout the Subject Lands (as shown on **Figure 4**, **Appendix A**).

Five bat species were confirmed to be present within the woodlands: Big Brown Bat, Silver-haired Bat, Hoary Bat, Eastern Red Bat, and Eastern Small-footed Myotis . During 30 detector evenings of acoustic surveys, a total of 657 calls were recorded.

Of the 657 calls that were identifiable to species, 329 were Big Brown Bat, 142 were Silver-haired Bat, 98 were Hoary Bat, 3 were Eastern Red Bat, and 1 was Eastern Small-footed Myotis (**Table 6**, **Appendix B**). An additional 1 call with Myotis characteristics (i.e., calls with frequencies greater than 40 kHz) was also recorded.

The Eastern Small-footed Myotis, Silver-haired Bat, Hoary Bat, and Eastern Red Bat are listed as Endangered on the SARO List. A total of one recording of Eastern Small-footed Myotis was detected at station CD-03. A total of 99 recordings of Silver-Haired Bat were detected at station CD-01, 15 recordings at station CD-02, and 28 recordings at station CD-03. A total of 43 recordings of Hoary Bat were detected at station CD-01, four recordings at station CD-02, and 51 recordings at station CD-03. A total of three recording of Eastern Red Bat was detected at station CD-03. These are all relatively low call abundances, and while numbers of calls recorded do not necessarily correspond to numbers of individuals, it can be assumed the overall abundance of each species is low given that these calls were recorded over ten consecutive evenings.

3.3.5.4. Incidental Wildlife Observations

All incidental wildlife observations are included within the Master Wildlife Table (**Table 7, Appendix B**). All incidental wildlife observations are common and secure or apparently common and secure species (S5 or S4).

Twenty-Four Midland Painted Turtles were documented within the open water community located within the Subject Lands during Bat Habitat Surveys. This species is common and secure within Ontario.

3.4. Aquatic Ecology

The Subject Lands are contained within Grand River watershed and Nith River subwatershed. The Nith River subwatershed is 112,800 ha in size and occupies approximately 17% of the overall Grand River watershed.

3.4.1. Watercourses

A single watercourse (WC1) (**Figure 4, Appendix A**) is mapped to occur along the southern boundary of the Subject Lands. This feature is ephemeral in nature, flowing only during the early spring and after significant melt or rain-based events. WC1 held only isolated pockets of water by late spring and was completely dry at the time of the summer inspection.

GRCA regulation mapping indicates this feature to be an isolated channel. The regulation limit of WC1 extends from the western edge of the Subject Lands along the southern boundary of site, connecting beneath Hwy 401 through a culvert. WC1 is connected to two online ponds within 150 m of its intersection with Hwy 401, at which point the feature is no longer regulated. Although regulation mapping does not extend beyond the western limit of the Subject Lands, historic aerial imagery and MNRF mapping indicate a potential seasonal connection between WC1 and Eden Creek. This potential connection would best be described as an ephemeral headwater swale, as the neighboring property is seasonally cropped over. Eden Creek occurs approximately 750 m to the west of the Subject Lands.

WC1 is characterized by a moderately defined bed and banks within the woodland community, however, no channel definition is present within the MAS2-1/SWT2-2 wetland community along the southern boundary of site. Flow within this wetland community is conveyed overland through a dense community of Narrow-leaved Cattail (*Typha angustifolia*). Given its ephemeral nature and lack of a navigable connection to permanent features, WC1 is considered contributing fish habitat to occupied reaches downstream.

3.4.2. Headwater Drainage Features

Ahead of conducting the site visit, GEI completed a desktop review to identify locations of potential headwater drainage features. This was completed through an ArcGIS mapping exercise using available LiDAR data to determine where potential flow paths may be located within the landscape based on topographic relief. Several potential flow paths were identified given the high level of sensitivity that was used to generate the mapping. Using this generated mapping, the entire site was reviewed in the field to determine whether drainage features were present.

A single headwater drainage feature (HDF) was confirmed to be present on the Subject Lands (**Figure 3, Appendix A**). H1S1 is located within the center of the property along the eastern side of pond, this feature was identified to convey overland flow from the edge of the woodland community into the pond. H1S1 is largely contained within a deciduous swamp community (SWD3-2) and represents contributing fish habitat to direct reaches downstream. The feature was flowing at the time of the first assessment, held isolated pooling at the time of the second assessment, and was dry during the final assessment.

HDF management recommendations were decided upon utilizing Part Three of the HDF Guidelines (CVC and TRCA 2014). This section of the Guidelines provides guidance in linking the habitat classification information with the proposed management approach for each HDF. The guidelines and information collected from the surveys were utilized to determine management recommendations.

Per the HDFA Guidelines, H1S1 was identified with a recommended management approach of Conservation (**Table 9, Appendix B**).

- Conservation
    - Maintain, relocate, and/or enhance drainage feature and its riparian zone corridor;
    - If catchment drainage has been previously removed or will be removed due to diversion of stormwater flows, restore lost functions through enhanced lot level controls (i.e. restore original catchment using clean roof drainage), as feasible;
    - Maintain or replace on-site flows using mitigation measures and/or wetland creation, if necessary;
    - Maintain or replace external flows, Use natural channel design techniques to maintain or enhance overall productivity of the reach;
    - Drainage feature must connect to downstream.

4. Analysis of Ecological and Natural Heritage Significance

Eight types of natural features are identified in the PPS (MMAH 2024):

- Significant wetlands;
- Significant coastal wetlands;
- Significant woodlands;
- Significant valleylands;
- SWH;
- Fish habitat;
- Habitat of endangered and threatened species; and
- Significant ANSIs.

The presence/absence of these natural features on the Subject Lands are discussed in the subsequent sections of this EIS. The NHRM (MNR 2010), NDOP (2018 Consolidation), RWOP (2015 Consolidation) and O. Reg. 41/24 were referenced to assess the potential significance of other natural features, and their associated forms and functions on the landscape. Where natural features are present on the Subject Lands, their sensitivities are discussed.

4.1. Significant Wetlands

Within Ontario, significant wetlands are identified by the MNRF or by their designates. Other evaluated or unevaluated wetlands may be identified for conservation by the municipality or the conservation authority.

There are no Provincially Significant Wetlands (PSW) identified on or within the general vicinity of the Subject Lands.

4.1.1. Unevaluated Wetlands

A Cattail Mineral Meadow Marsh/Willow Mineral Thicket Swamp (MAS2-1/SWT2-1) is in the southeast corner of the Subject Lands near Highway 401. A Reed-Canary Grass Mineral Meadow Marsh (MAM2-2) is in the southwest portion, while a Silver Maple Mineral Deciduous Swamp (SWD3-2) located just south of the open water community.

4.2. Significant Coastal Wetlands

Similar to significant wetlands, the MNRF or their designates identify significant coastal wetlands present on the landscape. Coastal wetlands are defined in the NHRM (MNR 2010) as:

a) “any wetland that is located on one of the Great Lakes or their connecting channels (Lake St. Clair, St. Mary’s, St. Clair, Detroit, Niagara and St. Lawrence Rivers); or

b) Any other wetlands that is on a tributary to any of the above-specified water bodies and lies, either wholly or in part, downstream of a line located two km upstream of the 1:100-year floodplain (plus wave run-up) of the large water body to which the tributary is connected."

No significant coastal wetlands were identified within the vicinity of the Subject Lands.

4.3. Significant Woodlands

Significant woodlands are identified by the planning authority in consideration of criteria established by the MNRF. Under the NHRM (2010), woodlands are defined as:

"...treed areas that provide environmental and economic benefits to both the private landowner and the general public, such as erosion prevention, hydrological and nutrient cycling, provision of clean air and the long-term storage of carbon, provision of wildlife habitat, outdoor recreational opportunities, and the sustainable harvest of a wide range of woodland products. Woodlands include treed areas, woodlots or forested areas and vary in their level of significance at the local, regional and provincial levels."

Significant woodlands are defined by the Region of Waterloo OP in **Section 7.C.6** as areas that meet all of the following criteria:

(a) greater than four hectares in size, excluding any adjoining hedgerows;
(b) consisting primarily of native species of trees; and
(c) meets the criteria of a woodland in accordance with the provisions of the Regional Woodland Conservation By-law.

The boundary of a Significant Woodland may be more precisely delineated, subject to Policy 7.A.6, to exclude plantations of primarily non-native species, small lobes and projections, and low-quality wooded habitat on the periphery of the feature, the removal of which does not create an adverse environmental impact on the residual woodland."

The woodland communities on the Subject Lands meet all three criteria defined within the regional OP, and therefore, are identified as candidate significant woodland. Further studies are required to determine basal area and continuity of the woodland feature in accordance with the Waterloo Woodland Conservation Bylaw, which may result in further refinement to the candidate feature.

4.4. Significant Valleylands

Significant Valleylands should be defined and designated by the planning authority. General guidelines for determining significance of these features are presented in the NHRM (MNR 2010) for Policy 2.1 of the PPS. Recommended criteria for designating Significant Valleylands include prominence as a distinctive landform, degree of naturalness, and importance of its ecological functions, restoration potential, and historical and cultural values.

No Significant Valleylands are identified on or within 120 m of the Subject Lands.

4.5. Significant Wildlife Habitat

SWH is one of the more complex natural heritage features to identify and evaluate. There are several provincial documents that discuss identifying and evaluating SWH including the NHRM (MNR 2010), the Significant Wildlife Habitat Technical Guide (MNR 2000), and the SWH Eco-Region Criterion Schedule (MNRF 2015). The Subject Lands are located in Eco-Region 6E and were therefore assessed using the 6E Criterion Schedule (MNRF 2015).

There are four general types of SWH:

- Seasonal concentration areas;
- Rare or specialized habitats;
- Habitat for species of conservation concern; and
- Animal movement corridors.

General descriptions of these types of SWH are provided in the following sections.

Seasonal Concentration Areas

Seasonal concentration areas are those sites where large numbers of a species gather together at one time of the year, or where several species congregate. Seasonal concentration areas include deer yards; wintering sites for snakes, bats, raptors and turtles; waterfowl staging and molting areas, bird nesting colonies, shorebird staging areas, and migratory stopover areas for passerines or butterflies. Only the best examples of these concentration areas are usually designated as SWH.

Candidate bat maternity colony for Big Brown Bat *(Eptesicus fuscus)* and Silver-haired Bat / may be present associated with the FOD communities on the Subject Lands. However, habitat is proposed to be retained with a 10m buffer and will not be directly affected by the proposed development.

Candidate turtle overwintering areas may be present within the SAM1-2 community on the Subject Lands. During early bat habitat surveys, 24 Midland Painted Turtles were incidentally observed, meeting SWH criteria and eliminating the need for targeted surveys. Additionally, this feature is being retained and will not directly be affected by the proposed development.

Rare or Specialized Habitats

Rare and specialized habitat are two separate components. Rare habitats are those with vegetation communities that are considered rare in the province. SRANKS are rarity rankings applied to species at the ‘state’, or in Canada at the provincial level, and are part of a system developed under the auspices of the Nature Conservancy (Arlington, VA). Generally, community types with SRANKS of S1 to S3 (extremely rare to rare-uncommon in Ontario), as defined by the NHIC (2024), could qualify. It is to be assumed that these habitats are at risk and that they are also likely to support additional wildlife species that are considered significant. Specialized habitats are microhabitats that are critical to some wildlife species. The NHRM (MNR 2010) defines specialized habitats as those that provide for species with highly specific habitat requirements, areas with exceptionally high species diversity or community diversity, and areas that provide habitat that greatly enhances species’ survival.

Candidate waterfowl nesting habitat may be present associated with the SAM community on the Subject Lands. However, habitat is proposed to be retained with a 10m buffer and will not be directly affected by the proposed development.

Candidate turtle nesting areas may be present associated with the MAS and SAM communities on the Subject Lands. However, habitat is proposed to be retained with a 30m buffer and will not be directly affected by the proposed development. It is noted that Snapping Turtle nesting evidence was observed within the agricultural field located within the northwestern portion of the Subject Lands, agricultural land is not considered SWH.

Habitat for Species of Conservation Concern

Species of conservation concern include those that are provincially rare (S1 to S3), provincially historic records (SH) and Special Concern species. Several specialized wildlife habitats are also included in this SWH category, including Terrestrial Crayfish habitat, and significant breeding bird habitats for marsh, open country and early successional bird species.

Habitats of species of conservation concern do not include habitats of endangered or threatened species as identified by the ESA (2021 Consolidation). Endangered and threatened species are discussed in **Section 4.7**.

Marsh Bird Breeding Habitat SWH is present on the Subject Lands in association with the SAM community. A Trumpeter Swan *(Cygnus buccinator)* was observed to be nesting, however, this feature will be retained and will not be directly affected by the proposed development.

The following Species of Conservation Concern were identified on the Subject Lands:

- Eastern Wood-pewee SWH is present on the Subject Lands in association with the wooded vegetation communities Singing males in suitable breeding habitat were observed over seven days apart in the same location (PC2) indicating probable breeding according to the Ontario Breeding Bird Atlas protocols of breeding evidence.

The following candidate Species of Conservation Concern for wildlife may be present on Subject Lands within the retained features:

- Northern Ribbonsnake (Thamnophis saurita);
- Snapping Turtle (Chelydra serpentina);
- Black Dash (Euphyes conspicua);
- Tawny Emperor (Asterocampa clyton); and
- Hackberry Emperor (Asterocampa celtis).

Candidate suitable habitat that may be present within the retained features will not be directly be affected by the proposed development. Additionally, a 10 m buffer will be established following the wooded vegetation communities limits.

Animal Movement Corridors

Animal movement corridors are areas that are traditionally used by wildlife to move from one habitat to another. This is usually in response to different seasonal habitat requirements, including areas used by amphibians between breeding and summer/over-wintering habitats, called amphibian movement corridors.

As neither deer wintering areas nor significant amphibian breeding habitat were identified on or within 120 m of the Subject Lands, this SWH type is not present.

SWH Summary

- Table 10 (**Appendix B**) assesses all types of SWH relevant to the Subject Lands considering the ecological data collected by GEI. As detailed in the table, the following SWH types are present within the Subject Lands: Species of Conservation Concern; and
- Marsh Breeding Bird Habitat – Trumpeter Swan.

Eastern Wood-peweeThe following candidate SWH types are present within Subject Lands associated with the retained features:

- Seasonal Concentration Areas
- Candidate bat maternity colony for Big Brown Bat and Silver-haired Bat;
- Candidate turtle overwintering areas;
- Rare or Specialized Habitats
- Candidate waterfowl nesting habitat;
- Candidate turtle nesting areas
- Habitat for Species of Conservation Concern
- Northern Ribbonsnake (*Thamnophis saurita*);
- Snapping Turtle (*Chelydra serpentina*);
- Black Dash (*Euphyes conspicua*);
- Tawny Emperor (*Asterocampa clyton*); and
- Hackberry Emperor (*Asterocampa celtis*).

As described previously, this habitat area will not be impacted either directly or indirectly by the proposed development application.

4.6. Fish Habitat

Fish habitat, as defined in the federal Fisheries Act, c. F-14, means “spawning grounds and nursery, rearing, food supply, and migration areas on which fish depend directly or indirectly in order to carry out their life processes.” Fish, as defined in S.2 of the Fisheries Act, c. F-14, includes “parts of fish, shellfish, crustaceans, marine animals and any parts of shellfish, crustaceans or marine animals, and the eggs, sperm, spawn, larvae, spat and juvenile stages of fish, shellfish, crustaceans and marine animals.”

Direct fish habitat is assumed to be present within the large open-aquatic wetland to the northwest. WC1 and H1S1 represent indirect fish habitat to direct reaches downstream.

4.7. Habitat for Endangered and Threatened Species

Species designated as Threatened or Endangered in Ontario are afforded both individual and habitat protection under ESA (2007). To identify the presence of any Threatened or Endangered species a background information review and detailed field investigations were completed.

The background review identified that SAR could potentially be present within the Subject Lands. To assess habitat suitability and species presence/absence targeted surveys were undertaken.

SAR bat species are present within the wooded vegetation communities on the Subject Lands. A leaf-off bat habitat assessment survey was completed in Fall 2024 to determine if suitable roosting habitat may be present for SAR bat species.

Majority of the wooded vegetation communities are proposed to be retained with minor encroachments within the cultural woodlands (CUW) and plantation vegetation communities (refer to **Figure 6, Appendix A**).

A single Black Ash was also observed on the Subject Lands along the edge of the cattail / bur-reed organic shallow marsh (MAS3-1/MAS3-7). The tree, located along the west edge of the Subject Lands, was young and in poor health. This feature will be retained and will not be directly impacted by the proposed development.

4.8. Significant Areas of Natural and Scientific Interest

No ANSIs were identified on or within 120 m of the Subject Lands (**Figure 2, Appendix A**).

4.9. GRCA Regulated Features

Pursuant to Ontario Regulation 41/24, the GRCA has the authority to regulate development within its regulated areas. The NPCA regulates the following features:

- Lands adjacent to or close to the shoreline of the Great Lakes-St. Lawrence River System
- River or stream valleys that have depressional features associated with a river or stream, whether or not they contain a watercourse;
- Hazardous lands;
- Wetlands; and
- Other areas where development could interfere with the hydrologic function of a wetland, including areas up to 120 m of all PSWs and wetlands greater than 2 ha in size, and areas within 30 m of wetlands less than 2 ha in size.

The wetlands within the Subject Lands in addition to the unnamed watercourse are regulated features. This is consistent with GRCA's Watershed Explorer (as discussed within **Section 1.3.3**).

4.10. Official Plans of the Region of Waterloo and the Township of North Dumfries

The Region of Waterloo Official Plan (2015) and Township of North Dumfries Official Plan (2010) set out policies to protect the Greenlands Network. A review was undertaken to understand what components of the Greenlands Network, as defined in the official policies, are present on and adjacent to the Subject Lands. The Greenlands Network is made up of the following components:

- Landscape Level Systems;
- Core Environmental Features;
- Fish Habitat;
- Supporting Environmental Features; and
- Linkages.

Landscape Level Systems are recognized within the Greenlands Network as large-scale environmental features or as significant concentrations of environmental features. Landscape Level Systems comprise:

- Environmentally Sensitive Landscapes;
- Significant Valleys;
- Regional Recharge Areas; and
- Provincial Greenbelt Plan Natural Heritage System.

Core Environmental Features of the Greenlands Network are:

- Significant Habitat of Endangered or Threatened Species;
- Provincially Significant Wetlands;
- Environmentally Sensitive Policy Areas;
- Significant Woodlands; or
- Environmentally Significant Valley Features.

Fish Habitat will be identified through watershed studies, Environmental Impact Statements or other appropriate studies accepted by the Township and other public agencies having jurisdiction.

Supporting Environmental Features do not meet the criteria for being regionally significant but play an important role in maintaining the ecological functions provided by the Greenlands Network. Supporting Environmental Features are areas that meet the following criteria:

- is identified by the Ministry of Natural Resources as a Locally Significant Wetland (including all previously classified Class 4 to 7 Wetlands identified by the Ministry of Natural Resources); or
- is identified by the Ministry of Natural Resources as significant wildlife habitat; or

- is identified by the GRCA as a cold or warm water fishery; or
- provides a connection or acts as a buffer or supporting area to other designated natural areas, thus maintaining ecological connection between communities; or
- performs vital hydrogeological functions, such as serving as headwaters of a stream, groundwater recharge and Environmentally Significant Discharge Areas.

Linkages are areas intended to provide opportunities for plant and animal movement within and between environmental features, support hydrological and nutrient cycling, and contribute to the overall ecological integrity of the Greenlands Network.

The Subject Lands contain fish habitat, core environmental features (candidate significant woodland, ESA habitat), and Supporting Environmental Features (wetlands, WC1, H1S1).

4.11. Summary of Ecological Components Subject to Impact Assessment

An analysis of existing natural heritage features on the Subject Lands and the adjacent 120 m was completed, followed by an evaluation of their significance against provincial and municipal criteria. The results of this analysis determined that the following significant natural heritage features will require impact assessment in **Section 6**:

- Unevaluated wetlands (within Subject Lands and adjacent 120 m);
- Woodlands (adjacent 120 m only);
- Candidate significant woodlands (within Subject Lands);
- Confirmed and Candidate SWH:
    - Confirmed SWH (within Subject Lands):
        - Species of Conservation Concern: Marsh Breeding Bird Habitat for Trumpeter Swan, and Eastern Wood-pewee.
    - Candidate SWH (adjacent 120 m only);
    - Seasonal Concentration Areas:
        - Candidate bat maternity colony for Big Brown Bat and Silver-haired Bat; and
        - Candidate turtle overwintering areas.
    - Rare or Specialized Habitats:
        - Candidate waterfowl nesting habitat; and
        - Candidate turtle nesting areas.
    - Habitat for Species of Conservation Concern:
        - Northern Ribbonsnake (*Thamnophis saurita*);
        - Snapping Turtle (*Chelydra serpentina*);
        - Black Dash (*Euphyes conspicua*);
        - Tawny Emperor (*Asterocampa clyton*); and
        - Hackberry Emperor (*Asterocampa celtis*).
- Direct and indirect fish habitat (within Subject Lands and adjacent 120 m);

- Habitat of Endangered and Threatened species (adjacent 120 m only):
    - SAR Bat Species; and
    - Black Ash.
- Rivers, lakes, streams, and creeks (WC1).

5. Description of Proposed Development

The Subject Lands encompass an area of 21.3 ha. The proposed development includes the construction of a slab-on-grade industrial building with gravel parking and two driveway entrances. The development is intended to function as a trucking facility including 19 loading dock bays and 5 repair bays. As part of the proposed development plan, the existing residential home will be demolished.

5.1. Site Grading

The proposed grading strategy will respect the existing grades along the northern and eastern property lines, buffer setbacks along the eastern side of the woodland will also be respected. strategy has been development to ensure that the drainage is directed to a series of storm structures throughout the Site and ultimately to the proposed SWMF located at the west side of the Subject Lands. The overland flow route for major storm events is also proposed to drain towards the SWMF.

5.2. Site Servicing

There are no existing storm or sanitary sewers, or watermain located on Cedar Creek Road. The closest municipal services are located within the settled area of Ayr, approximately 4km southwest. The existing industrial areas to the east of the Subject Lands are serviced by septic and well.

A private well and fire reservoir will be required to service the proposed development. The building is not expected to require process water and therefore water demands are expected to be limited. The Hydrogeological Investigation (MTE 2025) confirmed water supply wells of sufficient quantity and quality are expected to be available at depths approximately 30 to 40 m below ground level.

A private on-site septic system will be required to service the proposed building. Per the FCR (MTE 2025), the septic system is expected to be designed under Part 8 of the OBC, with Level IV treatment and a Type A dispersal bed. Based on the findings of the Geotechnical Report prepared by MTE (2024), the proposed septic system is not anticipated to require Environmental Compliance Approval (ECA). These calculations are explained in greater detail within the FCR. Details of the septic system including confirming the exact type of system, distribution piping and Level IV treatment system (if required) will be provided at detailed design when the building design and total daily sewage flow is confirmed.

It is noted that the on-site wastewater system has not been designed to treat any wash water that could be generated as part of the proposed development. Domestic wastewater will be conveyed to the treatment system; however, a separate holding tank would be required for any wash water generated by washing activities and floor drains in vehicle/repair bays.

5.3. Stormwater Management

A private storm sewer system will be installed on-site to collect runoff from the common driveway and parking areas. This storm sewer system will convey runoff through a combination of manholes and catchbasins towards the proposed stormwater management facility (SWMF) located at the west side of the development, adjacent to the northwest wetland.

Rooftop runoff will be directed to an infiltration gallery, prior to overflowing into the on-site storm sewer system. Runoff from the frontage of the building will flow towards the Cedar Creek Road right-of-way.

The proposed SWMF has been designed as a wet pond with a permanent pool depth of 2.0m. Runoff generated from the parking areas will be conveyed to the SWMF via on-site storm sewers, wherein the flow will be controlled with the installation of an outlet control manhole structure with the capability of controlling events up to and including the 100-year storm event. Storage volume will be provided within the forebay and the main cell. An emergency overflow weir is proposed along the west side of the pond, where runoff will be directed toward the existing wetland.

The SWMF incorporates a sediment forebay with a depth of 2.5m which offers the benefits of dilution and settling of sediment. Per the FCR, the forebay design is based on classic particle settling and flow dispersion equations, as presented in the MOE's 2003 *Stormwater Management Planning and Design Manual*. The forebay has been designed to treat minor storm flows, meaning that the main pond will essentially be empty (or at its permanent pool level) during minor storm events. The forebay has been designed to satisfy the following conditions (MTE 2025):

- A settling length based on a settling velocity of 0.0003 m/s using the main pond's peak discharge from the 25 mm storm event (as per MOE 2003);
- A settling length based on a settling velocity of 0.0055m/s using the forebay inflow/outflow from the 25 mm storm event;
- A dispersion length is such that, based on flow and depth of water, the velocity through the forebay is less than 0.5 m/s; and
- That velocity, based on flow divided by cross-sectional area, is less than 0.15 m/s to prevent scouring.

Under the future ultimate development condition, the total drainage area for the proposed SWMF is 7.283 ha at 98.2% imperviousness.

A planting plan for the SWMF will also be prepared at the time of detailed design. Plant species and their location will be selected on the basis of stabilizing banks, mitigating temperature increases, deterring waterfowl from nesting within the area, and providing aesthetics and safety benefits.

5.3.1. Erosion Control

The MECP recommends that any newly proposed development implements a SWM solution that provides at least a 24-hour drawdown for the volume generated during the 25mm storm event; to ensure that threshold flow durations do not exceed pre-development levels. As such, the proposed SWMF has been designed to provide approximately a 53-hour drawdown time on the 25mm storm event volume.

5.4. Water Balance

A water balance analysis of the Subject Lands was conducted to examine the impacts of the proposed development. In the pre-development condition, the Site is almost fully pervious and drains mostly towards the northwestern wetland pond. The southeast portion of the Subject Lands drains towards a smaller wetland located in the southeast corner of the property, while the southwest portion of the Subject Lands drains overland towards Eden Creek off site. It is noted that both wetlands appear to ultimately drain towards this same creek.

In the post-development condition, the southwest catchment area remains in its existing size and condition. As a result of the proposed development, a large portion of the area previously directed towards the southern wetland is redirected to the SWMF and ultimately the northwestern wetland pool. This results in reduced runoff towards the south and an increase in runoff towards the northwestern wetland, in addition to the increase in runoff from the property as a result of converting pervious area to impervious. To mitigate the increase in runoff, an infiltration gallery has been proposed to infiltrate runoff from the proposed building roof. The gallery is sized to retain 30 mm of roof drainage. While runoff volume has increased significantly when compared to existing conditions, it is expected any excess runoff directed to the northwestern wetland will be able to flow through the wetland and towards the Eden Creek, mitigating negative impacts from the increase in runoff.

6. Impact Assessment and Mitigation Measures

This section assesses the potential impacts, predicted effects, proposed mitigation and enhancement measures associated with proposed development of the Subject Lands. Potential effects to the natural heritage features and environmental functions that exist on and adjacent to the Subject Lands are evaluated over the short and long term, with consideration given to measures to avoid and/or mitigate negative impacts, where appropriate. Areas to be maintained, and where possible, improved or restored, to promote the health, diversity and size of natural heritage features within the Subject Lands, are also identified.

The range of potential impacts associated with a proposed development can generally be divided into three categories:

1. Direct impacts are normally associated with the physical removal or alteration of natural features that could occur based upon a land use application;
2. Indirect impacts may be changes or impacts (these could be minor or major) to less visible functions or pathways that could cause negative impacts to natural heritage features over time; and
3. Induced impacts are associated with post-development impacts that may result in increased demand on natural resources.

Figure 6 (**Appendix A**) provides a visual overview of the natural heritage constraints identified within the Subject Lands and the adjacent 120 m, as well as areas where the proposed development encroaches within natural heritage setbacks.

6.1. Unevaluated Wetlands

Multiple wetland communities have been identified within the Subject Lands. Those communities which occur in the closest proximity to the proposed development include the MAS2-1/SWT2-2 community along the southern property line, and the collection of wetland communities associated with the large open water wetland located within the northwestern quadrant of the Subject Lands.

6.1.1. Direct Impacts

No direct impacts are anticipated with the wetland communities on the Subject Lands, as no wetland removal is proposed as part of development.

6.1.2. Potential Indirect Impacts

Potential indirect impacts to wetlands within the Subject Lands and the adjacent 120 m include alterations to drainage and water balance, increased erosion and sedimentation, and various edge effects.

Development can significantly alter local hydrology by affecting surface runoff, infiltration, and groundwater flow, potentially changing both the quantity and direction of water movement. Modifying the grade of an area may redirect flows and disrupt the balance between infiltration and runoff. The introduction of impermeable surfaces, such as paved roads and buildings, further reduces infiltration capacity and increases surface runoff, potentially altering the natural water balance and drainage patterns critical for wetland function (MNR 2010).

Construction activities also pose risks by increasing erosion and sedimentation through the exposure of bare soil during grading, excavation, and vegetation removal. Without effective erosion and sediment control (ESC) measures, sediment-laden runoff can carry nutrients and pollutants into wetlands, degrading water quality and causing vegetation community shifts. These impacts are particularly pronounced in areas with steep slopes or near sensitive ecological features (MNR 2010).

Edge effects from development can exacerbate impacts to wetlands and adjacent habitats. Dust generated by heavy machinery can settle on vegetation and aquatic features, potentially interfering with photosynthesis and harming wetland ecosystems. Improperly secured construction waste, such as plastics and packaging, can be carried by wind into surrounding natural areas, degrading habitat quality. Additionally, soil and water contamination risks are heightened during construction due to accidental spills of fuels, oils, or other hazardous substances during equipment maintenance and refueling activities (MNR 2010).

6.1.3. Mitigation Measures

6.1.3.1. Ecological Setbacks

The establishment of setbacks from wetlands helps to protect the form and function of these retained natural areas from potential development impacts. The Region of Waterloo's Official Plan and Township of North Dumfries Official Plan do not prescribe specific setbacks.

GEI recommends a 30 m setback to provincially significant wetlands, and a 15 m setback to non-PSW's. In lieu of an evaluation of the northwestern wetland, the feature has been provided a 30m buffer from development. The southwestern wetland is also unevaluated, however, due to its small size and isolated nature, this wetland has been assumed to be non-PSW for the purposes of this assessment. These proposed setbacks are illustrated on **Figure 6** (**Appendix A**).

The current Draft Plan shows minor encroachment (0.002 ha) of the parking area into the buffer of the southernmost wetland community. GEI recommends buffer enhancement through restoration plantings within this area. Enhancement of the buffer area will improve upon the active agricultural lands which are currently abut the wetland, resulting in a net ecological improvement of this community.

6.1.3.2. Hydrology

The proposed SWMF is designed to discharge to the northwestern wetland community. A water balance analysis was completed to examine the potential impacts of the proposed development. Efforts were made to maintain the existing catchments and water balance, but ultimately the pre- and post-development conditions could not be fully maintained. In the post-development condition, the SWMF (and ultimately the northwestern wetland) will receive an increased amount of runoff from the impervious surfaces on site. To mitigate the increase in runoff, an infiltration gallery is proposed to infiltrate runoff from the proposed building roof. As the entirety of the Subject Lands ultimately drains to Eden Creek, any excess flows directed to the SWMF are expected to flow through the wetland and maintain their connection/contribution to Eden Creek downstream, mitigating the potential negative impacts associated with rerouting on-site flows.

6.1.3.3. Construction Management Practices

Although no specific erosion and sediment control (ESC) measures are currently identified, an ESC Plan will be developed during detailed design to minimize construction-phase impacts on the retained wetlands. The ESC Plan should include measures such as sediment control fencing, sediment traps, mud mats, or other best management practices to prevent sediment-laden runoff from entering sensitive features during construction. Given the proximity of the works to sensitive features, enhanced measures are likely to be required. Regular monitoring of ESC measures by a qualified inspector during construction is also recommended to ensure effectiveness.

To further reduce potential impacts on retained natural features, construction equipment and materials should be stored as far as possible from wetlands. Vehicle refueling and maintenance should occur off-site or in designated areas well away from wetlands to prevent accidental spills of fuels, oils, or other hazardous materials from entering these features. Additionally, all vehicles and equipment should arrive at the construction site clean and free of any soil or vegetation to prevent the introduction of invasive species. Before leaving the site, in line with best management practices, vehicles and equipment should be cleaned again to prevent the spread of invasive species to other areas.

With the implementation of these mitigation and compensation measures—including setbacks as shown in **Figure 6** (**Appendix A**), SWM measures, the recommended ESC Plan, careful construction management practices, and ecological restoration and enhancement efforts—no net negative impacts are anticipated to the wetlands as a result of the proposed development.

6.2. Candidate Significant Woodlands

Candidate significant woodland is present along the western half of the Subject Lands.

6.2.1. Direct impacts

The current development proposal requires the removal of approximately 0.7 ha of candidate significant woodland (**Figure 6**, **Appendix A**). Further studies are required to determine basal area and continuity of the woodland feature in accordance with the Waterloo Woodland Conservation Bylaw, which may result in further refinement to the candidate feature. These removals are associated with two ELC communities along the northwestern edge of the Subject Lands – cultural woodland (CUW1a/CUW1b) and red pine coniferous plantation (CUP3-1).

These woodland communities represent lower quality habitat when compared to those present within the southern half of the Subject Lands. Invasive species including buckthorn and garlic mustard are present throughout the understory of both the cultural woodland and red pine plantation. Many of the red pine within this location also appear to be declining in health. Although the reason for this decline is unknown, it is allowing sunlight to penetrate the canopy and encouraging the increased growth of invasive species within the understory.

Restoration efforts including invasive species management and the implementation of a restoration planting plan will be explored to compensate for these proposed removals. This is discussed in further detail within Section 7.1.

6.2.2. Potential Indirect Impacts

Potential indirect impacts on the significant woodland and other woodlands could include various edge effects. Dust generated by heavy machinery may settle on vegetation, potentially interfering with photosynthesis and reducing plant health. Improperly secured construction waste, such as plastics and packaging, may be carried by wind into surrounding natural areas, degrading habitat quality. Additionally, soil and water contamination risks are heightened during construction due to the potential for accidental spills of fuels, oils, or other hazardous substances during equipment maintenance and refueling activities (MNR 2010).

6.2.3. Mitigation Measures

6.2.3.1. Ecological Setbacks

The establishment of setbacks from woodlands helps to protect the form and function of these retained natural areas from potential development impacts. The Region of Waterloo's Official Plan and Township of North Dumfries Official Plan do not prescribe specific setbacks. GEI recommends a 10 m setback from all woodlands.

South of the proposed SWMF, a 10 m setback has been provided to the woodland. Where encroachment into the woodland has been proposed towards the northern end of the Subject Lands, this buffer has not been maintained. Buffer enhancement and compensation strategies are discussed in greater detail in **Section 7.1**.

6.2.3.2. Construction Management Practices

To further reduce potential impacts on retained natural features, construction equipment and materials should be stored as far as possible from woodlands. Vehicle refueling and maintenance should occur off-site or in designated areas well away from woodlands to prevent accidental spills of fuels, oils, or other hazardous materials from entering these features. Additionally, all vehicles and equipment should arrive at the construction site clean and free of any soil or vegetation to prevent the introduction of invasive species. Before leaving the site, in line with best management practices, vehicles and equipment should be cleaned again to prevent the spread of invasive species to other areas.

6.2.4. Habitats of Endangered and Threatened Species

The following Endangered and Threatened species were identified to inhabit the Subject Lands:

- Black Ash; and
- SAR Bat Species.

A single Black Ash was observed along the edge of the cattail / bur-reed organic shallow marsh (MAS3-1/MAS3-7). The tree, located along the west edge of the Subject Lands, was young and in poor health. This feature will be retained and will not be directly impacted by the proposed development.

The SAR Bat Species identified on the Subject Lands include Eastern Small-footed Myotis, Silver-haired Bat, Hoary Bat, and Eastern Red Bat, which are all listed as Endangered on the SARO List. Acoustic monitoring confirmed the overall abundance of each species to be low. Approximately 0.7 ha of woodland removal is currently proposed along the northern edge of the open wetland. This removal is not anticipated to have a significant negative impact on the bat species, as acoustic monitoring confirmed a higher abundance of bats to utilize the much denser portion of the southern woodland. MECP will be contacted to determine appropriate compensation for the proposed woodland removals.

6.2.5. Fish habitat

Direct fish habitat is assumed to be present within the open aquatic wetland pool at the northwestern corner of the Subject lands. Indirect fish habitat occurs on the Subject Lands in the form of ephemeral flow from WC1 and HDF H1S1.

6.2.5.1. Direct Impacts

No direct impacts to fish habitat are anticipated, all features are going to be retained as part of the proposed development.

6.2.5.2. Potential Indirect Effects

Indirect effects are those potential effects on the biophysical environment that could potentially result in adverse effects on the Subject Lands.

Development can significantly alter local hydrology, which is critical for maintaining fish habitat, particularly in areas where fish rely on wetlands. Changes to surface runoff, infiltration, and groundwater flow can affect both the quantity and direction of water movement. Modifying the grade of an area may redirect flows and disrupt the balance between infiltration and runoff. The introduction of impermeable surfaces, such as paved roads and buildings, further reduces infiltration capacity and increases surface runoff, potentially altering the natural water balance and drainage patterns that are essential for supporting fish habitat (MNR 2010).

Construction activities also pose risks by increasing erosion and sedimentation through the exposure of bare soil during grading, excavation, and vegetation removal. Without effective ESC measures, sediment-laden runoff can carry nutrients and pollutants into aquatic habitats, degrading water quality and potentially impairing fish habitat. These impacts are particularly pronounced in areas with steep slopes or near sensitive ecological features (MNR 2010).

Edge effects from development can also degrade fish habitat. Dust generated by heavy machinery can settle on aquatic features, potentially blocking light and interfering with ecosystem functions. Improperly secured construction waste, such as plastics and packaging, can be carried by wind into surrounding aquatic habitats. Additionally, sediment and water contamination risks are heightened during construction due to accidental spills of fuels, oils, or other hazardous substances during equipment maintenance and refueling activities (MNR 2010).

6.2.6. Mitigation measures

6.2.6.1. Ecological Setbacks

The establishment of setbacks from fish habitat helps to protect the form and function of these retained natural areas from potential development impacts. The Region of Waterloo's Official Plan and Township of North Dumfries Official Plan do not prescribe specific setbacks. GEI recommends a 15 m setback from fish habitat, measured from the top-of-bank of the watercourse.

No development is proposed within 15 m of any fish habitat on site.

6.2.6.2. Hydrology

As discussed in **Section 5.4**, the proposed development will result in a change to the existing drainage patterns on the Subject Lands. However, per the FCR (xx), all overland drainage from the Subject Lands ultimately contributes to the same off-site location (Eden Creek). As such, no impact is anticipated to downstream fish habitat.

6.2.6.3. Construction Management Practices

Although no specific ESC measures are currently identified, an ESC Plan will be developed during detailed design to minimize construction-phase impacts to fish habitat. The ESC Plan should include measures such as sediment control fencing, sediment traps, mud mats, or other best management practices to prevent sediment-laden runoff from entering sensitive features during construction. Given the proximity of the works to sensitive features, enhanced measures are likely to be required. Regular monitoring of ESC measures by a qualified inspector during construction is also recommended to ensure effectiveness.

With the implementation of these mitigation measures; including setbacks, SWM measures, the recommended ESC Plan, and careful construction management practices — no net negative impacts are anticipated to fish habitat as a result of the proposed development.

6.3. Migratory Birds

GEI observed a total of one species confirmed, 15 probable, and 11 possible breeders on the Subject Lands breeding bird species within the Subject Lands and the adjacent 120 m during breeding bird surveys.

Per the Migratory Birds Convention Act, the proponent is responsible for ensuring that no active bird nests are present within the work area before commencing activities. The federal MBCA (1994), prohibits the killing, capturing, injuring, taking or disturbing of migratory birds (including eggs) or the damaging, destroying, removing or disturbing of nests. During construction, particularly during activities that may result in tree or native vegetation removals, with lack of appropriate mitigation, migratory birds, and eggs and nests of these birds could be harmed inadvertently.

As per the MBCA (1994), it is recommended that any tree removals occur prior to, or after, the migratory breeding bird season (April 1 to August 31). If this window cannot be avoided, nest searches are necessary to determine the presence/absence of nesting birds or breeding habitat every 72 hours until clearing is complete, or until August 31, whichever comes first. If an active nest is observed, a designated setback will be identified within which no construction activity will be allowed while the nest remains active. The setback distance typically ranges from 5 m to 60 m from the nest, depending on the species and its sensitivity to adjacent activities.

With the implementation of the above-stated mitigation measures, no disturbance to migratory birds and/or their nests are anticipated during the breeding season.

6.4. Potential Induced Effects

Induced impacts are potential environmental effects associated with the post-development landscape. Each of these are discussed in the following sections.

6.4.1. Light and Noise Effects on Wildlife

Light could also be a concern where it is directed towards sensitive natural features, with functions and/or species that may be intolerant of light disturbance. Primary sources for "new light" will be from the industrial warehouses and associated parking lots. Given that the existing surrounding land uses are largely residential, commercial and industrial, existing wildlife communities are expected to be somewhat tolerant of disturbance from artificial lighting.

Additionally, noise associated with heavy equipment movement may temporarily disturb wildlife. However, given the existing traffic noise along Cedar Creek Road and Hwy 401, it is expected that local wildlife communities are desensitized and are fairly tolerant of anthropogenic noise sources.

6.4.2. Salt Management Plan

A Salt Management Plan was completed by MTE Consultants Inc. (2025) to address the potential impacts of salt associated with the proposed development. Improper or excessive use of road salts can cause detrimental effects to the surrounding environment. Salt can also damage grass, trees and other types of vegetation. Dissolved salt in snowmelt eventually also drains to water systems where elevated chloride concentrations can be toxic to fish and other aquatic life.

Aspects of the Grading and SWM design which will facilitate the protection of groundwater and surface water from road salt used on the Site include:

- The majority of the Site is relatively flat thereby requiring less salt to maintain traction; and
- Infiltration of storm runoff within the SWM facility is expected to be minimal since SWM facilities typically get more impermeable over time, as a result of suspended solids settling out and accumulating along the base and sides creating a relatively impermeable liner.

The Salt Management Plan identifies a number of best management practices (BMPs) to implement across the Subject Lands to address the concerns outlined above. The document recommends active monitoring and reporting to ensure effectiveness through its implementation.

6.4.3. General Construction Mitigation

Dust

During construction activities such as clearing and grubbing, dust can lead to changes in vegetation due to increased heat absorption and decreased transpiration; adverse effects to plants and/or wildlife that are not adapted to high levels of sedimentation; and visual impact. To mitigate dust, it is recommended to dampen exposed soil areas with water during construction activities, thereby minimizing the presence of dust within the development zone. Erosion and sediment control measures must be implemented and will assist in the reduction of dust.

Erosion and Sedimentation

Erosion and sedimentation from the disturbed work area associated with the proposed development could potentially result in adverse effects to water quality (e.g., increased turbidity) or sedimentation and associated effects on fish (e.g., injury or mortality due to suspended sediments or altered habitat use) or fish habitat (e.g., loss of interstitial spaces in rocky areas, smothering of aquatic vegetation and/or incubating eggs) in downstream areas.

An ESC Plan will be developed during the detailed design and implemented during construction to minimize the potential for erosion and sedimentation from the construction site. The ESC Plan will be developed based on the guidance provided in the Erosion and Sediment Control Guideline for Urban Construction (GGHCA 2019). Basic elements of the plan should include consideration of:

- Construction phasing to minimize the amount of time soils are barren and therefore, more susceptible to erosion;
- Requirements and timing for rehabilitation of disturbed areas;
- Stormwater management strategies during construction;
- Erosion prevention measures (e.g., hydroseeding, sodding, erosion control matting, tarping of stockpiles);
- Sedimentation control measures (e.g., silt fences); and
- Inspection and performance monitoring requirements and adaptive management considerations.

Implementation of an effective ESC Plan, incorporating both erosion and sedimentation controls, coupled with regular inspection and performance monitoring and implementation of any remedial actions necessary to ensure effective performance.

Accidental Spills

Accidental spills of potentially hazardous materials (e.g., fuel and oil from heavy equipment), could cause stress or injury to downstream fish and wildlife.

In order to mitigate the potential for adverse effects on aquatic and wetland habitats due to potential accidental spills during construction, it is recommended that a spill prevention and response plan be prepared to outline the material handling and storage protocols, mitigation measures (e.g., spill kits on-site), monitoring measures and spill response plans (i.e., emergency contact procedures, including the Spills Action Centre, and response measures including containment and clean-up). Implementation of an effective spill prevention and response plan is anticipated to be largely effective in preventing adverse effects on natural heritage features.

7. Restoration and Enhancement Opportunities

As discussed in Section 6.0, the proposed development requires the removal of approximately 0.7 ha of candidate significant woodland, with an additional 0.43 ha woodland buffer encroachment and 0.002 ha wetland buffer encroachment (Figure 6, Appendix A).

To address these impacts, opportunities for wetland and woodland restoration and enhancement have been identified across the Subject Lands, as well as protective enhancement measures within other wetland and woodland setbacks. The restoration efforts aim to offset disturbances from previous land management activities, minimize potential impacts associated with future development, and improve the ecological functions of retained natural heritage features.

This conceptual strategy, which aims to achieve no net loss of ecological function within the NHS, outlines restoration and enhancement measures to support the integrity and resilience of these natural features. These measures will be refined in consultation with the Region of Waterloo, Township of North Dumfries, and GRCA during subsequent planning stages.

None of the strategies outlined below are substantial enough to individually compensate for the proposed removals, however, they are intended to be viewed as a whole in an attempt to balance the removals, wherever possible. Any removals which are unaccounted for within the final restoration and enhancement strategy are anticipated to be addressed through a cash-in-lieu payment, the amount of which will be calculated after finalization of the restoration strategy, and further consultation with the Region of Waterloo, Township of North Dumfries, and GRCA.

7.1. Conceptual Restoration and Enhancement Strategy

As stated, the proposed development requires woodland removal within a combination of cultural woodland (CUW1a/CUW1b) and red pine coniferous plantation (CUP3-1) communities within the northern half of the Subject Lands. The feasibility and effectiveness of multiple restoration and enhancement strategies is currently being considered to compensate for these removals. These strategies are further discussed below.

7.1.1. Ecological Offsetting Policy Consideration

Ecological offsetting is a mitigation strategy that is often considered in an effort to achieve a net ecological benefit to projects, subject to the approval of the planning authority. This compensation strategy quantifies the loss of natural features in order to provide compensation through habitat re-creation or alternative consultation process. Ecological offsetting approaches are typically applied as a last resort (after avoidance and mitigation have been considered). In this case, ecological offsetting is proposed as a means to achieve additional ecological benefit by meeting and/or exceeding the replication requirement.

While the GRCA does not have a formal ecological offsetting guideline, several other local conservation authorities (TRCA, CVC and Lake Simcoe and Region Conservation Authority (LSRCA)) have guidelines in place, recognizing that "ecosystem compensation becomes an important tool to help ensure that critical ecosystem functions and services lost through development and infrastructure are restored back on the landscape for the betterment of communities" (TRCA 2018). The Region of Waterloo and Township of North Dumfries also do not have ecological offsetting guides.

7.1.2. Restoration Planting Plan

Along the southern portion of the Subject Lands, the proposed development does not directly abut the recommended buffers associated with the NHS (Figure 6, Appendix A). This area has been identified for potential restoration plantings to assist in compensating for the woodland removals which are proposed further north on site. An area of 0.51 ha is available for planting, which currently exists primarily as active agricultural field. Inclusion of this area into the existing 10 m buffer applied to the woodland would more than double its width at most locations.

Further discussion with the reviewing agencies is required to confirm the preferred planting strategy within this area.

If this strategy is pursued, at the detailed design stage, an NHS Design Brief will be prepared for review by GRCA and the Region ahead of submitting the NHS planting plan drawings. The NHS Design Brief will provide specific details for each restoration area including plant species lists, proposed plant stock type and sizing, planting timing considerations, and any potential wildlife habitat structure details.

7.1.3. Invasive Species Management

Based on the existing conditions, ten Category 1 invasive species are present across the Subject Lands. Category 1 plants are deemed to be the most invasive and can dominate a site indefinitely. These are a threat to natural areas wherever they occur because they have very effective reproduction and dispersal mechanisms. The 10 Category 1 plants observed on the Subject Lands are:

- Canada Thistle (*Cirsium arvense*);
- Dame's Rocket (*Hesperis matronalis*);
- Showy Fly Honeysuckle (*Lonicera* x *bella*);
- Garlic Mustard (*Alliaria petiolata*);
- Purple Crown-Vetch (*Securigera varia*);
- White Mulberry (*Morus alba*);
- Glossy Buckthorn (*Frangula alnus*);
- European Buckthorn (*Rhamnus cathartica*);
- Manitoba Maple (*Acer negundo*); and
- European Reed (*Phragmites australis ssp. Australis).*

Management of some of these invasive species may provide increased protection and enhancement to the existing woodland and wetland communities on site. These communities will be identified for abundance, and those species which would provide the highest overall return from management will be carefully identified from the list above.

8. Conclusions and Recommendations

The submission of this EIS addresses the natural heritage features and associated functions found on and adjacent to the Subject Lands and the broader Study Area. The impacts expected from the proposed development limit are shown on **Figure 6** (**Appendix A**).

Detailed ecological investigations were conducted within the Subject Lands in 2024 to assess the natural heritage features that were present within the property and identify the form and function of the features. Presently, the Subject Lands contain a mixture of anthropogenic, cultural and forested vegetation community types. The following natural heritage features were identified within or immediately adjacent to the Subject Lands:

- Unevaluated wetlands (within Subject Lands and adjacent 120 m);
- Woodlands (adjacent 120 m only);
- Candidate significant woodlands (within Subject Lands);
- Confirmed and Candidate SWH:
    - Confirmed SWH (within Subject Lands):
        - Species of Conservation Concern: Marsh Breeding Bird Habitat for Trumpeter Swan, and Eastern Wood-pewee.
    - Candidate SWH (adjacent 120 m only):
    - Seasonal Concentration Areas
        - Candidate bat maternity colony for Big Brown Bat and Silver-haired Bat; and
        - Candidate turtle overwintering areas.
    - Rare or Specialized Habitats
        - Candidate waterfowl nesting habitat; and
        - Candidate turtle nesting areas.
    - Habitat for Species of Conservation Concern
        - Northern Ribbonsnake (Thamnophis saurita);
        - Snapping Turtle (Chelydra serpentina);
        - Black Dash (Euphyes conspicua);
        - Tawny Emperor (Asterocampa clyton); and
        - Hackberry Emperor (Asterocampa celtis).
- Direct and indirect fish habitat (within Subject Lands and adjacent 120 m);
- Habitat of Endangered and Threatened species (adjacent 120 m only):
    - SAR Bat Species;
    - Black Ash; and
    - Rivers, lakes, streams, and creeks (WC1).

Of the listed natural heritage features, the proposed development overlaps with the following:

- Candidate Significant woodland (0.7 ha); and
- Buffer Encroachment (0.432 ha).

While direct removal of portions of the NHN are proposed, no negative impacts are expected as a result of the proposed development provided that the recommended mitigative and restorative measures are implemented and monitored as they establish. The restoration strategy puts forth multiple restorative measures to evaluated in an effort to improve the NHS. Further consultation with the client and reviewing agencies will assist in confirming the extent of the proposed restoration to be pursued, and the amount of compensation to be paid through the cash-in-lieu process.

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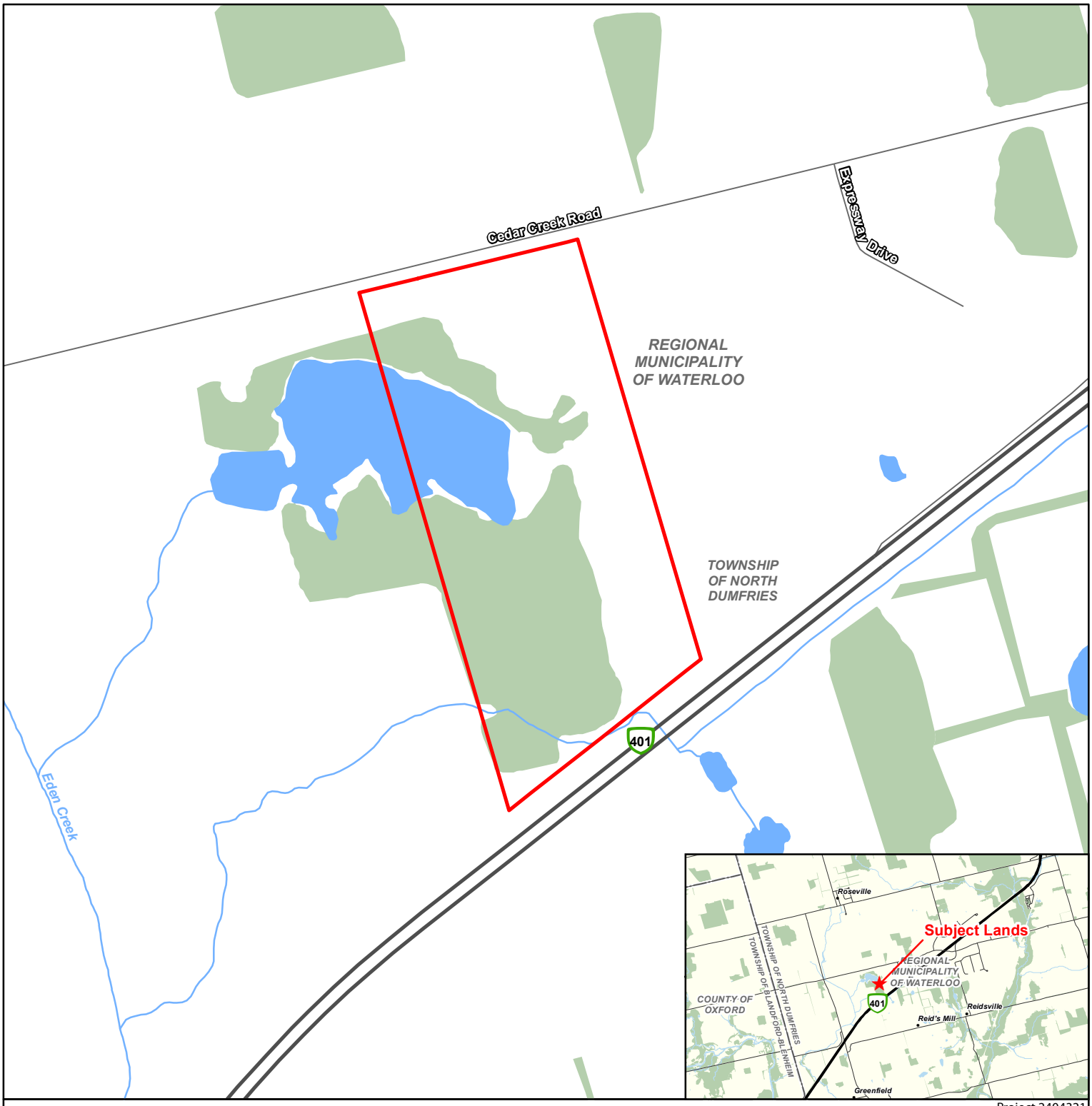
Appendix A Figures



NOTES:
1. Coordinate System: NAD 1983 UTM Zone 17N.
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Legend

- Subject Lands
- Municipal Boundary, Lower/Single Tier
- Municipal Boundary, Upper Tier
- Watercourse
- Waterbody
- Wooded Area

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Figure 1
Location of Subject Lands

0 100 m
1:7,500

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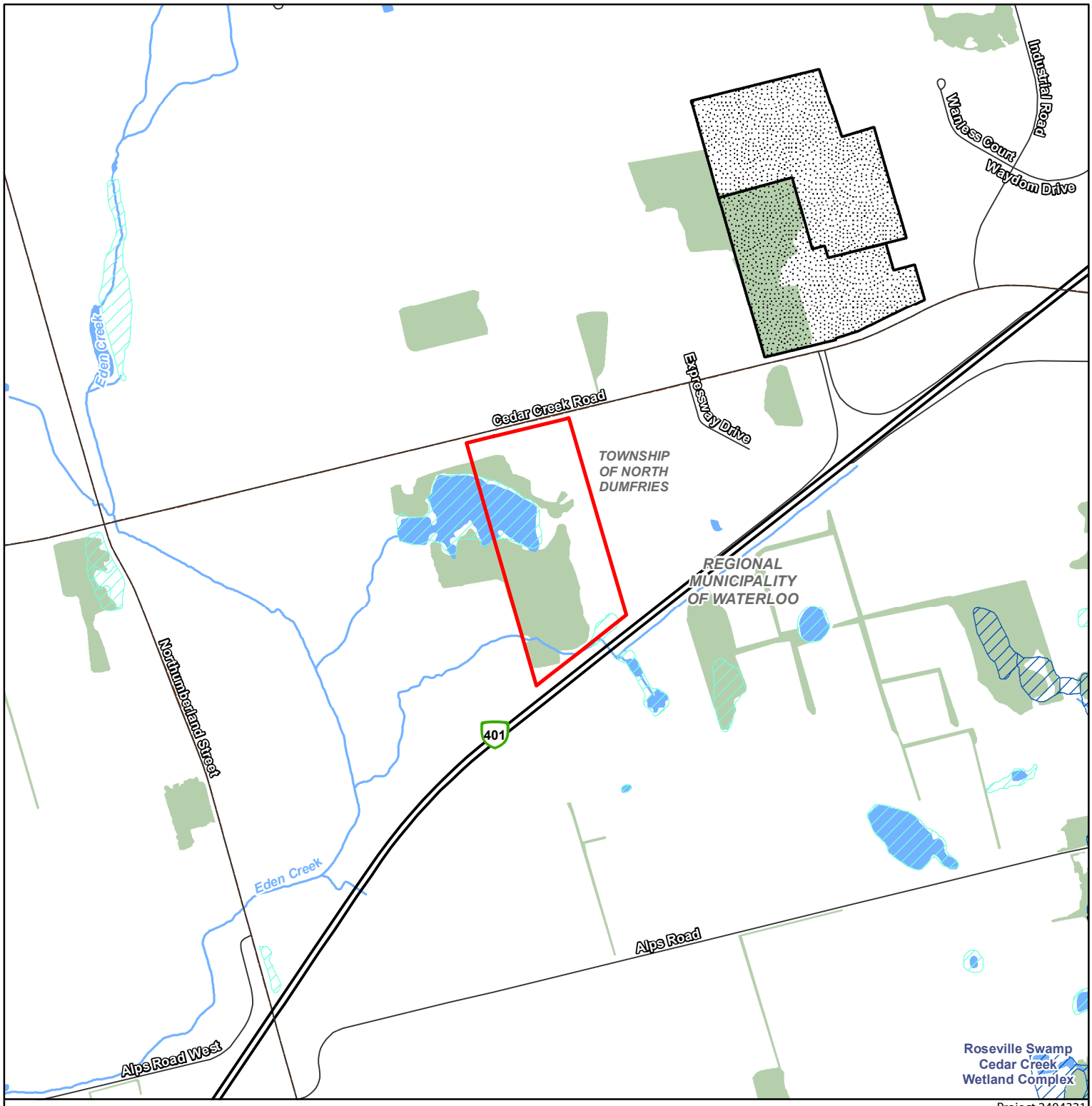

NOTES:
1. Coordinate System: NAD 1983 UTM Zone 17N.
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Legend

- Subject Lands
- Highway
- Road
- Trail Segment (OTN)
- Aggregate Site - Active
- Municipal Boundary, Lower/Single Tier
- Municipal Boundary, Upper Tier
- Provincially Significant Wetland
- Wetland - Not evaluated per OWES
- Watercourse
- Waterbody
- Wooded Area

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Cedar Creek EIS
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Figure 2
Landscape Setting

0 200 m
1:16,000

N

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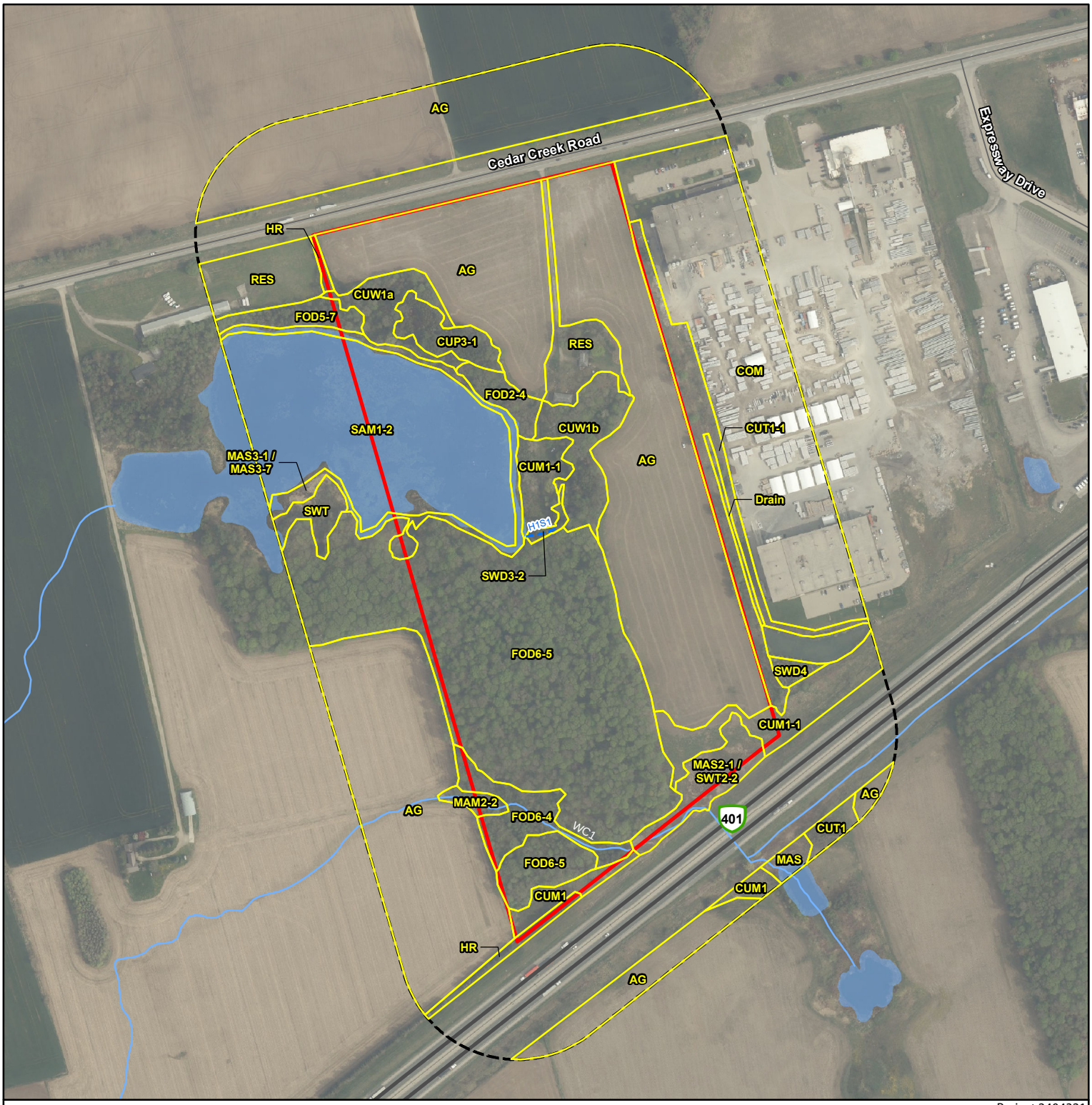

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- Subject Lands
- Subject Lands +120m
- Highway
- Road
- Watercourse
- Waterbody
- Ecological Land Classification
- Headwater Drainage Feature

ELC LEGEND

AG, Agricultural
COM, Commercial
CUM1, Mineral Cultural Meadow
CUM1-1, Dry-Moist Old Field Meadow
CUP3-1, Red Pine Coniferous Plantation
CUT1, Mineral Cultural Thicket
CUT1-1, Sumac Cultural Thicket
Drain, Drain
FOD2-4, Dry-Fresh Oak - Hardwood Deciduous Forest
FOD5-7, Dry-Fresh Sugar Maple - Black Cherry Deciduous Forest
FOD6-4, Fresh-Moist Sugar Maple - White Elm Deciduous Forest
FOD6-5, Fresh-Moist Sugar Maple - Hardwood Deciduous Forest
HR, Hedgerow
MAM2-2, Reed-canary Grass Mineral Meadow Marsh
MAS, Shallow Marsh
MAS2-1, Cattail-Mineral Shallow Marsh
MAS3-1, Cattail Organic Shallow Marsh
MAS3-7, Bur-reed Organic Shallow Marsh
RES, Residential
SAM1-2, Duckweed Mixed Shallow Aquatic
SWD3-2, Silver Maple Mineral Deciduous Swamp
SWD4, Mineral Deciduous Swamp
SWMP, Stormwater Management Pond
SWT, Thicket Swamp
SWT2-2, Willow Mineral Thicket Swamp

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Figure 3
Ecological Land Classification

0 100 m
1:5,500

N

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NOTES:

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- Subject Lands
- Subject Lands +120m
- Highway
- Road
- Watercourse
- Waterbody
- Ecological Land Classification
- Headwater Drainage Feature
- Amphibian Call Count Survey Location
- Bat Recorder
- Breeding Bird Survey Location

ELC LEGEND

AG, Agricultural
COM, Commercial
CUM1, Mineral Cultural Meadow
CUM1-1, Dry-Moist Old Field Meadow
CUP3-1, Red Pine Coniferous Plantation
CUT1, Mineral Cultural Thicket
CUT1-1, Sumac Cultural Thicket
Drain, Drain
FOD2-4, Dry-Fresh Oak - Hardwood Deciduous Forest
FOD5-7, Dry-Fresh Sugar Maple - Black Cherry Deciduous Forest
FOD6-4, Fresh-Moist Sugar Maple - White Elm Deciduous Forest
FOD6-5, Fresh-Moist Sugar Maple - Hardwood Deciduous Forest
HR, Hedgerow
MAM2-2, Reed-canary Grass Mineral Meadow Marsh
MAS, Shallow Marsh
MAS2-1, Cattail-Mineral Shallow Marsh
MAS3-1, Cattail Organic Shallow Marsh
MAS3-7, Bur-reed Organic Shallow Marsh
RES, Residential
SAM1-2, Duckweed Mixed Shallow Aquatic
SWD3-2, Silver Maple Mineral Deciduous Swamp
SWD4, Mineral Deciduous Swamp
SWMP, Stormwater Management Pond
SWT, Thicket Swamp
SWT2-2, Willow Mineral Thicket Swamp

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Figure 4
Survey Locations

0 100 m
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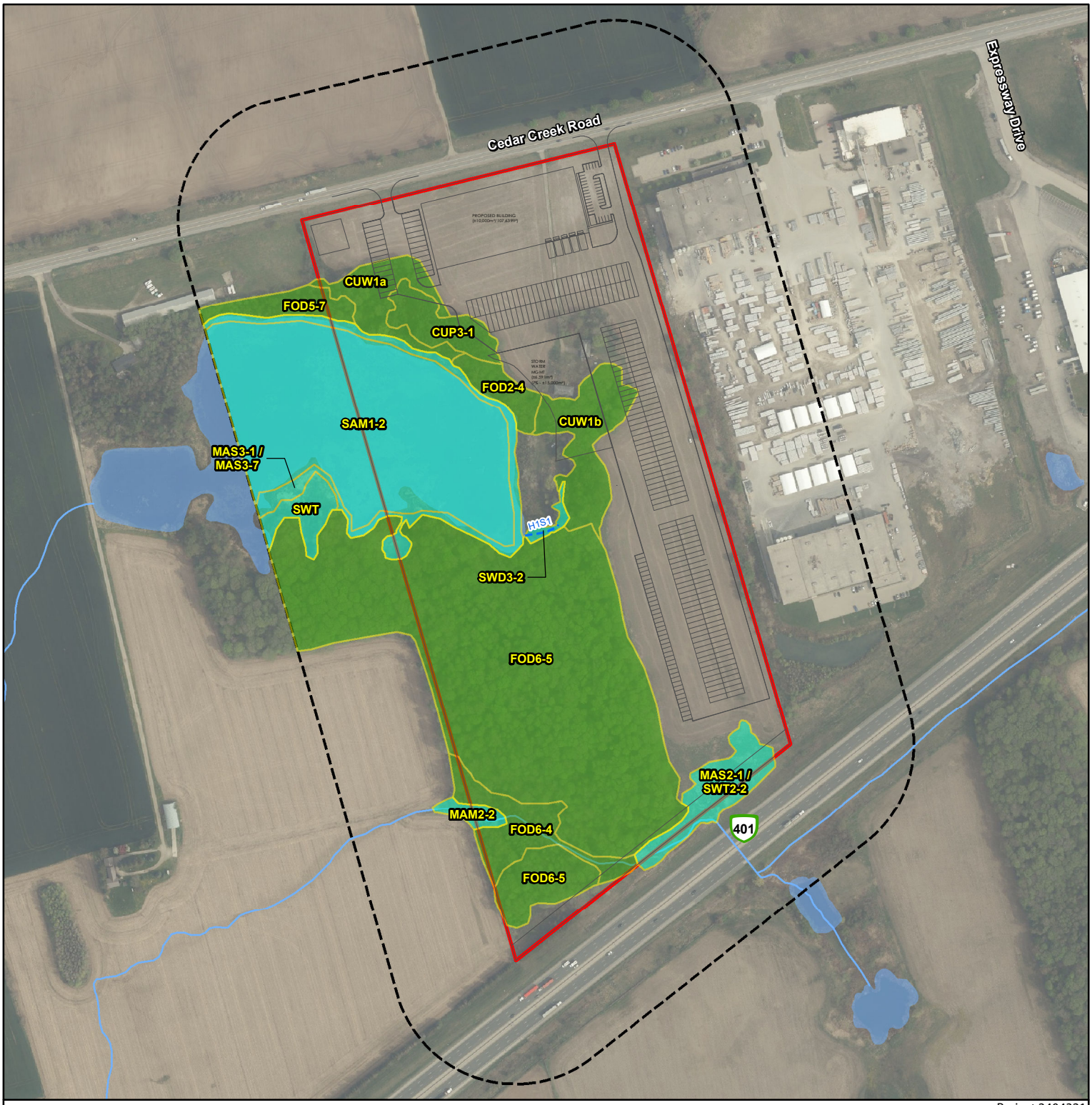

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- Subject Lands
- Subject Lands +120m
- Site Plan
- Watercourse
- Waterbody
- Wetland (ELC)
- Woodland (ELC)
- Headwater Drainage Feature

ELC LEGEND

CUP3-1, Red Pine Coniferous Plantation
FOD2-4, Dry-Fresh Oak - Hardwood Deciduous Forest
FOD5-7, Dry-Fresh Sugar Maple - Black Cherry Deciduous Forest
FOD6-4, Fresh-Moist Sugar Maple - White Elm Deciduous Forest
FOD6-5, Fresh-Moist Sugar Maple - Hardwood Deciduous Forest
MAM2-2, Reed-canary Grass Mineral Meadow Marsh
MAS, Shallow Marsh
MAS2-1, Cattail-Mineral Shallow Marsh
MAS3-1, Cattail Organic Shallow Marsh
MAS3-7, Bur-reed Organic Shallow Marsh
SWD3-2, Silver Maple Mineral Deciduous Swamp
SWD4, Mineral Deciduous Swamp
SWT2-2, Willow Mineral Thicket Swamp

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Figure 5
Site Plan

0 100 m
1:5,250

N

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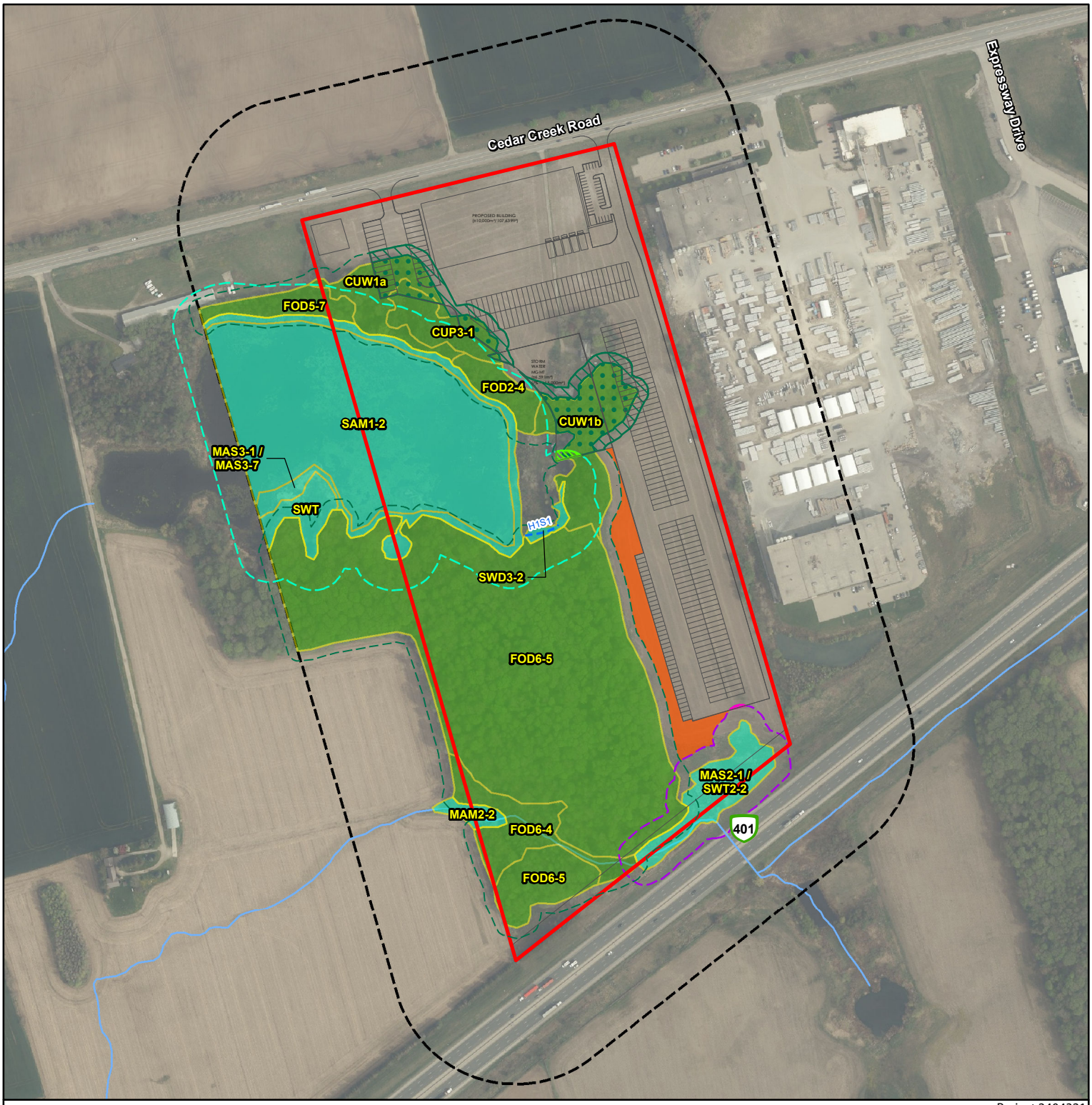

NOTES:

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- Subject Lands
- Subject Lands +120m
- Site Plan
- Watercourse
- Headwater Drainage Feature
- Wetland (ELC)
- Wetland 15m Buffer
- Wetland 30m Buffer
- Woodland (ELC)
- Woodland 10m Buffer
- Wetland 15m Buffer Encroachment (0.002 ha)
- Wetland 30m Buffer Encroachment (0.015 ha)
- Woodland 10m Buffer Encroachment (0.43 ha)
- Woodland Encroachment (0.70 ha)
- Potential Restoration/Enhancement Area (0.51 ha)

ELC LEGEND

CUP3-1, Red Pine Coniferous Plantation
FOD2-4, Dry-Fresh Oak - Hardwood Deciduous Forest
FOD5-7, Dry-Fresh Sugar Maple - Black Cherry Deciduous Forest
FOD6-4, Fresh-Moist Sugar Maple - White Elm Deciduous Forest
FOD6-5, Fresh-Moist Sugar Maple - Hardwood Deciduous Forest
MAM2-2, Reed-canary Grass Mineral Meadow Marsh
MAS, Shallow Marsh
MAS2-1, Cattail-Mineral Shallow Marsh
MAS3-1, Cattail Organic Shallow Marsh
MAS3-7, Bur-reed Organic Shallow Marsh
SWD3-2, Silver Maple Mineral Deciduous Swamp
SWD4, Mineral Deciduous Swamp
SWT2-2, Willow Mineral Thicket Swamp

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Figure 6
Opportunities and Constraints

0 100 m
1:5,250

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Appendix B Tables

Table 1: Field Studies and Natural Inventories (2024)

SURVEYORS (SURNAME, INTL)	SURVEY ROUND	SURVEY TYPE	DATE (2024)	TIME		AIR TEMP (C°)	HUMIDITY (%)	CLOUD COVER (%)	BEAUFORT WIND SPEED	PRECIPITATION COMMENTS
				START	END					
Williamson, L.	1	Bat Habitat Assessment	18-AP	08:00	10:02	10	70	50	2	None
Leslie, J.	1	Spring Botanical Inventory and Preliminary Ecological Land Classification (ELC)	29-MA	12:00	16:30	18	83	60	4	None
Burke, P.	1	Breeding Bird Survey	30-MA	06:30	08:00	10	59	0	1	None
Nieroda, M.	1	Bat Acoustic Deployment	01-JN	08:00	10:00	13	68	80	4	None
Nieroda, M.	1	Bat Acoustic Collection	02-JL	08:00	10:00	21	76	0	2	None
Foerster, L.	2	Breeding Bird Survey	20-JN	07:00	08:30	19	93	80	1	None
Kimble, B.	1	Headwater Drainage Feature Assessment	16-AP	09:00	15:30	13	65	100	4	None
Kimble, B.	1	Amphibian Call Count Survey	30-AP	20:30	23:45	14	50	50	0	None
Kimble, B.	2	Amphibian Call Count Survey	16-MA	21:00	23:00	17	73	5	1	None
Kimble, B.	2	Headwater Drainage Feature Assessment	22-MA	08:30	17:00	25	60	10	4	None
Kimble, B.	3	Amphibian Call Survey	12-JN	21:30	23:30	22	75	15	3	None

Table 1: Field Studies and Natural Inventories (2024)

SURVEYORS (SURNAME, INTL)	SURVEY ROUND	SURVEY TYPE	DATE (2024)	TIME		AIR TEMP (C°)	HUMIDITY (%)	CLOUD COVER (%)	BEAUFORT WIND SPEED	PRECIPITATION COMMENTS
				START	END					
Leslie, J.	2	Summer Botanical Inventory and ELC Refinements	22-JL	09:30	16:30	24	78	0	4	None
Kimble, B.	3	Headwater Drainage Feature Assessment	15-AU	09:00	14:30	25	63	0	1	None
Kimble, B.	1	Aquatic Habitat Assessment	15-AU	09:00	14:30	25	63	0	1	None
Leslie, J.	3	Fall Botanical Inventory and ELC Refinements	18-SE	10:00	15:00	24	93	5	2	None

LEGEND:

BEAUFORT WIND SPEED SCALE	
0	Calm (<1 km/hr)
1	
2	Light Air (1-5 km/hr)
3	Light Breeze (6-11 km/hr)
4	Gentle Breeze (12-19 km/hr)
	Moderate Breeze (20-28 km/hr)

MONTH (CODE)	
JA	January
FB	February
MR	March
AP	April
MA	May
JN	June
JL	July
AU	August
SE	September
OC	October
NO	November
DE	December

Table 2: Ecological Land Classification (ELC) Community Descriptions

ELC TYPE	COMMUNITY DESCRIPTION	S-RANK (NHIC 2021)
FOREST		
Deciduous Forest		
FOD2-4 Dry – Fresh Oak – Hardwood Deciduous Forest	• Mature forest with abundance of Red Oak (*Quercus rubra*) in the canopy and common occurrences of Black Cherry (*Prunus serotina*), White Elm (*Ulmus americana*), and Ironwood (*Ostrya virginiana*). • Understory with predominance of European Buckthorn (*Rhamnus cathartica*) and occasional Green Ash (*Fraxinus pennsylvanica*). • Ground cover somewhat sparse, with infrequent occurrences of Eastern Star Sedge (*Carex radiata*), Garlic Mustard (*Alliaria petiolata*), Bloodroot (*Sanguinaria canadensis*), and Large False Solomon's Seal (*Maianthemum racemosum*), among others. • Canopy semi-open due to Ash dieback.	S5
FOD5-7 Dry – Fresh Sugar Maple – Black Cherry Deciduous Forest	• Mature forest with abundance of Sugar Maple (*Acer saccharum*), and occasional Black Cherry, and Trembling Aspen (*Populus tremuloides*) in the canopy. • Understory with abundance of European Buckthorn, occasional White Ash (*Fraxinus americana*), and infrequent canopy saplings. • Ground cover with abundance of European Buckthorn and infrequent Broad-Leaved Helleborine (*Epipactis helleborine*), and Common Speedwell (*Veronica officinalis*). • Canopy semi-open due to Ash dieback.	S4S5
FOD6-4 Fresh – Moist Sugar Maple – White Elm Deciduous Forest	• Mid-age forest with abundance of Sugar Maple and occasional White Elm, American Basswood (*Tilia americana*), and Ironwood in the canopy. • Understory with abundance of Green Ash, and occasional Blue-beech (*Carpinus caroliniana ssp. virginiana*), European Buckthorn, and Chokecherry (*Prunus virginiana*). • Ground cover with occasional White Avens (*Geum canadense*), Eastern Star Sedge, Small-Spike False Nettle (*Boehmeria cylindrica*), and less frequent Herb-Robert (*Geranium robertianum*), Zig-Zag Goldenrod (*Solidago flexicaulis*), Sensitive Fern (*Onoclea sensibilis*), and Northeastern Lady Fern (*Athyrium filix-femina var. angustum*).	S5
FOD6-5 Fresh – Moist Sugar Maple – Hardwood Deciduous Forest	• Large, contiguous mature forest with abundance of Sugar Maple in the canopy with associations of Black Cherry, Shagbark Hickory (*Carya ovata var. ovata*), Yellow Birch (*Betula alleghaniensis*), and Red Oak. • Understory with abundance of Chokecherry, occasional Red Elderberry (*Sambucus racemosa*), Sugar Maple, and Black Raspberry (*Rubus occidentalis*).	S5

ELC TYPE	COMMUNITY DESCRIPTION	S-RANK (NHIC 2021)
	• Ground cover relatively diverse, with frequent Jack-in-the-pulpit (*Arisaema triphyllum ssp. triphyllum*), and Enchanter's Nightshade (*Circaea canadensis ssp. canadensis*), and occasional Wild Leek (*Allium tricoccum var. tricoccum*), Loose-Flowered Sedge (*Carex laxiflora*), Pennsylvania Sedge (*Carex pensylvanica*), Drooping Woodland Sedge (*Carex arctata*), Rosy Sedge (*Carex rosea*), and Long-stalked Sedge (*Carex pedunculata*), among others. • Evidence of historical logging as well as naturally fallen canopy trees (Ash), this resulting in dense sapling regeneration and relatively open subcanopy.	
CULTURAL		
Cultural Plantation		
CUP3-1 Red Pine Coniferous Plantation	• Mature coniferous plantation with predominantly Red Pine (*Pinus resinosa*) in the canopy. • Understory often with young Green Ash and European Buckthorn, and occasional Large-thorned Hawthorn (*Crataegus macracantha*). • Ground cover generally composed of Jack-in-the-pulpit, Herb-Robert, Enchanter's Nightshade, and Garlic Mustard (*Alliaria petiolata*). • Canopy semi-open due to dieback of Red Pine.	Not ranked
Cultural Meadow		
CUM1-1 Dry – Moist Old Field Meadow	• Varying from moist to dry-fresh (depending on location), but generally a mix of forb and graminoid species, such as Redtop (*Agrostis gigantea*), Canada Bluegrass (*Poa compressa*), Smooth Brome (*Bromus inermis*), Annual Fleabane (*Erigeron annuus*), Dudley's Rush (*Juncus dudleyi*), Wild Carrot (*Daucus carota*), Tall Goldenrod (*Solidago altissima*), Giant Goldenrod (*Solidago gigantea*), Common Teasel (*Dipsacus fullonum*), and Canada Thistle (*Cirsium arvense*). • Woody species sometimes present but occupying less than 25% cover.	Not ranked
Cultural Woodland		
CUW1a Mineral Cultural Woodland	• Mid-age to mature canopy, open, variably composed of Black Cherry, Green Ash, White Elm, Red Oak, and Trembling Aspen (*Populus tremuloides*). • Understory typically with abundance of European Buckthorn. • Ground cover also with abundance of European Buckthorn, with associations of Herb-Robert, Enchanter's Nightshade, Jack-in-the-pulpit, and Garlic Mustard.	Not ranked
CUW1b Mineral Cultural Woodland	• Canopy typically open, mature, generally composed of Sugar Maple, Black Cherry, and Red Oak, with a small inclusion of planted Red Pine. • Understory typically with abundance of European Buckthorn, scattered Chokecherry, Showy Fly Honeysuckle (*Lonicera x bella*), and periodic vines such as Thicket Creeper (*Parthenocissus vitacea*).	Not ranked

ELC TYPE	COMMUNITY DESCRIPTION	S-RANK (NHIC 2021)
	• Ground cover generally inclusive of Jack-in-the-pulpit, Wild Lily-Of-The-Valley (*Maianthemum canadense ssp. canadense*), Large False Solomon's Seal, White Trillium (*Trillium grandiflorum*), Garlic Mustard, Enchanter's Nightshade, and Herb-Robert.	
SWAMP		
Deciduous Swamp		
SWD3-2 Silver Maple Mineral Deciduous Swamp	• Small swamp with canopy dominated by mid-age Silver Maple (*Acer saccharinum*). • Understory open, with scattered occurrences of Green Ash, European Buckthorn, and Glossy Buckthorn (*Frangula alnus*). • Ground layer sparse, with infrequent occurrences of Sensitive Fern, Small-Spike False Nettle, Spotted Jewelweed (*Impatiens capensis*), all mostly confined to the perimeter. • Deep surface water (~45cm) observed in May and July, completely receded by September. Receives input (in part) through a tile drain.	S5
MARSH		
Meadow Marsh		
MAM2-2 Reed-canary Grass Mineral Meadow Marsh	• Small marsh dominated by Reed-canary Grass (*Phalaris arundinacea var. arundinacea*), with abundance of Spotted Jewelweed, and occasional Bittersweet Nightshade (*Solanum dulcamara*). • Soil saturated in July, moist in September.	S5
Shallow Marsh		
MAS2-1 Cattail Mineral Shallow Marsh	• Shallow marsh dominated by Narrow-leaved Cattail (*Typha angustifolia*), with scattered, infrequent occurrences of associates such as Reed-canary Grass, Small Duckweed (*Lemna minor*), Spotted Jewelweed, Sensitive Fern, Spotted Joe Pye Weed (*Eutrochium maculatum var. maculatum*), and Purple-stemmed Aster (*Symphyotrichum puniceum*). • Contains a smaller thicket swamp inclusion, dominated by Sandbar Willow (*Salix interior*). • Surface water up to 30cm depth (May), 15cm in July, and generally absent in September. Sheen on surface water, suggestive of possible ground water inputs.	S5
MAS3-1 / MAS3-7 Cattail Organic	• Large band of organic shallow marsh encircling the large shallow aquatic marsh, generally with two community-defining species - Broad-Leaved Cattail (*Typha latifolia*) and Broad-Fruited Burreed (*Sparganium eurycarpum*), abundant in isolation of the other, or sometimes mixed. Associate species generally include Spotted Jewelweed, Reed-canary Grass,	S5 / S5

ELC TYPE	COMMUNITY DESCRIPTION	S-RANK (NHIC 2021)
Shallow Marsh / Bur-reed Organic Shallow Marsh	Small Duckweed, Star Duckweed (*Lemna trisulca*), Great Duckweed (*Spirodela polyrhiza*), Northern Watermeal (*Wolffia borealis*), Columbia Watermeal (*Wolffia Columbiana*), Rice Cutgrass (*Leersia oryzoides*), and Bearded Sedge (*Carex comosa*).	
Shallow Aquatic		
SAM1-2 Duckweed Mixed Shallow Aquatic	• Inventoried and classified from the shoreline and therefore difficult to gauge abundances/diversity, but generally appeared to contain an abundance of Small Duckweed, Great Duckweed, Northern Watermeal Columbia Watermeal, and Greater Bladderwort (*Utricularia vulgaris ssp. macrorhiza*). • Sewage-like smell noted during the July survey.	S5

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DICOTYLEDONS	Amaranthaceae	Amaranthus retroflexus	Redroot Amaranth		N	SNA	G5					L.
DICOTYLEDONS	Anacardiaceae	Rhus typhina	Staghorn Sumac		N	S5	G5					L.
DICOTYLEDONS	Anacardiaceae	Toxicodendron radicans var. radicans	Eastern Poison Ivy		N	S5	G5T5					(L.) Kuntze
DICOTYLEDONS	Apiaceae	Cicuta bulbifera	Bulbous Water-Hemlock		N	S5	G5					L.
DICOTYLEDONS	Apiaceae	Daucus carota	Wild Carrot		N	SNA	GNR					L.
DICOTYLEDONS	Apocynaceae	Apocynum androsaemifolium	Spreading Dogbane		N	S5	G5					L.
DICOTYLEDONS	Apocynaceae	Asclepias incarnata ssp. incarnata	Swamp Milkweed		N	S5	G5T5					L.
DICOTYLEDONS	Apocynaceae	Asclepias syriaca	Common Milkweed		N	S5	G5					L.
DICOTYLEDONS	Aristolochiaceae	Asarum canadense	Canada Wild-Ginger		N	S5	G5					L.
DICOTYLEDONS	Asteraceae	Achillea millefolium	Common Yarrow		N	SNA	G5					L.
DICOTYLEDONS	Asteraceae	Antennaria howellii	Howell's Pussytoes		N	S5	G5					Greene
DICOTYLEDONS	Asteraceae	Arctium minus	Common Burdock		N	SNA	GNR					(Hill) Bernh.
DICOTYLEDONS	Asteraceae	Bidens cernua	Nodding Beggarticks		N	S5	G5					L.
DICOTYLEDONS	Asteraceae	Centaurea jacea	Brown Knapweed		N	SNA	GNR					L.
DICOTYLEDONS	Asteraceae	Centaurea stoebe	Spotted Knapweed	3	N	SNA	GNR					L.
DICOTYLEDONS	Asteraceae	Cichorium intybus	Wild Chicory		N	SNA	GNR					L.
DICOTYLEDONS	Asteraceae	Cirsium arvense	Canada Thistle	1	N	SNA	G5					(L.) Scop.
DICOTYLEDONS	Asteraceae	Erigeron annuus	Annual Fleabane		N	S5	G5					(L.) Pers.
DICOTYLEDONS	Asteraceae	Erigeron canadensis	Canada Horseweed		N	S5	G5					(L.)
DICOTYLEDONS	Asteraceae	Erigeron philadelphicus var. philadelphic	Philadelphia Fleabane		N	S5	G5T5					L.
DICOTYLEDONS	Asteraceae	Eupatorium perfoliatum	Common Boneset		N	S5	G5					L.
DICOTYLEDONS	Asteraceae	Euthamia graminifolia	Grass-Leaved Goldenrod		N	S5	G5					(L.) Nutt.
DICOTYLEDONS	Asteraceae	Eutrochium maculatum var. maculatum	Spotted Joe Pye Weed		N	S5	G5T5					(L.) E.E. Lamont
DICOTYLEDONS	Asteraceae	Pilosella piloselloides	Tall Hawkweed		N	SNA	GNR					(Vill.) Soják
DICOTYLEDONS	Asteraceae	Rudbeckia hirta var. pulcherrima	Black-Eyed Susan		N	S5	G5T5					Farwell
DICOTYLEDONS	Asteraceae	Solidago altissima var. altissima	Tall Goldenrod		N	S5	G5					L.
DICOTYLEDONS	Asteraceae	Solidago flexicaulis	Zigzag Goldenrod		N	S5	G5					L.
DICOTYLEDONS	Asteraceae	Solidago gigantea	Giant Goldenrod		P	S5	G5					Aiton
DICOTYLEDONS	Asteraceae	Sonchus arvensis ssp. arvensis	Field Sow-Thistle		N	SNA	GNRTNR					L.
DICOTYLEDONS	Asteraceae	Symphyotrichum lanceolatum	Panicled Aster		P	S5	G5					(Willd.) G.L. Nesom
DICOTYLEDONS	Asteraceae	Symphyotrichum novae-angliae	New England Aster		N	S5	G5					(L.) G.L. Nesom
DICOTYLEDONS	Asteraceae	Symphyotrichum pilosum var. pilosum	Old Field Aster		N	S5	G5T5					(Willd.) G.L. Nesom
DICOTYLEDONS	Asteraceae	Symphyotrichum puniceum	Purple-Stemmed Aster		N	S5	G5					(L.) Á. & D. Löve
DICOTYLEDONS	Asteraceae	Taraxacum officinale	Common Dandelion		N	SNA	G5					F.H. Wiggers
DICOTYLEDONS	Asteraceae	Tragopogon dubius	Yellow Goatsbeard		N	SNA	GNR					Scopoli
DICOTYLEDONS	Balsaminaceae	Impatiens capensis	Spotted Jewelweed		N	S5	G5					Meerburgh
DICOTYLEDONS	Berberidaceae	Podophyllum peltatum	May-Apple		N	S5	G5					L.
DICOTYLEDONS	Betulaceae	Betula alleghaniensis	Yellow Birch		N	S5	G5					Britton
DICOTYLEDONS	Betulaceae	Betula papyrifera	Paper Birch		N	S5	G5					Marshall
DICOTYLEDONS	Betulaceae	Carpinus caroliniana ssp. virginiana	Blue-Beech		N	S5	G5T5					(Marshall) Furlow
DICOTYLEDONS	Betulaceae	Ostrya virginiana	Eastern Hop-Hornbeam		N	S5	G5					(Miller) K. Koch
DICOTYLEDONS	Brassicaceae	Alliaria petiolata	Garlic Mustard	1	N	SNA	GNR					(M. Bieb.) Cavara & Grande
DICOTYLEDONS	Brassicaceae	Hesperis matronalis	Dame's Rocket	1	N	SNA	G4G5					L.
DICOTYLEDONS	Brassicaceae	Rorippa palustris ssp. palustris	Marsh Yellowcress		N	S5?	G5T5					(L.) Besser
DICOTYLEDONS	Brassicaceae	Turritis glabra	Tower Mustard		N	S5	G5					L.
DICOTYLEDONS	Cannabaceae	Celtis occidentalis	Common Hackberry		N	S4	G5				R*	L.
DICOTYLEDONS	Caprifoliaceae	Dipsacus fullonum	Common Teasel	3	N	SNA	GNR					L.
DICOTYLEDONS	Caprifoliaceae	Lonicera x bella	Showy Fly Honeysuckle	1	N	SNA	GNA					Zabel
DICOTYLEDONS	Caprifoliaceae	Triosteum aurantiacum var. aurantiacum	Orange-Fruit Horse-Gentian		N	S4S5	G5T5					E.P. Bicknell
DICOTYLEDONS	Caryophyllaceae	Cerastium fontanum ssp. vulgare	Common Mouse-Ear Chickweed		N	SNA	GNRTNR					(Hartman) Greuter & Burdet
DICOTYLEDONS	Caryophyllaceae	Dianthus armeria ssp. armeria	Deptford Pink		N	SNA	GNRTNR					L.
DICOTYLEDONS	Caryophyllaceae	Silene latifolia	White Campion		N	SNA	GNR					Poiret
DICOTYLEDONS	Caryophyllaceae	Silene vulgaris	Bladder Campion		N	SNA	GNR					(Moench) Garcke
DICOTYLEDONS	Convolvulaceae	Convolvulus arvensis	Field Bindweed	3	N	SNA	GNR					L.
DICOTYLEDONS	Cornaceae	Cornus alternifolia	Alternate-Leaved Dogwood		N	S5	G5					L. f.
DICOTYLEDONS	Cornaceae	Cornus obliqua	Silky Dogwood		N	S5	G5					Rafinesque
DICOTYLEDONS	Cornaceae	Cornus racemosa	Grey Dogwood		N	S5	G5					Lamarck
DICOTYLEDONS	Cornaceae	Cornus sericea	Red-Osier Dogwood		N	S5	G5					L.
DICOTYLEDONS	Cucurbitaceae	Echinocystis lobata	Wild Cucumber		N	S5	G5					(Michx.) Torr. & A. Gray
DICOTYLEDONS	Euphorbiaceae	Acalypha rhomboidea	Common Three-Seed Mercury		N	S5	G5					Raf.
DICOTYLEDONS	Fabaceae	Lotus corniculatus	Garden Bird's-Foot Trefoil	2	N	SNA	GNR					L.
DICOTYLEDONS	Fabaceae	Medicago lupulina	Black Medick	4	N	SNA	GNR					L.
DICOTYLEDONS	Fabaceae	Robinia pseudoacacia	Black Locust	2	N	SNA	G5					L.
DICOTYLEDONS	Fabaceae	Securigera varia	Purple Crown-Vetch	1	N	SNA	GNR					(L.) Lassen
DICOTYLEDONS	Fabaceae	Trifolium pratense	Red Clover	4	N	SNA	GNR					L.
DICOTYLEDONS	Fagaceae	Fagus grandifolia	American Beech		N	S4	G5					Ehrhart
DICOTYLEDONS	Fagaceae	Quercus alba	White Oak		N	S5	G5					L.
DICOTYLEDONS	Fagaceae	Quercus rubra	Northern Red Oak		N	S5	G5					L.
DICOTYLEDONS	Geraniaceae	Geranium maculatum	Spotted Geranium		N	S5	G5					L.
DICOTYLEDONS	Geraniaceae	Geranium robertianum	Herb-Robert		N	S5	G5					L.
DICOTYLEDONS	Grossulariaceae	Ribes americanum	Wild Black Currant		N	S5	G5					Miller
DICOTYLEDONS	Grossulariaceae	Ribes cynosbati	Eastern Prickly Gooseberry		N	S5	G5					L.
DICOTYLEDONS	Grossulariaceae	Ribes rubrum	European Red Currant		N	SNA	G4G5					L.
DICOTYLEDONS	Hypericaceae	Hypericum perforatum ssp. perforatum	Common St. John's-Wort	4	N	SNA	GNR					L.
DICOTYLEDONS	Juglandaceae	Carya cordiformis	Bitternut Hickory		N	S5	G5					(Wangenh.) K. Koch
DICOTYLEDONS	Juglandaceae	Carya ovata var. ovata	Shagbark Hickory		N	S5	G5					(Miller) K. Koch
DICOTYLEDONS	Juglandaceae	Juglans nigra	Black Walnut		N	S4?	G5				R+*	L.
DICOTYLEDONS	Lamiaceae	Glechoma hederacea	Ground-Ivy	4	N	SNA	GNR					L.

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DICOTYLEDONS	Lamiaceae	Leonurus cardiaca ssp. cardiaca	Common Motherwort		N	SNA	GNRTNR					L.
DICOTYLEDONS	Lamiaceae	Lycopus americanus	American Water-Horehound		N	S5	G5					Muhlenb. ex Bartram
DICOTYLEDONS	Lamiaceae	Lycopus uniflorus	Northern Water-Horehound		N	S5	G5					Michaux
DICOTYLEDONS	Lamiaceae	Nepeta cataria	Catnip	4	N	SNA	GNR					L.
DICOTYLEDONS	Lamiaceae	Prunella vulgaris ssp. lanceolata	Lance-Leaved Self-Heal		N	S5	G5T5					(W.P.C. Barton) Piper & Beattie
DICOTYLEDONS	Lamiaceae	Scutellaria lateriflora	Mad-Dog Skullcap		N	S5	G5					L.
DICOTYLEDONS	Lentibulariaceae	Utricularia vulgaris ssp. macrorhiza	Greater Bladderwort		N	S5	G5					(Leconte ex Torrey) R.T. Clausen
DICOTYLEDONS	Malvaceae	Abutilon theophrasti	Velvetleaf	3	N	SNA	GNR					Medikus
DICOTYLEDONS	Malvaceae	Hibiscus syriacus	Rose of Sharon		N	SNA	GNR					L.
DICOTYLEDONS	Malvaceae	Tilia americana	Basswood		N	S5	G5					L.
DICOTYLEDONS	Malvaceae	Tilia cordata	Little-Leaved Linden	P	N	SNA	GNR					Miller
DICOTYLEDONS	Moraceae	Morus alba	White Mulberry	1	N	SNA	GNR					L.
DICOTYLEDONS	Oleaceae	Fraxinus americana	White Ash		N	S4	G4					L.
DICOTYLEDONS	Oleaceae	Fraxinus nigra	Black Ash		Y	S4	G5	END	THR			Marshall
DICOTYLEDONS	Oleaceae	Fraxinus pennsylvanica	Red Ash		N	S4	G4					Marshall
DICOTYLEDONS	Oleaceae	Syringa vulgaris	Common Lilac	2	N	SNA	GNR					L.
DICOTYLEDONS	Onagraceae	Circaea canadensis ssp. canadensis	Canada Enchanter's Nightshade		N	S5	G5T5					(L.) Hill
DICOTYLEDONS	Onagraceae	Epilobium parviflorum	Small-Flowered Willowherb		N	SNA	GNR					Schreber
DICOTYLEDONS	Onagraceae	Oenothera parviflora	Small-Flowered Evening Primrose		N	S5	G5					L.
DICOTYLEDONS	Orobanchaceae	Epifagus virginiana	Beechdrops		N	S5	G5					(L.) Barton
DICOTYLEDONS	Oxalidaceae	Oxalis stricta	European Wood-Sorrel		N	SNA	G5					L.
DICOTYLEDONS	Papaveraceae	Chelidonium majus	Greater Celandine		N	SNA	GNR					L.
DICOTYLEDONS	Papaveraceae	Sanguinaria canadensis	Bloodroot		N	S5	G5					L.
DICOTYLEDONS	Plantaginaceae	Plantago lanceolata	English Plantain		N	SNA	G5					L.
DICOTYLEDONS	Plantaginaceae	Plantago major	Common Plantain		N	SNA	G5					L.
DICOTYLEDONS	Plantaginaceae	Plantago rugelii	Rugel's Plantain		N	S5	G5					Decaisne
DICOTYLEDONS	Plantaginaceae	Veronica officinalis	Common Speedwell		N	SNA	G5					L.
DICOTYLEDONS	Polygonaceae	Persicaria amphibia	Water Smartweed		N	S5	G5					L.
DICOTYLEDONS	Polygonaceae	Reynoutria japonica var. japonica	Japanese Knotweed	2	N	SNA	GNRTNR					Houttuyn
DICOTYLEDONS	Polygonaceae	Rumex crispus	Curled Dock		N	SNA	GNR					L.
DICOTYLEDONS	Ranunculaceae	Actaea pachypoda	White Baneberry		N	S5	G5					Elliott
DICOTYLEDONS	Ranunculaceae	Actaea rubra ssp. rubra	Red Baneberry		N	S5	G5T5					(Aiton) Willdenow
DICOTYLEDONS	Ranunculaceae	Anemone virginiana	Tall Anemone		N	S5	G5					L.
DICOTYLEDONS	Ranunculaceae	Aquilegia canadensis	Red Columbine		N	S5	G5					L.
DICOTYLEDONS	Ranunculaceae	Hepatica acutiloba	Sharp-Lobed Hepatica		N	S5	G5T5					DC.
DICOTYLEDONS	Rhamnaceae	Frangula alnus	Glossy Buckthorn	1	N	SNA	GNR					Miller
DICOTYLEDONS	Rhamnaceae	Rhamnus cathartica	European Buckthorn	1	N	SNA	GNR					L.
DICOTYLEDONS	Rosaceae	Crataegus macracantha	Large-Thorned Hawthorn		N	S5	G5				R*	Loddiges ex Loudon
DICOTYLEDONS	Rosaceae	Fragaria vesca	Woodland Strawberry		N	S5	G5					L.
DICOTYLEDONS	Rosaceae	Fragaria virginiana	Wild Strawberry		N	S5	G5					Miller
DICOTYLEDONS	Rosaceae	Geum aleppicum	Yellow Avens		N	S5	G5					Jacquin
DICOTYLEDONS	Rosaceae	Geum canadense	White Avens		N	S5	G5					Jacquin
DICOTYLEDONS	Rosaceae	Potentilla argentea	Silvery Cinquefoil		N	SNA	GNR					L.
DICOTYLEDONS	Rosaceae	Potentilla recta	Sulphur Cinquefoil		N	SNA	GNR					L.
DICOTYLEDONS	Rosaceae	Prunus pensylvanica	Pin Cherry		N	S5	G5					L. f.
DICOTYLEDONS	Rosaceae	Prunus serotina var. serotina	Black Cherry		N	S5	G5T5					Ehrhart
DICOTYLEDONS	Rosaceae	Prunus virginiana var. virginiana	Chokecherry		N	S5	G5T5					L.
DICOTYLEDONS	Rosaceae	Rubus idaeus ssp. strigosus	North American Red Raspberry		N	S5	G5T5					(Michaux) Focke
DICOTYLEDONS	Rosaceae	Rubus occidentalis	Black Raspberry		N	S5	G5					L.
DICOTYLEDONS	Rosaceae	Sorbus aucuparia	European Mountain-Ash	4	N	SNA	G5					L.
DICOTYLEDONS	Rubiaceae	Galium asprellum	Rough Bedstraw		N	S5	G5					Michaux
DICOTYLEDONS	Rubiaceae	Galium boreale	Northern Bedstraw		N	S5	G5					L.
DICOTYLEDONS	Rubiaceae	Galium mollugo	Smooth Bedstraw	2	N	SNA	GNR					L.
DICOTYLEDONS	Rubiaceae	Galium palustre	Common Marsh Bedstraw		N	S5	G5					L.
DICOTYLEDONS	Rutaceae	Zanthoxylum americanum	Common Prickly-Ash		N	S5	G5				R*	P. Miller
DICOTYLEDONS	Salicaceae	Populus balsamifera	Balsam Poplar		N	S5	G5					L.
DICOTYLEDONS	Salicaceae	Populus deltoides ssp. deltoides	Eastern Cottonwood		N	S5	G5T5				R+	Bartram ex Marshall
DICOTYLEDONS	Salicaceae	Populus grandidentata	Large-Toothed Aspen		N	S5	G5					Michaux
DICOTYLEDONS	Salicaceae	Populus tremuloides	Trembling Aspen		N	S5	G5					Michaux
DICOTYLEDONS	Salicaceae	Salix alba	White Willow	3	N	SNA	G5					L.
DICOTYLEDONS	Salicaceae	Salix amygdaloides	Peach-Leaved Willow		N	S5	G5					Andersson
DICOTYLEDONS	Salicaceae	Salix eriocephala	Cottony Willow		N	S5	G5					Michaux
DICOTYLEDONS	Salicaceae	Salix interior	Sandbar Willow		N	S5	G5					Rowlee
DICOTYLEDONS	Salicaceae	Salix x fragilis	Hybrid Crack Willow	3	N	SNA	GNA					L.
DICOTYLEDONS	Sapindaceae	Acer negundo	Manitoba Maple	1	N	S5	G5					L.
DICOTYLEDONS	Sapindaceae	Acer platanoides	Norway Maple	2	N	SNA	GNR					L.
DICOTYLEDONS	Sapindaceae	Acer saccharinum	Silver Maple		N	S5	G5					L.
DICOTYLEDONS	Sapindaceae	Acer saccharum	Sugar Maple		N	S5	G5					Marshall
DICOTYLEDONS	Scrophulariaceae	Verbascum thapsus ssp. thapsus	Common Mullein		N	SNA	GNRTNR					L.
DICOTYLEDONS	Solanaceae	Solanum dulcamara	Bittersweet Nightshade	3	N	SNA	GNR					L.
DICOTYLEDONS	Solanaceae	Solanum emulans	Eastern Black Nightshade		N	S5	G5					Rafinesque
DICOTYLEDONS	Ulmaceae	Ulmus americana	White Elm		N	S5	G4					L.
DICOTYLEDONS	Urticaceae	Boehmeria cylindrica	Small-Spike False Nettle		N	S5	G5					(L.) Swartz
DICOTYLEDONS	Urticaceae	Urtica gracilis ssp. gracilis	Slender Stinging Nettle		N	S5	G5T5					
DICOTYLEDONS	Verbenaceae	Verbena urticifolia	White Vervain		N	S5	G5					L.
DICOTYLEDONS	Viburnaceae	Sambucus canadensis	Common Elderberry		N	S5	G5T5					L.
DICOTYLEDONS	Viburnaceae	Sambucus racemosa	Red Elderberry	P	N	S5	G5					L.
DICOTYLEDONS	Viburnaceae	Viburnum lantana	Wayfaring Viburnum		N	SNA	GNR					L.

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DICOTYLEDONS	Viburnaceae	Viburnum opulus var. opulus	Cranberry Viburnum	4	N	SNA	G5TNR					
DICOTYLEDONS	Violaceae	Viola sororia	Woolly Blue Violet		N	S5	G5					Willdenow
DICOTYLEDONS	Vitaceae	Parthenocissus vitacea	Thicket Creeper		N	S5	G5					(Knerr) Hitchcock
DICOTYLEDONS	Vitaceae	Vitis riparia	Riverbank Grape		N	S5	G5					Michaux
GYMNOSPERMS	Cupressaceae	Thuja occidentalis	Eastern White Cedar		N	S5	G5					L.
GYMNOSPERMS	Pinaceae	Larix decidua	European Larch		N	SNA	G5					Miller
GYMNOSPERMS	Pinaceae	Pinus resinosa	Red Pine		N	S5	G5					Aiton
GYMNOSPERMS	Pinaceae	Pinus sylvestris	Scots Pine	2	N	SNA	GNR					L.
MONOCOTYLEDONS	Amaryllidaceae	Allium tricoccum var. tricoccum	Wild Leek		N	S4	G5					Aiton
MONOCOTYLEDONS	Araceae	Arisaema triphyllum ssp. triphyllum	Jack-In-The-Pulpit		N	S5	G5T5					(L.) Schott
MONOCOTYLEDONS	Araceae	Lemna minor	Small Duckweed		N	S5	G5					L.
MONOCOTYLEDONS	Araceae	Lemna trisulca	Star Duckweed		N	S5	G5					L.
MONOCOTYLEDONS	Araceae	Spirodela polyrhiza	Great Duckweed		N	S5	G5					(L.) Schleiden
MONOCOTYLEDONS	Araceae	Symplocarpus foetidus	Eastern Skunk Cabbage		N	S5	G5					(L.) Salisbury ex W.P.C. Barton
MONOCOTYLEDONS	Araceae	Wolffia borealis	Northern Watermeal		N	S5	G5				R*	(Engelm.) Landolt & Wildi ex Gandhi, Wiersema & Brouillet
MONOCOTYLEDONS	Araceae	Wolffia columbiana	Columbia Watermeal		N	S5	G5				R*	H. Karsten
MONOCOTYLEDONS	Asparagaceae	Maianthemum canadense ssp. canadens	Wild Lily-Of-The-Valley (ssp. canadense)		N	S5	G5T5					Desf.
MONOCOTYLEDONS	Asparagaceae	Maianthemum canadense ssp. interius	Wild Lily-Of-The-Valley (ssp. interius)		N	S4?	G5T4					(Fernald) Á. Löve & D. Löve
MONOCOTYLEDONS	Asparagaceae	Maianthemum racemosum	Large False Solomon's Seal		N	S5	G5T5					(L.) Link
MONOCOTYLEDONS	Asphodelaceae	Hemerocallis fulva	Orange Daylily	4	N	SNA	GNA					(L.) L.
MONOCOTYLEDONS	Cyperaceae	Carex arctata	Drooping Woodland Sedge		N	S5	G5					Boott
MONOCOTYLEDONS	Cyperaceae	Carex bebbii	Bebb's Sedge		N	S5	G5					(L.H. Bailey) Olney ex Fern.
MONOCOTYLEDONS	Cyperaceae	Carex brevior	Short-Beaked Sedge		N	S4	G5				R	(Dewey) Mackenzie ex Lunell
MONOCOTYLEDONS	Cyperaceae	Carex cephalophora	Oval-Headed Sedge		N	S5	G5					Muhlenb. ex Willdenow
MONOCOTYLEDONS	Cyperaceae	Carex comosa	Bearded Sedge		N	S5	G5					Boott
MONOCOTYLEDONS	Cyperaceae	Carex cristatella	Crested Sedge		N	S5	G5					Britton
MONOCOTYLEDONS	Cyperaceae	Carex deweyana var. deweyana	Dewey's Sedge		N	S5	G5T5					Schweinitz
MONOCOTYLEDONS	Cyperaceae	Carex gracillima	Graceful Sedge		N	S5	G5					Schweinitz
MONOCOTYLEDONS	Cyperaceae	Carex laxiflora	Loose-Flowered Sedge		N	S5	G5					Lamarck
MONOCOTYLEDONS	Cyperaceae	Carex pedunculata	Long-Stalked Sedge		N	S5	G5					Muhlenb. ex Willdenow
MONOCOTYLEDONS	Cyperaceae	Carex pensylvanica	Pennsylvania Sedge		N	S5	G5					Lamarck
MONOCOTYLEDONS	Cyperaceae	Carex radiata	Eastern Star Sedge		N	S5	G5					(Wahlenb.) Small
MONOCOTYLEDONS	Cyperaceae	Carex rosea	Rosy Sedge		N	S5	G5					Schkuhr ex Willdenow
MONOCOTYLEDONS	Cyperaceae	Carex sparganioides	Burreed Sedge		N	S4S5	G5				R*	Muhlenb. ex Willdenow
MONOCOTYLEDONS	Cyperaceae	Carex stipata var. stipata	Awl-Fruited Sedge		N	S5	G5T5					Muhlenb. ex Willdenow
MONOCOTYLEDONS	Cyperaceae	Carex tenera	Tender Sedge		N	S5	G5					Dewey
MONOCOTYLEDONS	Cyperaceae	Carex vulpinoidea	Fox Sedge		N	S5	G5					Michaux
MONOCOTYLEDONS	Cyperaceae	Cyperus engelmannii	Engelmann's Flatsedge		N	S4	G4Q					Steudel
MONOCOTYLEDONS	Cyperaceae	Cyperus esculentus var. leptostachyus	Perennial Yellow Flatsedge		N	S5	G5T5					Boeckeler
MONOCOTYLEDONS	Cyperaceae	Schoenoplectus tabernaemontani	Soft-Stemmed Bulrush		N	S5	G5					(C.C. Gmelin) Palla
MONOCOTYLEDONS	Juncaceae	Juncus dudleyi	Dudley's Rush		N	S5	G5					Wiegand
MONOCOTYLEDONS	Juncaceae	Luzula acuminata ssp. acuminata	Hairy Woodrush		N	S5	G5T5					Rafinesque
MONOCOTYLEDONS	Melanthiaceae	Trillium erectum	Red Trillium		N	S5	G5					L.
MONOCOTYLEDONS	Melanthiaceae	Trillium grandiflorum	White Trillium		N	S5	G5					(Michx.) Salisbury
MONOCOTYLEDONS	Orchidaceae	Epipactis helleborine	Broad-Leaved Helleborine		N	SNA	GNR					(L.) Crantz
MONOCOTYLEDONS	Poaceae	Agrostis gigantea	Redtop		N	SNA	G4G5					Roth
MONOCOTYLEDONS	Poaceae	Bromus inermis	Smooth Brome	4	N	SNA	G5T5					Leysser
MONOCOTYLEDONS	Poaceae	Dactylis glomerata	Orchard Grass	3	N	SNA	GNR					L.
MONOCOTYLEDONS	Poaceae	Echinochloa crus-galli	Large Barnyard Grass		N	SNA	GNR					(L.) Palisot de Beauvois
MONOCOTYLEDONS	Poaceae	Elymus repens	Quackgrass	3	N	SNA	GNR					(L.) Gould
MONOCOTYLEDONS	Poaceae	Glyceria striata	Fowl Mannagrass		N	S5	G5					(Lam.) Hitchcock
MONOCOTYLEDONS	Poaceae	Leersia oryzoides	Rice Cutgrass		N	S5	G5					(L.) Swartz
MONOCOTYLEDONS	Poaceae	Lolium arundinaceum	Tall Fescue	3	N	SNA	GNR					(Schreber) Darbyshire
MONOCOTYLEDONS	Poaceae	Muhlenbergia mexicana var. mexicana	Mexican Muhly		N	S5	G5T5					(L.) Trinius
MONOCOTYLEDONS	Poaceae	Panicum capillare	Common Panicgrass		N	S5	G5					L.
MONOCOTYLEDONS	Poaceae	Panicum miliaceum ssp. miliaceum	Proso Millet		N	SNA	GNRTNR					L.
MONOCOTYLEDONS	Poaceae	Phalaris arundinacea var. arundinacea	Reed Canary Grass	P	N	S5	G5TNR					L.
MONOCOTYLEDONS	Poaceae	Phragmites australis ssp. australis	European Reed	1	N	SNA	G5T5					(Cav.) Trinius ex Steudel
MONOCOTYLEDONS	Poaceae	Poa compressa	Canada Bluegrass		N	SNA	GNR					L.
MONOCOTYLEDONS	Poaceae	Poa nemoralis	Eurasian Woodland Bluegrass		N	SNA	G5TU					L.
MONOCOTYLEDONS	Poaceae	Poa palustris	Fowl Bluegrass		N	S5	G5					L.
MONOCOTYLEDONS	Poaceae	Poa pratensis	Kentucky Bluegrass	2	P	S5	G5					L.
MONOCOTYLEDONS	Poaceae	Schizachne purpurascens ssp. purpurasce	Purple False Melic		N	S5	G5T5					(Torr.) Swallen
MONOCOTYLEDONS	Poaceae	Setaria pumila	Yellow Foxtail	4	N	SNA	GNR					(Poir.) Roemer & Schultes
MONOCOTYLEDONS	Typhaceae	Sparganium eurycarpum	Broad-Fruited Burreed		N	S5	G5					Engelmann
MONOCOTYLEDONS	Typhaceae	Typha angustifolia	Narrow-Leaved Cattail	P	N	SNA	G5					L.
MONOCOTYLEDONS	Typhaceae	Typha latifolia	Broad-Leaved Cattail		N	S5	G5					L.
PTERIDOPHYTES	Athyriaceae	Athyrium filix-femina var. angustum	Northeastern Lady Fern		N	S5	G5T5					(Willdenow) G. Lawson
PTERIDOPHYTES	Dryopteridaceae	Dryopteris carthusiana	Spinulose Wood Fern		N	S5	G5					(Vill.) H.P. Fuchs
PTERIDOPHYTES	Dryopteridaceae	Polystichum acrostichoides	Christmas Fern		N	S5	G5					(Michx.) Schott
PTERIDOPHYTES	Equisetaceae	Equisetum arvense	Field Horsetail		N	S5	G5					L.
PTERIDOPHYTES	Onocleaceae	Onoclea sensibilis	Sensitive Fern		N	S5	G5					L.

ORDER	FAMILY	LATIN NAME	COMMON NAME	INVASIVE EXOTIC RANK (Urban Forest Associates 2002)	PROVINCIALLY TRACKED (NHIC) (NHIC FEB 6 2024)	PROVINCIAL STATUS (S-RANK) (NHIC FEB 6 2024)	GLOBAL STATUS (G-RANK) (NHIC FEB 6 2024)	SARO (MNRF) (NHIC FEB 6 2024)	COSEWIC STATUS (NHIC FEB 6 2024)		WATERLOO (Richardson et al. 1999)	AUTHORITY
	STATISTICS											
	Species Diversity											
	Total Number of Species:	228										
	Native Species:	155	68%									
	Exotic Species:	73	32%									
	S1-S3 Species:	0	0%									
	S4 Species:	12	8%									
	S5 Species:	143	92%									
	Provincially Tracked Species:	1	1%									
	Floristic Quality Assessment (FQA)											
	Mean Co-efficient of Conservatism (CC)	3.8										
	CC 0 - 3 = lowest sensitivity	62	40%									
	CC 4 - 6 = moderate sensitivity	84	54%									
	CC 7 - 8 = high sensitivity	9	6%									
	CC 9 - 10 = highest sensitivity	0	0%									
	Floristic Quality Index (FQI)	47										
	Weedy & Invasive Species											
	Mean Weediness Index (Oldham et al):	-1.8										
	-1 = low potential invasiveness	26	36%									
	-2 = moderate potential invasiveness	23	32%									
	-3 = high potential invasiveness	16	22%									
	Mean Exotic Rank (Urban Forest Associates):	3										
	Category 1	10	14%									
	Category 2	8	11%									
	Category 3	10	14%									
	Category 4	10	14%									
	Potentially Invasive (P)	4	5%									
	Wetland Species											
	Mean Wetness Index	0.9										
	Upland	43	19%									
	Facultative upland	85	37%									
	Facultative	33	14%									
	Facultative wetland	34	15%									
	Obligate wetland	31	14%									

No.	X	Common Name	Species Code	Scientific Name	Provincial Status (S Rank)	Global Status (G Rank)	SARO (MECP)	COSEWIC (Federal)	SWH Indicator Species
	X								
	X								
	X	**Anseriformes**							
	X	***Anatidae***							
		Trumpeter Swan	TRUS	*Cygnus buccinator*	S4	G4		NAR	X
		Mallard	MALL	*Anas platyrhynchos*	S5	G5			X
	X								
	X	**Galliformes**							
	X	***Phasianinae***							
		Wild Turkey	WITU	*Meleagris gallopavo*	S5	G5			X
	X								
	X	**Columbiformes**							
	X	***Columbidae***							
		Rock Pigeon	ROPI	*Columba livia*	SNA	G5			
	X								
	X	**Charadriiformes**							
	X	***Scolopacidae***							
		Spotted Sandpiper	SPSA	*Actitis macularius*	S5B	G5			X
	X								
	X	**Piciformes**							
	X	***Picidae***							
		Northern Flicker	NOFL	*Colaptes auratus*	S5	G5			
	X								
	X	**Passeriformes**							
	X	***Tyrannidae***							
		Eastern Wood-Pewee	EAWP	*Contopus virens*	S4B	G5	SC	SC	X
	X								
	X	***Vireonidae***							
		Warbling Vireo	WAVI	*Vireo gilvus*	S5B	G5			
		Red-eyed Vireo	REVI	*Vireo olivaceus*	S5B	G5			
	X								
	X	***Corvidae***							
		Blue Jay	BLJA	*Cyanocitta cristata*	S5	G5			
		American Crow	AMCR	*Corvus brachyrhynchos*	S5	G5			
	X								
	X	***Hirundinidae***							
		Barn Swallow	BARS	*Hirundo rustica*	S4B	G5	SC	SC	
	X								
	X	***Turdidae***							
		American Robin	AMRO	*Turdus migratorius*	S5	G5			
	X								
	X	***Mimidae***							
		Gray Catbird	GRCA	*Dumetella carolinensis*	S5B, S3N	G5			
	X								
	X	***Sturnidae***							
		European Starling	EUST	*Sturnus vulgaris*	SNA	G5			
	X								
	X	***Bombycillidae***							
		Cedar Waxwing	CEDW	*Bombycilla cedrorum*	S5	G5			
	X								
	X	***Passeridae***							
		House Sparrow	HOSP	*Passer domesticus*	SNA	G5			
	X								
	X	***Fringillidae***							
		American Goldfinch	AMGO	*Spinus tristis*	S5	G5			
	X								
	X	***Passerellidae***							
		Chipping Sparrow	CHSP	*Spizella passerina*	S5B, S3N	G5			
		Savannah Sparrow	SAVS	*Passerculus sandwichensis*	S5B, S3N	G5			X
		Song Sparrow	SOSP	*Melospiza melodia*	S5	G5			
	X								
	X	***Icteridae***							
		Baltimore Oriole	BAOR	*Icterus galbula*	S4B	G5			
		Red-winged Blackbird	RWBL	*Agelaius phoeniceus*	S5	G5			

No.	X	Common Name	Species Code	Scientific Name	Provincial Status (S Rank)	Global Status (G Rank)	SARO (MECP)	COSEWIC (Federal)	SWH Indicator Species
	X								
	X								
		Common Grackle	COGR	*Quiscalus quiscula*	S5	G5			
	X								
	X	***Parulidae***							
		Mourning Warbler	MOWA	*Geothlypis philadelphia*	S5B	G5			
		Common Yellowthroat	COYE	*Geothlypis trichas*	S5B, S3N	G5			
		Yellow Warbler	YWAR	*Setophaga petechia*	S5B	G5			
	X								
	X	***Cardinalidae***							
		Northern Cardinal	NOCA	*Cardinalis cardinalis*	S5	G5			
		Rose-breasted Grosbeak	RBGR	*Pheucticus ludovicianus*	S5B	G5			
		Indigo Bunting	INBU	*Passerina cyanea*	S5B	G5			
	X								

Species Common Name and Scientific Name: Chesser, R. T., K. J. Burns, C. Cicero, J. L. Dunn, A. W. Kratter, I. J. Lovette, P. C. Rasmussen, J. V. Remsen, Jr., D. F. Stotz, B. M. Winger, and K. Winker. 2018. Check-list of North American Birds (online). American Ornithological Society. Available online: http://checklist.aou.org/taxa

Species Code: Consistent with the American Ornithologists' Union. 2018. Species 4-Letter-Codes. Available online: http://www.birdsontario.org/atlas/codes.jsp?lang=en&pg=species

Highest Breeding Evidence: Codes assigned for breeding evidence are consistent with the Ontario Breeding Bird Atlas (OBBA). 2018. Breeding Evidence Codes. Available online: http://www.birdsontario.org/atlas/codes.jsp?lang=en&pg=breeding&sortorder=aou

S ranks: Provincial ranks are from the Natural Heritage Information Centre; S1 (critically imperiled), S2 (imperlied), S3 (vulnerable), S4 (apparently secure), S5 (secure); ranks were updated using NHIC species list 2021. Available to download from: https://www.ontario.ca/page/get-natural-heritage-information

G ranks: Global ranks are from the Natural Heritage Information Centre; G1 (extremely rare), G2 (very rare), G3 (rare to uncommon), G4 (common), G5 (very common); ranks were updated using NHIC species list 2021. Available to download from: https://www.ontario.ca/page/get-natural-heritage-information

SARO (MECP): Ontario Species at Risk as listed by the Committee on the Status of Species at Risk in Ontario (from Ontario Regulation 230/08 Species at Risk in Ontario website: https://www.ontario.ca/laws/regulation/080230/); END - Endangered; THR - Threatened; SC - Special Concern; NAR - Not at Risk

COSEWIC: Assessed Species at Risk at the national level as listed by the Committee on the Status of Endangered Wildlife in Canada (from COSEWIC: https://wildlife-species.canada.ca/species-risk-registry/sar/index/default_e.cfm); END - Endangered, THR - Threatened, SC - Special Concern, NAR - Not at Risk

SWH Indicator Species: SWH refers to Significant Wildlife Habitat as defined by the MNRF (2015) Significant Wildlife Habitat Criteria Schedules for Ecoregions 7E and 6E (as appropriate for the Subject Lands). SWH indicator species are identified in this table and any potential SWH is discussed in the text of this report. Available online: http://www.townofnemi.on.ca/wp-content/uploads/2016/02/NEMI-OP-App-C-schedule-6e-jan-2015-access-ver-final-s.pdf

Appendix B – Suitable Maternity Roost Trees for Little Brown Myotis/Northern Myotis

Include all live and dead standing trees >10cm dbh with loose or naturally exfoliating bark, cavities, hollows or cracks.

Project Number: 2403674

Site Name: 3927 Cedar Creek

ELC Ecosite:

Survey Start Date/Time: April 18, 2024 8:00 AM

Survey End Date/Time: April 18, 2024 10:02 AM

Observer(s): Laura Williamson

Snag Density (snags/ha):

Tree #	Tree Species ID	dbh (cm)	Height Class	Snag Attributes	Decay Class	Easting	Northing	Notes
1	Manitoba maple	19	2. Co-dominant (canopy height)	Loose Bark	1. Healthy, live tree	543610	4797249	2 stems
2	Manitoba maple	24	2. Co-dominant (canopy height)	Loose Bark	1. Healthy, live tree	543647	4797194	2 stems
3	Manitoba maple	23	2. Co-dominant (canopy height)	Loose Bark, Knot Hole	1. Healthy, live tree	543687	4797010	Three stems
4	Ash	25	2. Co-dominant (canopy height)	Loose Bark, Knot Hole	3. Very recently dead, bark intact, branches intact	543731	4796867	Dead ash
5	Maple Spp	11	3. Intermediate (just below canopy)	Loose Bark		543545	4797107	
6	Pine	23	2. Co-dominant (canopy height)	Loose Bark, Knot Hole, Other Snag within 10m	2. Declining live tree, part of canopy lost	543540	4797114	
7	Ash	56	2. Co-dominant (canopy height)	Cavity, Loose Bark, Other Snag within 10m	3. Very recently dead, bark intact, branches intact	543531	4797111	
8	Black Cherry	34	2. Co-dominant (canopy height)	Loose Bark, Other Snag within 10m	2. Declining live tree, part of canopy lost	543527	4797109	
9	Black Cherry	30	3. Intermediate (just below canopy)	Loose Bark	2. Declining live tree, part of canopy lost	543525	4797105	2 stems
10	Black Cherry	45	2. Co-dominant (canopy height)	Loose Bark, Other Snag within 10m	2. Declining live tree, part of canopy lost	543526	4797104	
11	Hawthorn	25	3. Intermediate (just below canopy)	Loose Bark	3. Very recently dead, bark intact, branches intact	543529	4797093	2 stems
12	Hop Hornbeam	23	3. Intermediate (just below canopy)	Loose Bark, Other Snag within 10m	2. Declining live tree, part of canopy lost	543516	4797103	2 stems

Tree #	Tree Species ID	dbh (cm)	Height Class	Snag Attributes	Decay Class	Easting	Northing	Notes
13	Dead Pine	85	2. Co-dominant (canopy height)	Cavity, Loose Bark, Other Snag within 10m	3. Very recently dead, bark intact, branches intact	543522	4797117	
14	Black Cherry	47	2. Co-dominant (canopy height)	Loose Bark, Other Snag within 10m	2. Declining live tree, part of canopy lost	543531	4797127	
15	Dead pine	21	3. Intermediate (just below canopy)	Loose Bark, Other Snag within 10m	3. Very recently dead, bark intact, branches intact	543531	4797133	
15	Black cherry	52	2. Co-dominant (canopy height)	Loose Bark, Other Snag within 10m	1. Healthy, live tree	543541	4797140	
17	Hawthorn	15	3. Intermediate (just below canopy)	Loose Bark, Other Snag within 10m	3. Very recently dead, bark intact, branches intact	543539	4797142	
18	Black Cherry	41	2. Co-dominant (canopy height)	Loose Bark, Other Snag within 10m	2. Declining live tree, part of canopy lost	543550	4797109	
19	Black cherry	22	3. Intermediate (just below canopy)	Loose Bark, Other Snag within 10m	1. Healthy, live tree	543532	4797140	
20	Maple Spp	17	3. Intermediate (just below canopy)	Loose Bark	1. Healthy, live tree	543527	4797141	
21	Ash		2. Co-dominant (canopy height)	Loose Bark	3. Very recently dead, bark intact, branches intact	543517	4797139	
22	Maple Spp	48	3. Intermediate (just below canopy)	Loose Bark, Other Snag within 10m	2. Declining live tree, part of canopy lost	543510	4797146	
23	Ash	40	2. Co-dominant (canopy height)	Loose Bark, Other Snag within 10m	2. Declining live tree, part of canopy lost	543523	4797162	
24	Maple Spp	31	3. Intermediate (just below canopy)	Loose Bark, Other Snag within 10m	1. Healthy, live tree	543524	4797159	
25	Maple Spp	30	2. Co-dominant (canopy height)	Loose Bark, Other Snag within 10m	1. Healthy, live tree	543531	4797163	
26	Ash	28	2. Co-dominant (canopy height)	Loose Bark, Other Snag within 10m	3. Very recently dead, bark intact, branches intact	543540	4797182	
27	Ash	10	3. Intermediate (just below canopy)	Loose Bark, Other Snag within 10m	3. Very recently dead, bark intact, branches intact	543545	4797185	
28	Ash	44	2. Co-dominant (canopy height)	Loose Bark, Other Snag within 10m	1. Healthy, live tree	543576	4797197	
29	Ash	22	3. Intermediate (just below canopy)	Loose Bark, Other Snag within 10m	3. Very recently dead, bark intact, branches intact	543541	4797187	

Tree #	Tree Species ID	dbh (cm)	Height Class	Snag Attributes	Decay Class	Easting	Northing	Notes
30	Maple	26	2. Co-dominant (canopy height)	Loose Bark, Other Snag within 10m	2. Declining live tree, part of canopy lost	543546	4797193	2 stems
31	Ash	11	3. Intermediate (just below canopy)	Loose Bark, Other Snag within 10m	3. Very recently dead, bark intact, branches intact	543558	4797195	
32	Ash	15	2. Co-dominant (canopy height)	Loose Bark, Other Snag within 10m	3. Very recently dead, bark intact, branches intact	543557	4797189	
33	Maple spp	36	2. Co-dominant (canopy height)	Loose Bark, Other Snag within 10m	2. Declining live tree, part of canopy lost	543558	4797203	
34	Ash	13	3. Intermediate (just below canopy)	Loose Bark, Other Snag within 10m	3. Very recently dead, bark intact, branches intact	543558	4797208	
35	Ash	42	2. Co-dominant (canopy height)	Loose Bark, Other Snag within 10m	3. Very recently dead, bark intact, branches intact	543549	4797213	
36	Oak	59	1. Dominant (above canopy)	Loose Bark, Other Snag within 10m	2. Declining live tree, part of canopy lost	543550	4797224	2 stems
37	Black cherry	38	2. Co-dominant (canopy height)	Loose Bark, Other Snag within 10m	2. Declining live tree, part of canopy lost	543547	4797232	
38	Maple Spp	42	2. Co-dominant (canopy height)	Loose Bark, Other Snag within 10m	2. Declining live tree, part of canopy lost	543535	4797224	
39	Ash	24	2. Co-dominant (canopy height)	Loose Bark, Other Snag within 10m	3. Very recently dead, bark intact, branches intact	543523	4797210	
40	Hop hornbeam	26	3. Intermediate (just below canopy)	Loose Bark, Other Snag within 10m	1. Healthy, live tree	543533	4797192	
41	Ash	21	3. Intermediate (just below canopy)	Loose Bark, Other Snag within 10m	3. Very recently dead, bark intact, branches intact	543529	4797181	
42	Black Cherry	12	3. Intermediate (just below canopy)	Loose Bark, Other Snag within 10m	1. Healthy, live tree	543525	4797185	
43	Black Cherry	43	2. Co-dominant (canopy height)	Loose Bark, Other Snag within 10m	1. Healthy, live tree	543513	4797179	
44	Black Cherry	10	3. Intermediate (just below canopy)	Loose Bark, Other Snag within 10m	1. Healthy, live tree	543503	4797179	
45	Ash	58	1. Dominant (above canopy)	Loose Bark, Other Snag within 10m	3. Very recently dead, bark intact, branches intact	543502	4797179	

Tree #	Tree Species ID	dbh (cm)	Height Class	Snag Attributes	Decay Class	Easting	Northing	Notes
46	Oak	40	2. Co-dominant (canopy height)	Loose Bark, Other Snag within 10m	2. Declining live tree, part of canopy lost	543496	4797198	
47	Oak	60	2. Co-dominant (canopy height)	Loose Bark, Other Snag within 10m	1. Healthy, live tree	543510	4797227	
48	Black Cherry	38	2. Co-dominant (canopy height)	Loose Bark, Other Snag within 10m	1. Healthy, live tree	543514	4797241	
49	Ash	11	3. Intermediate (just below canopy)	Loose Bark, Other Snag within 10m	3. Very recently dead, bark intact, branches intact	543535	4797235	
50	Ash	35	2. Co-dominant (canopy height)	Loose Bark, Other Snag within 10m	3. Very recently dead, bark intact, branches intact	543544	4797233	
51	Oak	55	2. Co-dominant (canopy height)	Loose Bark, Other Snag within 10m	2. Declining live tree, part of canopy lost	543555	4797251	
52	Maple spp	18	3. Intermediate (just below canopy)	Loose Bark, Other Snag within 10m	2. Declining live tree, part of canopy lost	543535	4797261	
53	Black Cherry	59	2. Co-dominant (canopy height)	Loose Bark, Other Snag within 10m	2. Declining live tree, part of canopy lost	543531	4797267	
54	Black Cherry	21	2. Co-dominant (canopy height)	Loose Bark, Other Snag within 10m	1. Healthy, live tree	543530	4797273	
55	Black Cherry	24	3. Intermediate (just below canopy)	Loose Bark, Other Snag within 10m	2. Declining live tree, part of canopy lost	543530	4797275	
56	Ash	32	2. Co-dominant (canopy height)	Loose Bark, Other Snag within 10m	3. Very recently dead, bark intact, branches intact	543534	4797278	
57	Black Cherry	54	2. Co-dominant (canopy height)	Loose Bark, Other Snag within 10m	2. Declining live tree, part of canopy lost	543530	4797280	
58	Black Cherry	48	2. Co-dominant (canopy height)	Loose Bark, Other Snag within 10m	2. Declining live tree, part of canopy lost	543527	4797276	
59	Oak	105	2. Co-dominant (canopy height)	Loose Bark, Crack, Other Snag within 10m	2. Declining live tree, part of canopy lost	543515	4797274	
60	Birch	30	2. Co-dominant (canopy height)	Loose Bark, Other Snag within 10m	1. Healthy, live tree	543510	4797270	
61	Birch	37	2. Co-dominant (canopy height)	Loose Bark, Other Snag within 10m	1. Healthy, live tree	543511	4797271	2 stems
62	Manitoba maple	15	3. Intermediate (just below canopy)	Loose Bark	2. Declining live tree, part of canopy lost	543260	4797362	

Acoustic Monitoring Station	ELC Community						High Frequency Calls								Total
		Hoary Bat	Big Brown Bat	Silver-haired Bat	Unknown Low Freqency	Total Low Frequency Calls	Eastern Red Bat	Eastern Small-footed Myotis	Northern Myotis	Little Brown Myotis	Tri-colored Bat	Unknown Myotis (40K Myotis Characteristics)	Unknown High Frequency	Total High Frequency Calls	
CD-01	FOD2-4	43	49	99	47	238	0	0	0	0	0	0	0	0	238
CD_02	CUW1b	4	2	15	4	25	0	0	0	0	0	0	0	0	25
CD-03	FOD6-5	51	278	28	31	388	3	1	0	0	0	1	1	6	394
Total		98	329	142	82	651	3	1	0	0	0	1	1	6	657

Table 7: Amphibian Call Count Survey Station Results

SURVEY ROUND	STATION NUMBER	SPECIES CODE												Water Presence
		NOAM	AMTO	FOTO	GRTR	SPPE	CHFR	WOFR	NLFR	PIFR	GRFR	BULL	MIFR	
1	AMC1		1(2)											Yes
2	AMC1										1(2)			Yes
3	AMC1										2(4)			Yes
1	AMC2		1(2)											Yes
2	AMC2				1(1)						1(1)			Yes
3	AMC2				1(1)						1(3)			Yes
1	AMC3		2(4)											Yes
2	AMC3				1(2)						1(2)			Yes
3	AMC3				1(4)						2(5)			Yes
1	AMC4	X												Yes
2	AMC4	X												DRY
1	AMC5	X												Yes
2	AMC5	X												DRY

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOAM	No Amphibians	No amphibians despite survey effort
AMTO	American Toad	*Anaxyrus americanus*
FOTO	Fowler's Toad	*Anaxyrus fowleri*
GRTR	Gray Treefrog	*Hyla versicolor*
SPPE	Spring Peeper	*Pseudacris crucifer*
CHFR	Western Chorus Frog	*Pseudacris triseriata*

CALL CODES	
X	No amphibians heard
1	Calls can be counted without error
2	Calls overlap but can be reliably estimated
3	Calls overlap too much to estimate number

Table 7: Amphibian Call Count Survey Station Results

WOFR	Wood Frog	*Lithobates sylvaticus*	
NLRF	Northern Leopard Frog	*Lithobates pipiens*	
PIFR	Pickerel Frog	*Lithobates palustris*	
GRFR	Green Frog	*Lithobates clamitans*	
BULL	American Bullfrog	*Lithobates catesbeianus*	
MIFR	Mink Frog	*Lithobates septentrionalis*	

Note: For each species, the first number is the call code and the second number, which is in brackets, is the number of individuals of that species heard calling.

Inside Study Area	Outside Study Area	COMMON NAME	SCIENTIFIC NAME	Provincial Status (S RANK)	Global Status (G RANK)	SARO List (MECP)	SARA Schedule 1 (Federal)	Local Status TRCA	SWH Indicator Species 6E	SWH Indicator Species 7E
		AMPHIBIANS								
X		American Toad	*Anaxyrus americanus*	S5	G5			L4	X	X
X		Northern Green Frog	*Lithobates clamitans*	S5	G5			L4	X	X
		REPTILES								
X		Snapping Turtle	*Chelydra serpentina*	S4	G5	SC	SC	L3	X	X
X		Midland Painted Turtle	*Chrysemys picta marginata*	S4	G5T5		SC	L3	X	X
		BIRDS								
X		Trumpeter Swan	*Cygnus buccinator*	S4	G4			L+	X	X
X		Mallard	*Anas platyrhynchos*	S5	G5			L5	X	X
X		Wild Turkey	*Meleagris gallopavo*	S5	G5			L3	X	X
X		Rock Pigeon	*Columba livia*	SNA	G5					
X		Spotted Sandpiper	*Actitus macularius*	S5B	G5					
X		Northern Flicker	*Colaptes auratus*	S5	G5			L4		
X		Eastern Wood-Pewee	*Contopus virens*	S4B	G5	SC	SC	L4	X	X
X		Warbling Vireo	*Vireo gilvus*	S5B	G5			L5		
X		Red-eyed Vireo	*Vireo olivaceus*	S5B	G5			L4		
X		Blue Jay	*Cyanocitta cristata*	S5	G5			L5		
X		American Crow	*Corvus brachyrhynchos*	S5	G5			L5		
X		Barn Swallow	*Hirundo rustica*	S4B	G5	THR	SC	L4		
X		American Robin	*Turdus migratorius*	S5	G5			L5		
X		Gray Catbird	*Dumetella carolinensis*	S5B, S3N	G5			L4		
X		European Starling	*Sturnus vulgaris*	SNA	G5			L+		
X		Cedar Waxwing	*Bombycilla cedrorum*	S5	G5			L5		
X		House Sparrow	*Passer domesticus*	SNA	G5			L+		
X		American Goldfinch	*Spinus tristis*	S5	G5			L5		
X		Chipping Sparrow	*Spizella passerina*	S5B, S3N	G5			L5		
X		Savannah Sparrow	*Passerculus sandwichensis*	S5B, S3N	G5			L4	X	X
X		Song Sparrow	*Melospiza melodia*	S5	G5			L5		
X		Baltimore Oriole	*Icterus galbula*	S4B	G5			L5		
X		Red-winged Blackbird	*Agelaius phoeniceus*	S5	G5			L5		
X		Common Grackle	*Quiscalus quiscula*	S5	G5			L5		
X		Mourning Warbler	*Geothlypis philadelphia*	S5B	G5			L3		
X		Common Yellowthroat	*Geothlypis trichas*	S5B, S3N	G5			L4		
X		Yellow Warbler	*Setophaga petechia*	S5B	G5			L5		
X		Northern Cardinal	*Cardinalis cardinalis*	S5	G5			L5		
X		Rose-breasted Grosbeak	*Pheucticus ludovicianus*	S5B	G5			L4		
X		Indigo Bunting	*Passerina cyanea*	S5B	G5			L4		
		MAMMALS								
X		Eastern Small-footed Myotis	*Myotis leibii*	S2S3	G4	END				
X		Silver-haired Bat	*Lasionycteris noctivagans*	S4	G3G4				X	X
X		Eastern Red Bat	*Lasiurus borealis*	S4	G3G4			LX		X
X		Big Brown Bat	*Eptesicus fuscus*	S4	G5			L4	X	X
X		Hoary Bat	*Lasiurus cinereus*	S4	G3G4			LX		X
X		Eastern Gray Squirrel	*Sciurus carolinensis*	S5	G5			L5		
x		Muskrat	*Ondatra zibethicus*	S5	G5			L4		

Inside Study Area	Outside Study Area	COMMON NAME	SCIENTIFIC NAME	Provincial Status (S RANK)	Global Status (G RANK)	SARO List (MECP)	SARA Schedule 1 (Federal)	Local Status TRCA	SWH Indicator Species 6E	SWH Indicator Species 7E
		SUMMARY								
		Total Odonata:	*3*							
		Total Butterflies:	*2*							
		Total Other Arthropods	*1*							
		Total Amphibians:	*4*							
		Total Reptiles:	*3*							
		Total Birds:	*63*							
		Total Mammals:	*20*							
		SIGNIFICANT SPECIES								
		Global:	*4*							
		National:	*8*							
		Provincial:	*8*							
		Regional:	*8*							
		Local:	*16*							
		Explanation of Status and Acronymns								
		S1: Critically Imperiled—Critically imperiled in the province (often 5 or fewer occurrences)								
		S2: Imperiled—Imperiled in the province, very few populations (often 20 or fewer),								
		S3: Vulnerable—Vulnerable in the province, relatively few populations (often 80 or fewer)								
		S4: Apparently Secure—Uncommon but not rare								
		S5: Secure—Common, widespread, and abundant in the province								
		SX: Presumed extirpated								
		SH: Possibly Extirpated (Historical)								
		SNR: Unranked								
		SU: Unrankable—Currently unrankable due to lack of information								
		SNA: Not applicable—A conservation status rank is not applicable because the species is not a suitable target for conservation activities.								
		S#S#: Range Rank—A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species								
		S#B- Breeding status rank								
		S#N- Non Breeding status rank								
		?: Indicates uncertainty in the assigned rank								
		G1: Extremely rare globally; usually fewer than 5 occurrences in the overall range								
		G1G2: Extremely rare to very rare globally								
		G2: Very rare globally; usually between 5-10 occurrences in the overall range								
		G2G3: Very rare to uncommon globally								
		G3: Rare to uncommon globally; usually between 20-100 occurrences								
		G3G4: Rare to common globally								
		G4: Common globally; usually more than 100 occurrences in the overall range								
		G4G5: Common to very common globally								
		G5: Very common globally; demonstrably secure								
		GU: Status uncertain, often because of low search effort or cryptic nature of the species; more data needed.								
		T: Denotes that the rank applies to a subspecies or variety								
		Q: Denotes that the taxonomic status of the species, subspecies, or variety is questionable.								
		END: Endangered								
		THR: Threatened								
		SC: Special Concern								
		NAR: Not At Risk								
		IND: Indeterminant, insufficient information to assign status								
		DD: Data Deficient								
		6: Rare in Site Region 6								
		7: Rare in Site Region 7								
		Area: Minimum patch size for area-sensitive species (ha)								
		H- highly significant in Hamilton Region (i.e. rare)								
		m- moderately significant in Hamilton Region (i.e. uncommon)								
		L1- extremely rare locally (Toronto Region)								
		L2- very rare locally (Toronto Region)								
		L3- rare to uncommon locally (Toronto Region)								
		HR- rare in Halton Region, highly significant								
		HU- uncommon in Halton Region, moderately significant								
		REFERENCES								
		COSSARO Status								
		Endangered Species Act, 2007 (Bill 184). Species at Risk in Ontario List (O. Reg. 230/08). Accessed July 4, 2024.								
		COSEWIC Status								
		COSEWIC. 2024. Canadian Species at Risk. Committee on the Status of Endangered Wildlife in Canada.								
		Local Status								
		Toronto and Region Conservation Authority (TRCA). 2023. Revised Fauna Scores and Ranks.								
		Significant Wildlife Habitat (SWH) Indicator Species								
		Ministry of Natural Resources and Forestry (MNRF). 2015. Significant wildlife habitat criteria schedules for ecoregion 6E. Available at: https://dr6j45jk9xcmk.cloudfront.net/documents/4775/schedule-6e-jan-2015-access-ver-final-s.pdf.								
		Natural Heritage Information Center (NHIC). 2024. Ontario Species List: All Species.								

Table 9: Headwater Drainage Feature Classification and Management Recommendations

DRAINAGE FEATURE SEGMENT	STEP 1. HYDROLOGY		STEP 2. RIPARIAN	STEP 3. FISH HABITAT	STEP 4. TERRESTRIAL HABITAT	MANAGEMENT RECOMMENDATION PER HDFA GUIDELINES	INTERPRETED MANAGEMENT RECOMMENDATION – GEI
	FUNCTION	MODIFIERS					
H1S1	FT – 6 (wetland) FC – 4 (Round 1) FC– 2 (Round 2) FC – 1 (Round 3) **Contributing** – Reach was flowing during early spring and was dry by early summer. Considering the local topography, it is anticipated this feature will display ephemeral flow.	Hydrology influenced by upstream agricultural activities.	**Important** – Feature is a wetland bordered by forest and meadow community.	**Contributing** – No direct fish habitat.	**Valued** – Feature is a wetland but does not support breeding amphibians.	**Conservation**	**Conservation**

LEGEND:

FT	Feature Types (1-defined natural channel, 2-channelized, 3-multi-thread, 4-no defined feature, 5-tiled drainage, 6-wetland, 7-swale, 8-roadside ditch, 9-online pond outlet)
FC	Flow Conditions (1-no surface water, 2-standing water, 3-interstitial flow, 4-surface flow minimal, 5-surface flow substantial)

Note: Codes correspond with Ontario Stream Assessment Protocol (OSAP) guidelines.

Table 10: Ecoregion 6E Significant Wildlife Habitat Assessment

SIGNIFICANT WILDLIFE HABITAT (SWH) TYPE	ELC ECOSITE(S) PRESENT	HABITAT CRITERIA MET	TARGETED FIELD STUDIES REQUIRED	DEFINING CRITERIA MET (MINIMUM ABUNDANCES AND/OR DIVERSITY REQUIRED TO CONFIRM SWH)	SWH TYPE PRESENT
1. SEASONAL CONCENTRATION AREAS OF ANIMALS					
Waterfowl Stopover and Staging Areas (terrestrial)	Yes – CUM vegetation communities are present within the Subject Lands.	No – No evidence of significant sheet water during spring surveys. This area is not known to have historical waterfowl stopover use and is not known for sheet water presence.	No	N/A	Not Present
Waterfowl Stopover and Staging Areas (aquatic)	Yes – MAS, SWD, and SAM vegetation communities are present within the Subject Lands.	No – The SAM feature does contain open water and could potentially attract or support significant numbers of waterfowl.	Yes	No - No large aggregations of waterfowl were observed within the Subject Lands.	Not Present
Shorebird Migratory Stopover Areas	Yes – MAM vegetation communities are present within the Subject Lands.	No – Muddy, unvegetated shorelines are not present. This area is not known to support large congregations of shorebirds.	No	N/A	Not Present
Raptor Wintering Areas	Yes – FOD vegetation communities are present within the Subject Lands.	No – Habitat provides a combination of fields and woodlands that provide roosting, foraging and resting habitats for winter raptors. Potential wintering Sites do not meet the minimum size criteria of > 20 ha with a combination of forest and uplands.	No	N/A	Not Present
Bat Hibernacula	No – Cave ecosites are absent from the Subject Lands.	No	No	N/A	Not Present
Bat Maternity Colonies	Yes – FOD vegetation communities are present within the Subject Lands.	Yes – Snag abundance (>25cm dbh; >10 stems/ha) was met within the CUW1b community. No other suitable communities within the development footprint met the snag abundance (see **Table 5**, **Appendix B)**. Snag abundance is also expected to be met within the FOD feature that is to be retained on the Subject Lands.	Yes	Passive bat detectors were deployed over ten consecutive evenings (see **Figure 7**, **Appendix A** for station locations). Two SWH Indicator species were documented within the Subject Lands; however, species specific abundance criteria were not met. Average nightly calls for Big Brown Bat at CD-01 were recorded at 4.9 calls per night and Silver-haired Bat was recorded at 9.9 calls per night (see **Table 6**, **Appendix B** for survey results). Average nightly calls for Big Brown Bat at CD-01 were recorded at 27.8 calls per night and Silver-haired Bat was recorded at 2.8 calls per night (see **Table 6**, **Appendix B** for survey results). No detailed acoustics were completed within the FOD feature that is to be retained within the Subject Lands, however suitable habitat is assumed to be present.	Candidate - Potential SWH features which will be retained and protected from the proposed development. .

Table 10: Ecoregion 6E Significant Wildlife Habitat Assessment

Turtle Wintering Areas	Yes – SA, MA, and SW vegetation communities are present within the Subject Lands.	Yes – The SAM vegetation communities have the potential to provide sufficient hydroperiods and/or water depth to provide ice-free overwintering conditions for turtles.	No - These features which will be retained within the Subject Lands and protected from the proposed development.	N/A – It is acknowledged that 24 Midland Painted Turtles were observed within the SAM feature incidentally during bat habitat assessments.	Confirmed – 24 Midland Painted Turtles were observed within the SAM feature which is to be retained within the Subject Lands.
Reptile Hibernacula	Yes – Required ecosites are present within the Subject Lands.	No – No anthropogenic or natural features within the development footprint were documented that could provide subsurface access below the frost line.	No	N/A	Not Present
Colonially-Nesting Bird Breeding Habitat (Bank and Cliff)	Yes – CUM vegetation communities are present within the Subject Lands.	No – Presence of exposed or eroding banks, hills, steep slopes and sand piles were not recorded within the Subject Lands.	No	N/A	Not Present
Colonially-Nesting Bird Breeding Habitat (Tree and Shrub)	No – No suitable vegetation communities are present within the Subject Lands.	N/A	No	N/A	Not Present
Colonially-Nesting Bird Breeding Habitat (Ground)	No – No rocky islands or peninsulas are present within the Subject Lands.	N/A	No	N/A	Not Present
Migratory Butterfly Stopover Areas	Yes – CUM, and FOD vegetation communities are present within the Subject Lands.	No – The Subject Lands is greater than 5 km from Lake Ontario.	No	N/A	Not Present
Landbird Migratory Stopover Areas	Yes – FOD vegetation communities are present on the Subject Lands.	No - The Subject Lands are greater the 5 km away from Lake Ontario.	No	N/A	Not Present
Deer Yarding Area	No – Mapping from the MNRF LIO database did not depict any deer yarding areas on or adjacent to the Subject Lands.	N/A	No	N/A	Not Present
Deer Winter Congregation Areas	No – Mapping from the MNRF LIO database did not depict any deer wintering areas on or adjacent to the Subject Lands. No woodlots of >100 ha in size were present on the Subject Lands.	N/A	No	N/A	Not Present
2. RARE VEGETATION COMMUNITIES OR SPECIALIZED HABITAT FOR WILDLIFE					
2a. Rare Vegetation Communities					
Rare Vegetation Types (cliffs, talus slopes, sand barrens, alvars, old-growth forests, savannahs, and tallgrass prairies)	No – Rare vegetation types are not present within the Phase 1 Lands	No	No	N/A	Not Present
Other Rare Vegetation Types (S1 to S3 communities)	No – All vegetation communities identified within the Subject Lands are culturally influenced or commonly occurring natural communities (**Table 2, Appendix B**).	No	No	N/A	Not Present

Table 10: Ecoregion 6E Significant Wildlife Habitat Assessment

2b. Specialized Wildlife Habitat					
Waterfowl Nesting Areas	Yes – MAS, MAM, and SAM vegetation communities are present within the Subject Lands.	Yes –suitable upland area is present adjacent to wetland communities features which is to be retained within the Subject Lands. Upland areas within the development footprint consist mainly of agricultural lands which are actively managed.	No	N/A	Candidate - Potential SWH features which will be retained and protected from the proposed development.
Bald Eagle and Osprey Nesting, Foraging and Perching Habitat	Yes – FOD vegetation communities are present within the Subject Lands.	Yes – Vegetation communities are located near the SAM and tributary to Eden Creek.	No - These features which will be retained within the Subject Lands and protected from the proposed development.	N/A	Not Present
Woodland Raptor Nesting Habitat	Yes – Forested vegetation communities are present within the Subject Lands.	No – The forested vegetation communities do not meet the minimum size criteria (>30 ha with >4 ha interior habitat that is greater than 200 m from the woodland edge).	No	N/A	Not Present
Turtle Nesting Areas	Yes – MAS and SAM vegetation communities are present within the Subject Lands	Yes – Potential nesting habitat may be present features within the Subject Lands which will be retained and protected from the proposed development. No suitable turtle nesting areas were identified within the development footprint. It is noted that Snapping Turtle nesting evidence was observed within the agricultural field located within the northwestern portion of the Subject Lands, agricultural land is not considered SWH.	No - These features which will be retained within the Subject Lands and protected from the proposed development.	N/A	Candidate - Potential SWH features which will be retained and protected from the proposed development.
Seeps and Springs	Yes – Forested vegetation communities are present within the Subject Lands.	Yes – Drainage features are documented within and adjacent to forested communities features which will be retained and protected from the proposed development.	Yes – Data will be collected incidentally during ecological surveys.	No – Groundwater seeps were not recorded within the Subject Lands.	Not Present
Amphibian Breeding Habitat (Woodland)	Yes – FOD and SWD vegetation communities are present within the Subject Lands.	Yes – Presence of wetland communities adjacent to FOD and SWD vegetation communities. Size criteria (>25 m diameter) was met for several FOD communities within the Subject Lands.	Yes	Three rounds of amphibian call count surveys were completed within the Subject Lands (see **Figure 6**, **Appendix A** for station locations). None of the amphibian stations on the Subject Lands met the SWH criteria for species diversity and abundance (see **Table 7**, **Appendix B** for survey results).	Not Present.

Table 10: Ecoregion 6E Significant Wildlife Habitat Assessment

Amphibian Breeding Habitat (Wetland)	Yes – SA and MA vegetation communities are present within the Subject Lands.	Yes – Minimum size criteria (>25 m diameter) was met for several vegetation communities within the Subject Lands.	Yes	Three rounds of amphibian call count surveys were completed within the participating properties (see **Figure 6**, **Appendix A** for station locations). None of the amphibian stations on the Subject Lands met the SWH criteria for species diversity and abundance (see **Table 7**, **Appendix B** for survey results).	Not Present
Woodland Area-Sensitive Bird Breeding Habitat	Yes – FO vegetation communities are present within the Subject Lands.	No – Vegetation communities do not meet the minimum size criteria (>30 ha with interior habitat >200 m from the woodland edge).	No	N/A	Not Present
3. SPECIES OF CONSERVATION CONCERN					
Marsh Bird Breeding Habitat	Yes – MA and SA vegetation communities are present within the Subject Lands.	Yes – All wetlands contain shallow water with emergent aquatic vegetation.	Yes	Two rounds of breeding bird surveys were conducted within the Subject Lands (see **Figure 4**, **Appendix A** for survey locations). One SWH indicator species was identified nesting within the SAM feature within the Subject Lands: Trumpeter Swan (see **Table 4**, **Appendix B** for survey results).	Confirmed - features which will be retained and protected from the proposed development.
Open Country Bird Breeding Habitat	Yes – CUM vegetation communities are present within the Subject Lands.	No - Vegetation communities do not meet the minimum size criteria (no habitat >30 ha).	No	N/A	Not Present
Shrub/Early Successional Bird Breeding Habitat	Yes – CUW vegetation communities are present within the Subject Lands.	No - Vegetation communities do not meet the minimum size criteria (no habitat >10 ha).	No	N/A	Not Present
Terrestrial Crayfish	Yes – MAM and MAS, vegetation communities are present on the Subject Lands.	Yes – No minimum size requirement.	Yes – observations of crayfish chimneys will be documented, if present, during all ecological surveys.	Terrestrial crayfish chimneys were not observed incidentally during ecological inventories.	Not Present
Special Concern and Rare Wildlife Species					
ii) Barn Swallow (*Hirundo rustica)*	N/A	No – No suitable breeding habitat (e.g., anthropogenic structures) were observed within the Subject Lands.	No	Two rounds of breeding bird surveys were conducted within participating properties (see **Figure 4**, **Appendix A** for survey locations). Up to three foraging Barn Swallows were documented during survey efforts on Property 1 within two shipping containers (see **Table 4**, **Appendix B** for survey results). No Barn Swallow nesting was observed within the Subject Lands.	Not Present

Table 10: Ecoregion 6E Significant Wildlife Habitat Assessment

iii) Eastern Wood-Pewee (*Contopus virens*)	N/A	Yes – Forested habitats are present within the Subject Lands.	Yes	Two rounds of breeding bird surveys were conducted within the participating properties (see **Figure 4**, **Appendix A** for survey locations). Eastern Wood-Pewee were documented at PC2 during both rounds of survey efforts (see **Table 4**, **Appendix B** for survey results).	Confirmed - features which will be retained and protected from the proposed development.
iv) Wood Thrush (*Hylocichla mustelina*)	N/A	Yes – Forested habitats are present within the Subject Lands.	Yes	Two rounds of breeding bird surveys were conducted within the participating property (see **Figure 4**, **Appendix A** for survey locations). No Wood Thrush were documented despite survey efforts (see **Table 4**, **Appendix B** for survey results).	Not Present
American Coot (*Fulica americana*)	N/A	Yes – Marsh communities are present within the Subject Lands.	Yes	Two rounds of breeding bird surveys were conducted within the participating property (see **Figure 4**, **Appendix A** for survey locations). No American Coot were documented despite survey efforts (see **Table 4**, **Appendix B** for survey results).	Not Present
Common Gallinule (*Gallinula galeata*)	N/A	Yes – Marsh communities are present within the Subject Lands.	Yes	Two rounds of breeding bird surveys were conducted within the participating properties (see **Figure 4**, **Appendix A** for survey locations). No Common Gallinule were documented despite survey efforts (see **Table 4**, **Appendix B** for survey results).	Not Present
v) Blue-winged Teal (*Spatula discors*)	N/A	Yes – Marsh communities are present within the Subject Lands.	Yes	Two rounds of breeding bird surveys were conducted within the participating properties (see **Figure 4**, **Appendix A** for survey locations). No Blue-winged Teal were documented despite survey efforts (see **Table 4**, **Appendix B** for survey results).	Not Present
vi) Ruddy Duck (*Oxyura jamaicensis)*	N/A	Yes – Marsh communities are present within the Subject Lands.	Yes	Two rounds of breeding bird surveys were conducted within the participating properties (see **Figure 4**, **Appendix A** for survey locations). No Ruddy Ducks were documented despite survey efforts (see **Table 4**, **Appendix B** for survey results).	Not Present
vii) Northern Ribbonsnake (*Thamnophis saurita*)	N/A	No – No anthropogenic or natural features within the development footprint were documented that could provide subsurface access below the frost line.	No –features which will be retained and protected from the proposed development.	N/A	Candidate - features which will be retained and protected from the proposed development.

Table 10: Ecoregion 6E Significant Wildlife Habitat Assessment

viii) Snapping Turtle (*Chelydra serpentina*)	N/A	Yes – MAS and SAM vegetation communities are present within the Subject Lands	No – features which will be retained and protected from the proposed development.	N/A	Candidate - features which will be retained and protected from the proposed development.
ix) Black Dash (*Euphyes conspicua*)	N/A	Yes – marsh communities are present within the Subject Lands.	Yes - occurrences will be documented during other targeted field investigations	No incidental occurrences recorded to-date.	Candidate - features which will be retained and protected from the proposed development.
x) Monarch (*Danaus plexippus*)	N/A	No – Cultural meadows with abundance of Common Milkweed (*Asclepias syriaca*; host plant) were not present.	No	N/A .	Not Present
xi) Tawny Emperor (*Asterocampa clyton*)	N/A	Yes – riparian forest communities containing Hackberry trees (*Celtis spp.*) are present within the Subject Lands.	Yes - occurrences will be documented during other targeted field investigations	No incidental occurrences recorded to-date.	Candidate - features will be retained and protected from the proposed development.
xii) Hackberry Emperor (*Asterocampa celtis*)	N/A	Yes – riparian forest communities containing Hackberry trees (*Celtis spp.*) are present within the Subject Lands.	Yes - occurrences will be documented during other targeted field investigations	No incidental occurrences recorded to-date.	Candidate - features will be retained and protected from the proposed development.
4. ANIMAL MOVEMENT CORRIDORS					
Amphibian Movement Corridors	N/A	No – Amphibian breeding SWH is present features and there are nearby forested habitats that would support movement.	No – features which will be retained and protected from the proposed development.	N/A	Not Present
Deer Movement Corridors	N/A	No – Mapping from the MNRF LIO database did not depict any deer yarding or wintering areas on or adjacent to the Subject Lands.	No	N/A	Not Present

Appendix C Functional Servicing Report (MTE 2025)

3027 Cedar Creek Road

Functional Servicing Report

Project Location:
3027 Cedar Creek Road, Ayr, ON

Prepared for:
Royal Truck and Trailer Sales Ltd.
73 Stafford Drive
Brampton, ON L6W 1L3

Prepared by:
MTE Consultants Inc.
520 Bingemans Centre Drive
Kitchener, ON N2B 3X9

February 13, 2025

MTE File No.: 55566-100

Engineers, Scientists, Surveyors.

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Drawing

1.0 INTRODUCTION

MTE Consultants Inc. was retained by Royal Truck and Trailer Sales Ltd. to complete a Functional Servicing Report for a new industrial development to be constructed at 3027 Cedar Creek Road, Ayr (herein referred to as 'the Site') in the Township of North Dumfries in support of the Zoning By-Law Amendment Application. The current zoning of the site is Zone 1 – Agricultural. The property is proposed to be re-zoned as Zone 11 – Industrial.

The Site is legally described as Part of Lot 34, Concession 10 in the Township of North Dumfries. The property is bounded to the north by Cedar Creek Road, to the west by natural areas and farmland, to the south by Highway 401, and to the east by an existing industrial development. For the exact location of the Site, refer to Figure 1.0.

The proposed development for the Site is the construction of slab-on-grade industrial building complete with gravel parking areas and two driveway entrances, as well as the demolition of an existing residential home. The proposed development is intended to function as a trucking facility including 19 loading dock bays as well as 5 repair bays.

The purpose of this study is to support the Zoning By-Law Amendment Applications. This will be accomplished by reviewing the opportunities and constraints for the subject property with respect to servicing, grading, and stormwater management; reviewing the requirements of the reviewing agencies; describing the development concept; and demonstrating the functional serviceability of the property. Pending approval of the Amendment application, detailed design of the site will commence and be submitted to the City in support of Site Plan Approval.

2.0 CRITERIA

2.1 Existing Topography

The Site encompasses an area of 21.326ha and currently comprises an existing residential building centrally located on the Site with a single gravel driveway. A portion of a large wetland occupies the northwest area of the Site, a smaller wetland is located at the rear of the Site, and a significant woodland occupies the southwest corner of the Site. In the existing condition, surface runoff from a majority of the Site drains overland towards the large wetland, while runoff from a portion of the south area drains overland towards the smaller wetland. The large and small wetland both appear to ultimately drain westerly towards Eden Creek. With the wetlands and woodland, the developable area is limited to approximately 9.0ha. The Site ranges from 311masl in the southwest corner to a high of 320masl near Cedar Creek Road. The Site is approximately 1% impervious in the existing condition.

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PROJECT
3027 CEDAR CREEK ROAD CIVIL WORKS

TITLE
SITE LOCATION PLAN

Drawn: BDW	Scale: 1:7,500	Figure: **1.0**
Checked: AJS	Project No.: 55566-100	
Date: 2024-11-13	Rev No.: 0	

CAD: P:\P\55566\100\55566-100-F1.DWG

Plot Date: February 13, 2025 - 12:05 PM

2.2 Existing Servicing

There are no existing storm or sanitary sewers, or watermain located on Cedar Creek Road. The closest municipal services are located within the settled area of Ayr, approximately 4km southwest. The existing industrial areas to the east of the Site are serviced by septic and well.

2.3 Existing Soils Information

The subject property is located within the physiographic region known as the Waterloo Hills. Kame moraines, one of the primary landforms of the Waterloo Hills, are mapped at the Site (Chapman and Putnam, 1984).

15 boreholes were advanced by MTE as part of the Geotechnical Investigation, dated August 2024, in order to determine the underlying soil conditions on the Site. Upon completion of drilling, four monitoring wells were installed to support the Hydrogeological Investigation, prepared by MTE dated September 2024. The subsurface stratigraphy was generally revealed to comprise of topsoil overlying native sand and glacial till. Bedrock was not encountered. Refer to the Geotechnical Investigation for details.

Groundwater was not encountered at the time of drilling. On-going monitoring revealed groundwater ranging from 2.5 to 11 metres below grade, representing elevations ranging from 307.7masl to 305.2masl. Groundwater is generally interpreted to flow from northeast to southwest. Unfactored infiltration rates were estimated utilizing particle size distributions and ranged from 50mm/hr to 540mm/hr, indicating high infiltration capacity. Refer to the Hydrogeological Investigation, dated February 2025, prepared by MTE for details.

2.4 Reviewing Agencies

Grading, servicing and stormwater management designs as well as this Functional Servicing and Stormwater Management Report will be required for submission to the Township of North Dumfries in support of the Zoning By-Law Amendment and the Site Plan Applications. The Township will also be responsible for the review and approval of site plans, site grading, servicing, stormwater management, lighting and landscape design and ultimately issuing building permits.

As the Site falls within GRCA Regulation limit, the site engineering design will also be submitted to the GRCA for their review and approval. A ‘Fill Permit’ will be required.

Cedar Creek Road is a Regional Road. As such, the Region of Waterloo will be circulated on the Site Plan Application submission and will need to approve the site grading, servicing and stormwater management design.

3.0 METHODOLOGY

Preliminary grading and servicing strategies for the proposed development have been developed based on GRCA contours and the Conceptual Site Plan prepared by MHBC, dated November 2024.

3.1 Proposed Grading

The proposed development will include an approximately 10,000m^2 industrial building complete with two driveway connections to Cedar Creek Road. The proposed grading strategy will respect the existing grades along the north and east property lines while wetland and woodland setbacks will be respected in the south and east portions of the Site. The building will have a finished floor elevation of 319.80mASL, which is subject to change during the detailed design. The grading

strategy has been development to ensure that the drainage is directed to a series of storm structures throughout the Site and ultimately to the proposed stormwater management facility (SWMF) located at the west side of the Site. The major storm overland flow route is proposed to be towards the SWMF.

3.1.1 Water

A private well and fire reservoir will be required to service the proposed buildings. The building is not expected to require process water and therefore water demands are expected to be limited. The Hydrogeological Investigation noted water supply wells of sufficient quantity and quality are expected to be available at depths approximately 30 to 40 metres below ground level. A preliminary well location is shown on MTE Drawing C2.1.

As a municipal water connection is not available, an on-site fire reservoir will be required. Preliminary fire reservoir sizing was determined to be 1,853m^3. Refer to Appendix A for details. The largest Wilkinson Precast Concrete Water Holding Tank is 114m^3, therefore 17 tanks connected in tandem are required to provide sufficient firefighting volume. Fire reservoir sizing will be refined and further details provided during detailed design.

3.1.2 Sanitary

A private on-site septic system will be required to service the proposed building and is expected to be designed under Part 8 of the OBC, with Level IV treatment and a Type A dispersal bed. The estimated T-Time at BH109, the closest to the proposed septic location, is 10mins/cm as per the Geotechnical Report prepared by MTE dated August 27, 2024. Exact flows will be confirmed during detailed design but are expected to be under 10,000L/d and therefore an Environmental Compliance Approval (ECA) will not be required. Preliminary estimated flows are provided in the table below.

Table 3.1 – Preliminary Total Daily Sewage Flow

Component	Parameter	OBC Rate	Total Quantity	Daily Flow
Office[1]	Floor area	75 L/day per 9.3m^2 of office area	600m^2	4,840L/day
Warehouse[1]	Water Closets	950 L/d per water closet	1 water closets (total)	950L/day
	Loading Bays	150 L/d per loading bay	24 loading bays (total)	3,600L/day
PRELIMINARY TOTAL				**9,390L/day**

[1] It is assumed one water closet is in the warehouse area. Any water closets servicing the office space are accounted for under the office floor area calculation. Total office area is assumed and is subject to change at detailed design.

It is noted that the on-site wastewater system is not expected to be required to treat any wash water that could be generated at the Site. Only domestic wastewater will be conveyed to the Level IV treatment system. A separate holding tank would be required for any wash water generated at the Site due to washing activities and floor drains in vehicle/repair bays.

Based on the loading rate of 10L/m^2/day for the underlying native soils, per Table 8.7.4.1.A. of OBC, the proposed fill contact area must be greater than 939m^2.

The size of the area bed is determined by the following formulas (OBC):

$$A_{Stone} = \frac{Q}{50} \;\; When\ Q > 3000\ Lpd$$

$$A_{Sand} = \frac{QT}{850} \;\; when\ T < 15 \;\; min/cm$$

Where *Q* is the daily sewage design flow (L/d), and *T* is the T-time of the soils.

From the above calculations, the required stone area is 187.8m^2 and the required sand area is 110.5m^2 for a daily flow of 9,390L and a T-time of 10mins/cm. There is up to 2500m^2 of area allocated to the septic system in the northwest corner of the Site, which is sufficient for the system based on the above preliminary area calculations.

The following clearances are required for the proposed on-site wastewater treatment and disposal system installation:

Table 3.2 – Clearance Requirements

Clearance From	Treatment Tank(s) / Unit	To Distribution Piping
Building or Structure	1.5 m	5 m
Potable Water Wells (Drilled)	15 m	15 m
Water Body	15 m	15 m
Property Line	3 m	3 m

The proposed on-site wastewater works will conform to the required clearance distances.

Details of the septic system including confirming the exact type of system, distribution piping and Level IV treatment system (if required) will be provided at detailed design when the building design and total daily sewage flow is confirmed.

Groundwater was measured at 307.08masl at MW110, the closest monitoring well to the proposed septic location. Proposed grades are expected to be at least 10m above the measured groundwater elevation and thus groundwater is expected to be at sufficient depth to provide the minimum 0.60m separation below the bottom of the stone layer.

A preliminary Nitrate Dilution Assessment and Phosphorus Impact Assessment have been completed and are included in the Hydrogeological Assessment.

3.1.3 Storm

A private storm sewer system will be installed on-site to collect runoff from the common driveway and parking areas. This storm sewer system, which will include catchbasins, manholes and catchbasin manholes, will convey runoff towards the proposed stormwater management facility located at the west side of the development adjacent to the northwest wetland. Runoff from the building rooftop will be directed to an infiltration gallery, before overflowing onto the on-site storm sewer system. Runoff from the frontage of the building will flow towards the Cedar Creel Road right-of-way.

4.0 PRELIMINARY STORMWATER MANAGEMENT DESIGN

4.1 SWM Criteria

The stormwater management design criteria for the subject Site, as established by the Township of North Dumfries and GRCA, are as follows:

i) **Water Quality Control** – Implementation of Enhanced Level (Level 1) water quality controls.

ii) **Water Quantity Control** – Provide attenuation of the post-development peak flows for the 2-, 5-, and 100-year storm events to the pre-development (existing) peak flow.

iii) **Erosion Control** – Implementation of Erosion and Sediment Control measures.

iv) **Annual Water Balance** – Maintain an infiltration balance where reasonably feasible.

4.2 Catchment parameters

In order to successfully complete the preliminary stormwater management design for the Site, the following specific tasks were undertaken:

i) Calculate the allowable runoff rates using MIDUSS NET.

ii) Determine the percent impervious of the site and catchment parameters for inclusion in MIDUSSS modeling.

iii) Calculate post-development runoff hydrographs using MIDUSS NET.

The following table summarizes the catchments used in modeling of the Site. The pre-development condition was separated into three catchment areas: the area directed to Wetland #1, the area directed to Wetland #2, and the area directed off-site. The post-development condition was separated into six catchment areas: area directed to the SWM Facility (SWMF), the SWMF, the uncontrolled area to wetland #1, uncontrolled area off-site, area to Wetland #2, and area directed to the southwest neighboring property. Figure 2.0 illustrates the limits of the pre-development catchment areas. Figure 3.0 illustrates the limits of the post-development catchment areas.

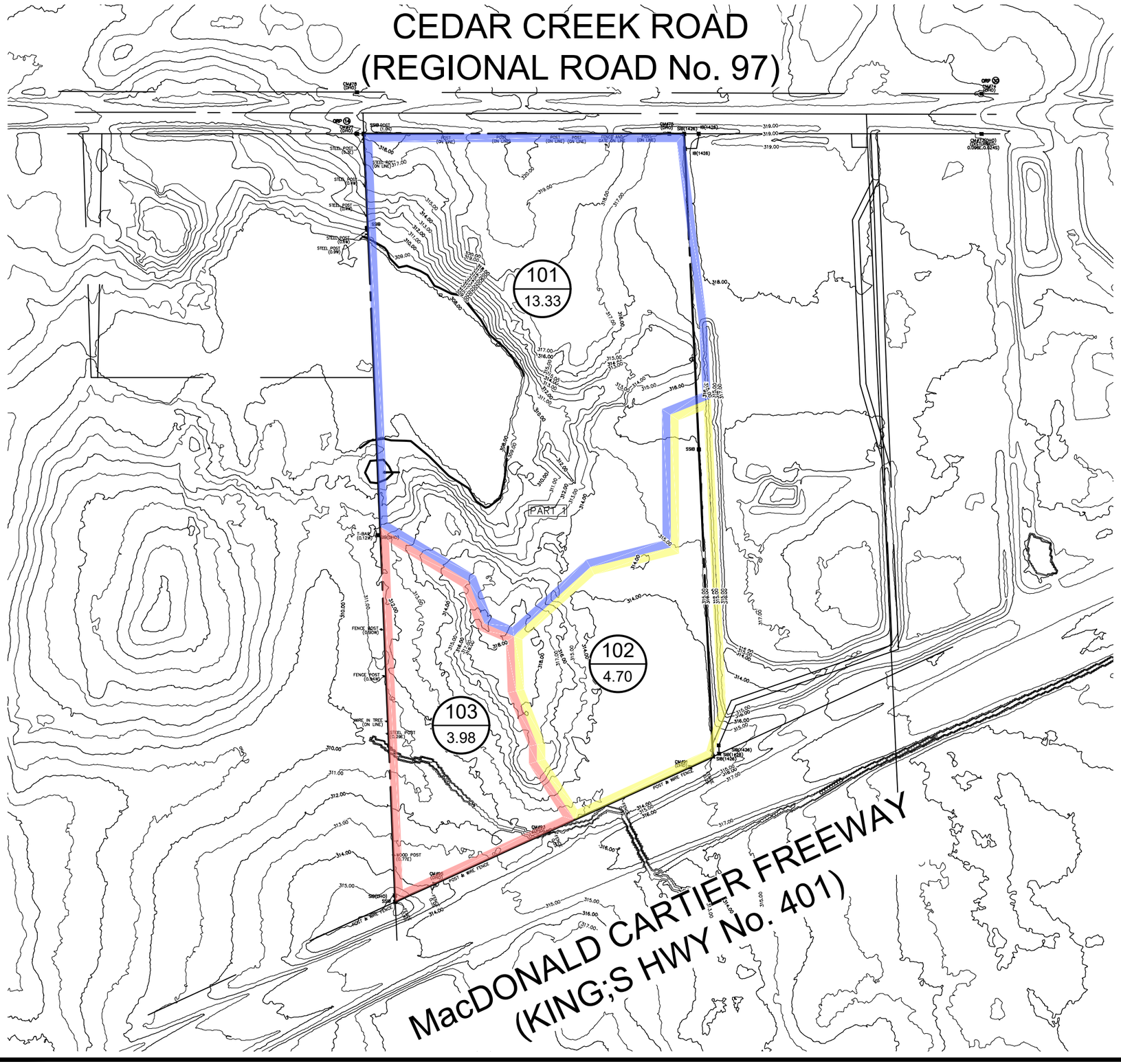
Table 4.1 – Catchment Parameters

#	Catchment	Area (m)	% Impervious	Pervious CN	Impervious CN	Slope (%)	Flow Length (m)
Pre-Development Catchment Areas							
101	Area to Wetland #1	12.476	1.0	65	98	3.0	160
102	Area to Wetland #2	5.190	0.0	65	98	5.0	100
103	Area to Southwest Neighboring Property	3.660	0.0	65	98	8.0	140

#	Catchment	Area (m)	% Impervious	Pervious CN	Impervious CN	Slope (%)	Flow Length (m)
Post-Development Catchment Areas							
201	Area to SWMF	6.736	98.0	65	91	3.5	50
202	SWMF	0.547	100	65	98	10.0	25
203	Uncontrolled Area to Wetland #1	7.044	0.0	65	98	3.0	120
204	Uncontrolled Area to Off-site	0.587	0.0	65	98	8.0	10
205	Area to Wetland #2	2.752	0.0	65	98	5.0	100
206	Area to Southwest Neighboring Property	3.660	0.0	65	98	8.0	140

As previously noted, the subsurface stratigraphy was generally revealed to comprise of topsoil overlying native sand and glacial till. Therefore, a pervious CN of 65 is appropriate. An impervious CN of 91 for the gravel driveway and parking lot is used for MIDUSS modelling.

CEDAR CREEK ROAD
(REGIONAL ROAD No. 97)



LEGEND

- CATCHMENT 101
- CATCHMENT 102
- CATCHMENT 103

101 / 13.33 — SUB-CATCHMENT NUMBER / AREA (ha.)

0 40 80 120 160 200m

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PROJECT	3027 CEDAR CREEK
TITLE	PRE-DEVELOPMENT CATCHMENT AREAS
Drawn: BDW	Scale: 1:4,000
Checked: AJS	Project No.: 55566-100
Date (yyyy-mm-dd): 2024-11-26	Rev No.: 0
	Figure: 2.0

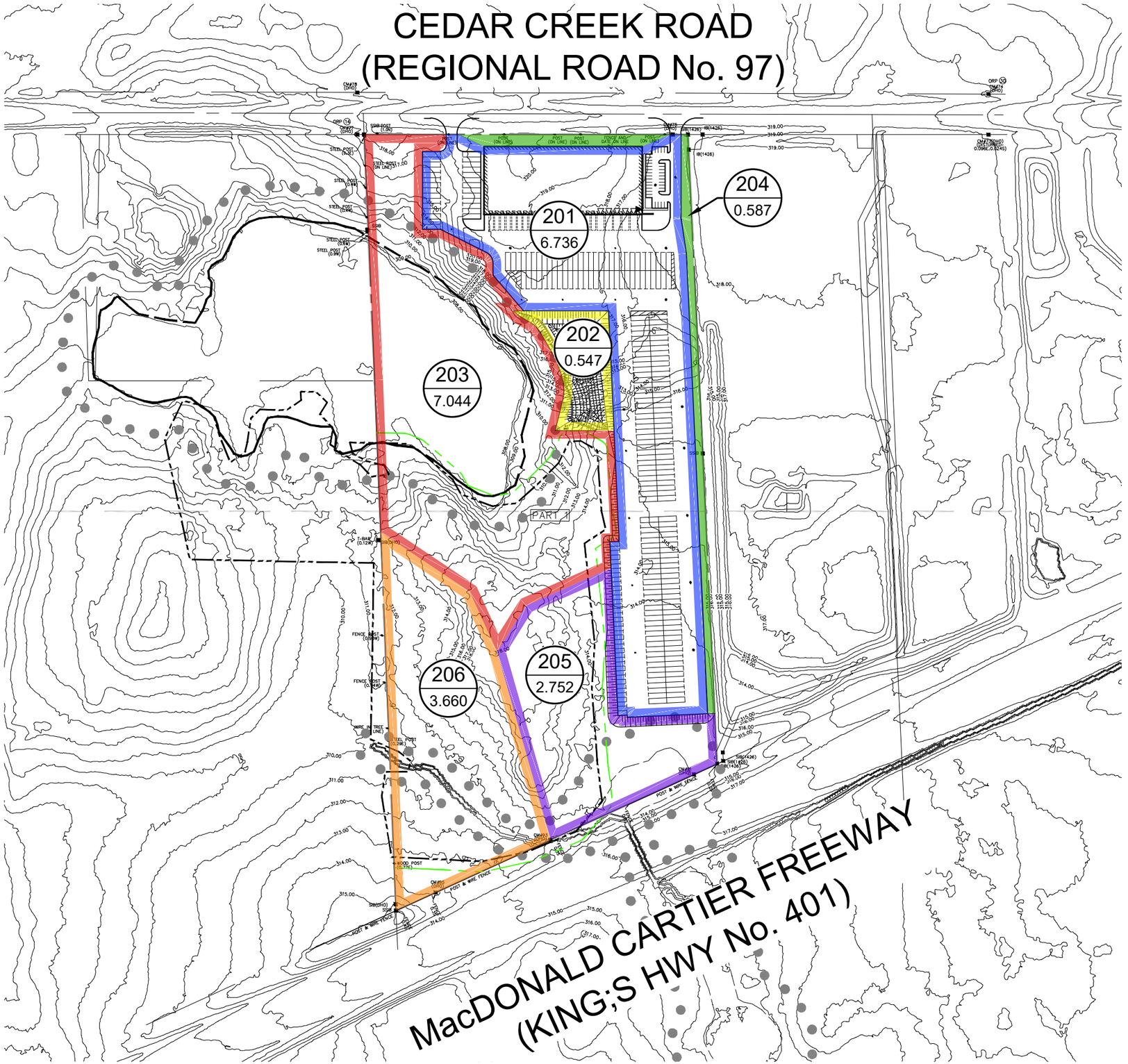
CAD: P:\P\55566\100\55566-100-F2.DWG

Plot Date: February 13, 2025 - 12:05 PM

CAD: P:\P_55566\100\55566-100-F3.DWG

Plot Date: February 13, 2025 - 12:41 PM

CEDAR CREEK ROAD
(REGIONAL ROAD No. 97)



N

LEGEND

- CATCHMENT 201
- CATCHMENT 202
- CATCHMENT 203
- CATCHMENT 204
- CATCHMENT 205
- CATCHMENT 206

201 / 8.56 — SUB-CATCHMENT NUMBER; AREA (ha.)

0 40 80 120 160 200m

MTE
Engineers, Scientists, Surveyors

PROJECT	3027 CEDAR CREEK
TITLE	POST-DEVELOPMENT CATCHMENT AREAS

Drawn: BDW	Scale: 1:4,000	Figure: 3.0
Checked: AJS	Project No.: 55566-100	
Date (yyyy-mm-dd): 2024-11-26	Rev No.: 0	

4.3 Water Quality

The proposed SWMF has been designed as a wet pond with a permanent pool depth of 2.0m. The facility will also incorporate a sediment forebay with a depth of 2.5m which offers the benefits of dilution and settling of sediment. A planting scheme will be prepared at detailed design that selects plant species and their location in and around the basins to stabilize banks, mitigate temperature increases, deter waterfowl from nesting within the area, and provide aesthetics and safety benefits.

The forebay design is based on classic particle settling and flow dispersion equations, as presented in the MOE's 2003 *Stormwater Management Planning and Design Manual*. The methodology presented in that document suggests that the design flow for the forebay should be taken as the peak outflow from the facility. A forebay is typically designed to treat minor storm flows. Therefore, the main pond will essentially be empty (or at its permanent pool level) during minor storm events. As such, there will be no mass of water at the outlet of the forebay that would control the flow through the forebay to that of the main pond's discharge rate.

The design of the forebay should be based on the notion that the flow into the forebay equals the flow through the forebay, which equals the flow out of the forebay. Therefore, the forebay is designed to satisfy the following four conditions:

- A settling length based on a settling velocity of 0.0003m/s using the main pond's peak discharge from the 25mm storm event (as per MOE 2003).
- A settling length based on a settling velocity of 0.0055m/s using the forebay inflow/outflow from the 25mm storm event.
- A dispersion length such that, based on flow and depth of water, the velocity through the forebay is less than 0.5m/s.
- That velocity, based on flow divided by cross-sectional area, is less than 0.15m/s to prevent scouring.

The 2003 MOE document suggests that the clean-out frequency for a stormwater management facility be based on the sediment loading within the entire pond; however, it is recommended that the clean-out frequency be based on the loading within the forebay only. While this typically results in more frequent clean-out, it is restricted to the forebay area only and eliminates disturbance of the main pond. The clean-out frequency for the proposed SWMF can be found in the forebay design calculations in **Appendix B**.

Under the future ultimate development condition, the total drainage area for the proposed SWMF is 7.283ha at 98.2% imperviousness. According to Table 3.2 from MOE's 2003 stormwater management guidelines, the constructed wet pond requires 271.92m^3/ha of storage. As described in Section 3.1, 40m^3/ha of which is extended detention and the remainder of which is the permanent pool. As such, the required extended detention volume is 291.32m^3.

The proposed SWMF design characteristics are summarized in **Table 4.2**. Refer to **Appendix B** for the relevant design sheets and calculations (e.g., catchment parameters, imperviousness calculations, stage-storage-discharge relationships, drawdown calculations, etc.) Further details for the SWM facility design will be provided at detailed design.

Table 4.2 – Water Quality Control Details

General	Facility Characteristics
Stormwater Management Facility Type	Wet Pond
Required MECP Water Quality Protection	Enhanced (Level 1)
Total Contributing Area	7.283ha
Imperviousness	98.2%
Bottom Elevation (Wet Pond)	311.00
Storage	
Unit Area Storage Volume Requirements as per SWMMP (MOE 2003)	271.92m^3/ha
Required Total Volume	1980.4m^3
Permanent Pool	
Required Permanent Pool Volume	1,689m^3
Permanent Pool Volume Provided	1,854m^3
Permanent Pool Elevation	313.00m
Extended Detention	
Minimum Required Volume (based on 40m^3/ha)	291m^3
Extended Detention Elevation (MOE)	301.15m
Peak Release Rate for Extended Detention (Quality)	0.0041m^3/s
Quantity and Erosion Control (25mm-4hr)	
Drawdown Volume	681m^3
Approximate Drawdown Time	53.3 hours
Peak Release Rate	0.0068m^3/s
Forebay	
Required Forebay Length	33.0m
Actual Forebay Length	10.0m
Permanent Pool Elevation	313.00m
Bottom Elevation	310.50m
Outlet Controls	
1500mm diameter Outlet Control Manhole	
Orifice 1 Diameter	75mm Vertical
Orifice 1 Invert	313.00m
Orifice 2 Diameter	300mm Vertical
Orifice 2 Invert	313.60m
Emergency Overflow Weir (Bottom Length)	17m
Emergency Overflow Weir Elevation	314.70m

4.4 Water Quantity

In order to achieve the stormwater management requirements for the site, runoff generated from the parking areas will be conveyed to the stormwater management facility via on-site storm sewers, wherein the flow will be controlled with the installation of an outlet control manhole structure complete with a 75mm and 300mm diameter online orifice plates within the control manhole to control events up to and including the 100-year storm event. Storage volume for the orifices will be provided within the forebay and the main cell. An emergency overflow weir is proposed along the west side of the pond, where runoff will be directed toward the existing wetland #1. Runoff from the building rooftop is proposed to be directed to an infiltration gallery sized to retain 30mm of runoff before overflowing onto the on-site storm sewer system. The infiltration gallery is not included in modelling as a conservative design choice. Runoff from the frontage of the building is draining towards the Cedar Creek Road right-of-way. Runoff along the east property of the Site is proposed to drain south along the property line and ultimately towards wetland #2.

The MIDUSS modeling output is included in **Appendix C.**

A summary of the preliminary stage-storage-discharge relationship of the proposed SWMF is shown in shown in **Table 4.3** below.

Table 4.3 – Stage-Storage-Discharge Summary

Elevation (m)	Discharge (m^3/s)	Active Volume (m^3)	Remarks
313.00	0.000	0	Permanent Pool, 75mm diameter Orifice
313.20	0.0048	401	Contour
313.40	0.0073	836	Contour
313.60	0.0091	1301	300 diameter Orifice
313.80	0.0329	1799	Contour
314.00	0.1002	2330	Contour
314.20	0.1380	2895	Contour
314.40	0.1671	3495	Contour
314.60	0.1918	4136	Contour
314.80	0.2621	4840	Emergency Overflow Weir

A summary of the peak flows and associated maximum ponding elevations from the SWMF under the post-development conditions is provided in **Table 4.4** below. A summary of the pre- and post-development peak flows from the Site is included in **Table 4.5**.

Table 4.4 – Summary of Peak Flows and Maximum Ponding Elevations from SWMF

Storm Event	Proposed SWM Facility		
	Peak Outflow from Proposed SWM Facility (m^3/s)	Maximum Ponding Volume (m^3)	Maximum Ponding Elevation (m)
2-Year Storm Event	0.009	1,246	313.58
5-Year Storm Event	0.040	1,887	313.83
100-Year Storm Event	0.180	3,808	314.50

Table 4.5 – Summary of Peak Flows

Modelling Condition		2-Year Storm Event (m^3/s)	5-Year Storm Event (m^3/s)	100-Year Storm Event (m^3/s)
Pre-Development	To Wetland #1	0.032	0.121	0.794
	To Wetland #2	0.018	0.068	0.448
	Overall Pre-Development	**0.062**	**0.235**	**1.540**
Post-Development	To Wetland #1	0.029	0.106	0.676
	To Wetland #2	0.010	0.036	0.238
	Overall Post-Development	**0.056**	**0.205**	**1.299**

Note: Some runoff is directed towards the right-of-way and/or bypasses the wetlands. As such, the overall rates from the Site are greater than the rates directed to the wetlands. Runoff rates to the wetlands have been provided to illustrate the efforts taken to mitigate negative impacts to the wetlands.

4.5 Erosion Control

The MECP recommends that any newly proposed development throughout the watershed implement a SWM solution that provides at least a 24-hour drawdown for the volume generated during the 25mm storm event; to ensure that threshold flow durations do not exceed pre-development levels. As such, the proposed SWMF has been designed to provide approximately a 53-hour drawdown time on the 25mm storm event volume.

4.6 Water Balance

A water balance analysis has been conducted to examine the impacts of the proposed development. Using the Waterloo Wellington Airport weather station, an average annual precipitation estimate for the property of 916.5 mm/yr was utilized.

In the pre-development condition, the Site is almost fully pervious and drains mostly towards Wetland #1, located in the northwest portion of the Site. The southeast portion of the Site drains towards a smaller wetland located in the southeast corner of the Site, while the southwest portion of the Site drains overland towards a creek approximately 600m west of the Site. It is

noted Wetland #1 and Wetland #2 both appear to ultimately drain towards the aforementioned creek.

In the post-development condition, the southwest catchment area remains in its existing size and condition. As a result of the proposed development, a large portion of the area previously directed towards Wetland #2 is redirected to the SWMF and ultimately Wetland #1. This results in reduced runoff towards Wetland #2 and an increase in runoff towards Wetland #1, in addition to the increase in runoff from the Site as a result of converting pervious area to impervious. To mitigate the increase in runoff, an infiltration gallery is proposed to infiltrate runoff from the proposed building roof. The gallery is sized to retain 30mm of runoff from the proposed roof.

The following table summarizes the pre- and post-development runoff directed to each wetland, as well as runoff and infiltration from the Site as a whole. Please refer to **Appendix D** for detailed calculations.

Table 4.6 – Yearly Water Balance Summary

		Pre-Development	Post-Development	Volume Change	Percentage Change
Runoff Volume (m^3/yr)	Wetland #1	17,092	55,272	38,180	323%
	Wetland #2	7,110	3,440	-3,670	-52%
	Entire Site	29,217	64,021	34,804	219%
Infiltration Volume (m^3/yr)		43,718	36,378	7,341	-17%

While the runoff volume has increased significantly, this is to be expected when development occurs. As previously mentioned, Wetland #1 appears to ultimately drain towards a creek based on GRCA contours. It is expected any excess runoff directed to Wetland #1 will be able to flow through the wetland and towards the creek, mitigating negative impacts from the increase in runoff. Further, while the development results in a slight decrease in infiltration volume from the Site, best efforts have been made to actively infiltrate ‘clean’ runoff on Site.

5.0 EROSION & SEDIMENT CONTROL

Precautions will need to be taken during construction to limit erosion and sedimentation. Erosion and Sediment Control Plans will be prepared and provided during the detailed design stage. The plans will illustrate the erosion and sediment control measures to be implemented during construction, which will limit impacts associated with the development.

Typically, the recommended construction sequence for erosion and sediment control measures are as follows:

- Erosion and sedimentation facilities are to be installed prior to any area grading operations.
- Stripping and strategic placement of topsoil stockpiles. Placement of sediment control fencing where required and around all stockpile areas.
- All erosion control measures are to be inspected and monitored by the contractor and repairs are to be completed as required.

- All materials and equipment used for the purpose of site preparation and project completion should be operated and stored in a manner that prevents any deleterious substance from leaving the site.
- Construction of temporary swales to direct runoff to sedimentation basins as required, with rock check dams as required to control velocities.
- Re-vegetation of completed areas as soon as possible after construction, including those areas not slated for construction within 60-days.

Sediment control fencing shall consist of filter fabric attached to page wire fencing and sealed at ground level. It will be installed at the perimeter of the work areas and intermittently on sloped areas where required. Sediment control fencing will be placed around all topsoil stockpiles.

It is recommended that during construction, monitoring and inspection of the erosion and sediment controls be conducted to ensure the satisfactory performance of these measures. Reporting of the inspection and monitoring results should be distributed to the Township of North Dumfries.

6.0 CONCLUSIONS

Based on the foregoing analysis, it is concluded that:

- The proposed grading design will respect the natural topography of the Site to achieve a reasonable cut/fill balance where possible and maintain the minimum required cover over the proposed sewers, and the proposed development will respect the limit and setback from the wetlands.
- The Site can be adequately serviced for sanitary servicing by an on-site septic system with further details provided during detailed design.
- An on-site well is expected to be suitable to provide domestic water supply for the proposed development.
- An on-site reservoir will be required to meet fire fighting requirements.
- The stormwater management criteria can be satisfied by directing runoff generated from the developed area to a SWMF which will provide quality and quantity control.
- Additional grading, servicing and stormwater management details will be provided during detailed design.

All of which is respectfully submitted,

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Appendix A

Fire Reservoir Sizing

3027 Cedar Creek Road

FIRE FLOW ANALYSIS

Ayr, Ontario

Project Number: 55566-100
Date: February 13, 2025
Design By: JHN

File: Q:\55566\100\Fire Flow\Site Fire Flow Analysis.xlsx

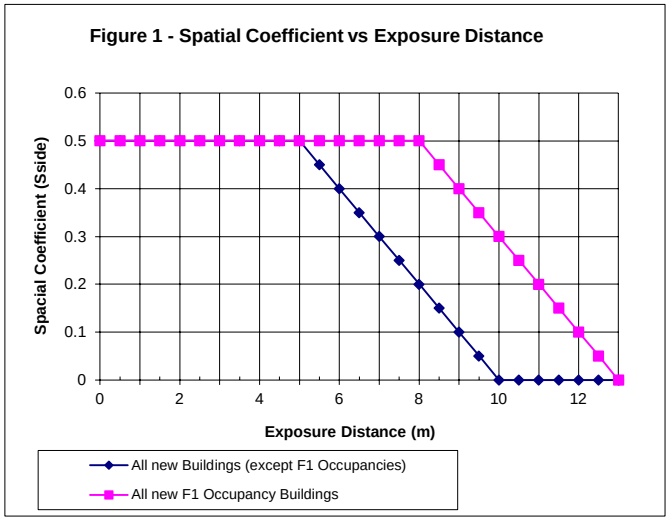
Step 1: Determining Water Supply Coefficient

	Table 1 from OBC 2012 A3.2.5.7												
	Type of Construction	Classification by group or division in Accordance with Table 3.1.2.1 of the Ontario Building Code											
		A2	B1	B2	B3	C	D	A4	F3	A1	A3	E	F2	F1
1	Building is of Noncombustible construction with fire separation and fire-resistance ratings provided in accordance with Subsection 3.2.2 of the OBC, including loadbearing walls, columns and arches						10	12		14		17		23
2	Building is of Noncombustible construction or of heavy timber construction conforming to Article 3.1.4.6 of the OBC. Floor assemblies are fire separations but no fire-resistance rating. Roof assemblies, mezzanines, loadbearing walls, columns and arches do not have a fire-resistance rating.						16	19		22		27		37
3	Building is of Combustible Construction with fire separations and fire-resistance ratings provided in accordance with Subsection 3.2.2 of the OBC, including loadbearing walls, columns and arches. Noncombustible construction may be used in lieu of fire resistance rating where permitted in subsection 3.2.2 of the OBC						18	22		25		31		41
4	Building is of combustible construction. Floor assemblies are fire separations but with no fire-resistance rating. Roof assemblies, mezzanines, loadbearing walls, columns and arches do not have a fire-resistance rating.						23	28		32		39		53

Type of Construction	Building Classification	Water Supply Coefficient (K)
2	F3	**19**

Step 2: Determine the Spacial Coefficient

		Distance	S_{side}
N	Exposure Distance 1 (m)	10.50	0.00
S	Exposure Distance 2 (m)	45.00	0.00
E	Exposure Distance 3 (m)	45.00	0.00
W	Exposure Distance 4 (m)	45.00	0.00
	Exposure Distance 5 (m)		
		S_{tot}	**1.00**



Step 3: Determine Volume of Building

Building Length(m)	Building Width (m)	Building Height to the underside of roof deck (m)	Volume (m^3)
150.00	65.00	10.00	97500.00

Number of Stories	1

Step 4: Calculate Minimum Water Supply

$$Q = KVS_{tot}$$

Minimum Water Supply (L)	1,852,500.00

Step 5: Calculate Minimum Supply Flow Rate

Table 2 from OBC 2012 A3.2.5.7			
Minimum Water Supply Flow Rates			
Building Code, Part 3 Buildings	Required Minimum Water Supply Flow Rate (L/min)		
One Storey Building with building area not exceeding 600 m2 (excluding F1 occupancy)	1800		
All Other Buildings	if Q> and	Q<=	
		108000	2700
	108000	135000	3600
	135000	162000	4500
	162000	190000	5400
	190000	270000	6300
	270000		9000

Minimum Water Supply Flow Rate (L/min)	9000

Step 6: Is a private fire reservoir required? **Yes**

Appendix B

Preliminary SWM Facility Design Calculations

3027 Cedar Creek Rd

STORMWATER MANAGEMENT

Township of North Dumfries, Ontario

Project Number:	55566-100
Date:	12/23/2024
Design By:	JHN
File:	Q:\55566\100\SWM\JHN Master SWM Facility Design Sheet.xlsx

HYDROLOGIC PARAMETERS

Pre-Development Conditions

Sub-Catchment Number	Area	Overland Slope	Overland Length	SCS Curve Number			Percent Impervious	Land Use	Comment
				Pervious (AMC II)	Pervious (AMC III)	Impervious			
	(ha)	*(%)*	*(m)*				*(%)*		
101	12.476	3	160	65	81	98	2		
102	5.19	5	100	65	81	98	0		
103	3.66	8	140	65	81	98	0		
Total	**21.326**						**1.17**		

Post-Development Conditions

Sub-Catchment Number	Area	Overland Slope	Overland Length	SCS Curve Number			Percent Impervious	Land Use	Comment
				Pervious (AMC II)	Pervious (AMC III)	Impervious			
	(ha)	*(%)*	*(m)*				*(%)*		
201	6.736	3.5	50	65	81	91	98		
202	0.547	10	25	65	81	98	100		
203	7.044	3	120	65	81	98	100		
204	0.587	8	10	65	81	98	0		
205	2.752	5	100	65	81	98	0		
206	3.66	8	140	65	81	98	0		
Total to SWMF	**7.283**						**98.15**		

IDF PARAMETERS

Region of Waterloo

Frequency (Years)	a	b	c	Comment
25mm (4hr)	509	6	0.7989	
2	743	6	0.7989	
5	1,593	11	0.8789	
10	2,221	12	0.9080	
25	3,158	15	0.9355	
50	3,886	16	0.9495	
100	4,688	17	0.9624	

3027 Cedar Creek Rd
STORMWATER MANAGEMENT
Township of North Dumfries, Ontario

Project Number:	55566-100
Date:	December 23, 2024
Design By:	JHN
File:	Q:\55566\100\SWM\JHN Master SWM Facility Design Sheet.xlsx

Step 1: Choose Level of Water Quality Control

Enhanced 80% long-term S.S. removal

Step 2: Choose Type of Facility

Wet Pond

Step 3: Define Catchment area and Imperviousness

Catchment Area (ha)	Imperviousness (%)
7.283	98.15

Interpolated Storage Volume Requirement (m^3/ha)

271.92

Permanent Pool Required (m^3)

1689.05

Extended Detention Volume Required (m^3)

291.32

1980.37

Table 3.2 Water Quality Storage Requirements based on Receiving Waters (from MOE Stormwater Management Planning and Design Manual, March 2003)

Protection Level	SWMP Type	Storage Volume (m^3/ha) for Impervious Level			
		35	55	70	85
Enhanced 80% long-term S.S. removal	*Wetlands*	80	105	120	140
	Hybrid Wet Pond/Wetland	110	150	175	195
	Wet Pond	140	190	225	250
Normal 70% long-term S.S. Removal	*Wetlands*	60	70	80	90
	Hybrid Wet Pond/Wetland	75	90	105	120
	Wet Pond	90	110	130	150
Basic 60% long-term S.S. Removal	*Wetlands*	60	60	60	60
	Hybrid Wet Pond/Wetland	60	70	75	80
	Wet Pond	60	75	85	95
	Dry Pond (Continuous Flow)	90	150	200	240

3027 Cedar Creek Rd
STORMWATER MANAGEMENT
Township of North Dumfries, Ontario

Project Number: 55566-100
Date: 12/23/2024
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File: Q:\55566\100\SWM\JHN Master SWM Facility Design Sheet.xlsx

STAGE-STORAGE RELATIONSHIP

Stage	Active Depth	Forebay			Main Pond			Total Pond Volume	Active Storage Volume	Volume Summary	Ponding Elevation	Comments	Stage
		Area	Volume	Cumulative Volume	Area	Volume	Cumulative Volume						
m	m	m^2	m^3	m^3	m^2	m^3	m^3	m^3	m^3	m^3	m		m
310.50		29	0	0				0					310.50
310.60		39	4	4				4					310.60
310.70		51	5	8				8					310.70
310.80		62	6	14				14					310.80
310.90		74	7	21				21					310.90
311.00		86	8	29	177	0	0	29					311.00
311.10		99	9	38	205	19	19	58					311.10
311.20		112	11	49	233	22	42	90					311.20
311.30		126	12	61	263	25	67	127					311.30
311.40		140	13	74	294	28	95	169					311.40
311.50		154	15	89	325	31	126	215					311.50
311.60		169	16	105	358	34	160	265					311.60
311.70		184	18	123	391	38	198	320					311.70
311.80		200	19	142	425	41	239	381					311.80
311.90		216	21	162	464	44	283	446					311.90
312.00		255	24	186	520	49	333	519					312.00
312.10		297	28	214	578	55	388	602					312.10
312.20		340	32	247	639	61	449	696					312.20
312.30		386	37	284	702	67	516	800					312.30
312.40		435	42	326	767	74	590	916					312.40
312.50		485	47	373	834	80	671	1044					312.50
312.60		538	53	426	904	88	758	1184					312.60
312.70		584	57	483	966	94	852	1335					312.70
312.80		631	61	544	1030	100	953	1497					312.80
312.90		679	66	610	1095	107	1059	1670					312.90
313.00		728	71	681	1161	113	1173	1854		1854		Permanent Pool	313.00
313.00	0.00	728	71	681	1161	113	1173	1854	0				313.00
313.10	0.10	777	76	757	1229	120	1292	2050	196				313.10
313.20	0.20	810	80	837	1273	126	1418	2255	401	291	313.15	MOE Extended Detention	313.20
313.30	0.30	843	83	921	1317	130	1548	2469	615				313.30
313.40	0.40	876	87	1007	1362	134	1682	2690	836	681	313.34	25mm (4hrs) Event	313.40
313.50	0.50	910	90	1097	1407	139	1821	2918	1065				313.50
313.60	0.60	944	93	1191	1453	143	1965	3155	1301	1246	313.58	1:2 Year Event	313.60
313.70	0.70	978	97	1288	1500	148	2113	3400	1546				313.70
313.80	0.80	1013	100	1388	1546	153	2265	3653	1799				313.80
313.90	0.90	1049	104	1492	1594	157	2423	3915	2061	1886	313.84	1:5 Year Event	313.90
314.00	1.00	1085	108	1599	1642	162	2585	4184	2330				314.00
314.10	1.10	1121	111	1711	1690	167	2752	4463	2609				314.10
314.20	1.20	1158	115	1825	1739	172	2924	4749	2895				314.20
314.30	1.30	1195	119	1944	1789	177	3101	5045	3191				314.30
314.40	1.40	1232	122	2066	1839	182	3282	5349	3495				314.40
314.50	1.50	1273	126	2193	1891	187	3469	5662	3808	3807	314.50	1:100 Year Event	314.50
314.60	1.60	1351	134	2327	2012	194	3663	5990	4136				314.60
314.70	1.70	1422	139	2465	2109	204	3868	6333	4479				314.70
314.80	1.80	1495	146	2611	2208	215	4083	6694	4840			Emergency Weir	314.80
314.90	1.90	1566	153	2765	2309	225	4308	7073	5219				314.90
315.00	2.00	1639	161	2926	2410	236	4544	7469	5615				315.00
													0.00

3027 Cedar Creek Rd
STORMWATER MANAGEMENT
Township of North Dumfries, Ontario

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Orifice Calculations

$Q_o = C_d * A_o * (2 * g * H_o)^{0.5}$

	Orifice 1	Orifice 2	Orifice 3
C_d	0.63	0.63	0.63
Invert (m)	313.00	313.60	500.00
Width (m)			
Diameter/Height (m)	0.075	0.300	
Type (H/V)	V	V	V

C_d	Description
0.63	Orifice Plate
0.80	Orifice Tube

Weir Calculations

$Q_w = 2/3 * C_d * (2g)^{1/2} * L * H_w^{3/2} + 8/15 * C_d * (2g)^{1/2} * \tan\theta * H_w^{5/2}$

C_d	0.50	0.50
Invert (m)	314.70	500.00
Length (m)	1.000	
Side Slope (H:V)	1	1
Side Slope (rad)	0.785	0.785

STAGE-DISCHARGE RELATIONSHIP

		Orifice 1			Orifice 2			Orifice 3								Extended Detention	Erosion Control
Stage	Active Volume	Area	H_o	Flow	Area	H_o	Flow	Area	H_o	Flow	Weir 1 Flow	Weir 2 Flow	Total Flow		Average Discharge	Increment Volume	Increment Dewatering Time	Cumulative Dewatering Time	Cumulative Dewatering Time
m	m^3	m^2	*m*	m^3/s	m^2	*m*	m^3/s	m^2	*m*	m^3/s	m^3/s		m^3/s		m^3/s	m^3	*hours*	*hours*	*hours*
313.00	0	0.00	0.00	0.0000	0.00	0.00	0.0000	0.00	0.00	0.0000	0.0000	0.0000	0.0000		0.0015	196	35	97	97
313.10	196	0.00	0.06	0.0031	0.00	0.00	0.0000	0.00	0.00	0.0000	0.0000	0.0000	0.0031		0.0040	206	14.18	61.61	61.61
313.20	401	0.00	0.16	0.0050	0.00	0.00	0.0000	0.00	0.00	0.0000	0.0000	0.0000	0.0050		0.0056	213	10.50	47.43	47.43
313.30	615	0.00	0.26	0.0063	0.00	0.00	0.0000	0.00	0.00	0.0000	0.0000	0.0000	0.0063		0.0069	221	8.94	36.93	36.93
313.40	836	0.00	0.36	0.0074	0.00	0.00	0.0000	0.00	0.00	0.0000	0.0000	0.0000	0.0074		0.0079	229	8.04	28.00	28.00
313.50	1065	0.00	0.46	0.0084	0.00	0.00	0.0000	0.00	0.00	0.0000	0.0000	0.0000	0.0084		0.0088	237	7.46	19.95	19.95
313.60	1301	0.00	0.56	0.0092	0.00	0.00	0.0000	0.00	0.00	0.0000	0.0000	0.0000	0.0092		0.0161	245	4.23	12.49	12.49
313.70	1546	0.00	0.66	0.0100	0.02	0.05	0.0129	0.00	0.00	0.0000	0.0000	0.0000	0.0229		0.0389	253	1.81	8.26	8.26
313.80	1799	0.00	0.76	0.0108	0.05	0.10	0.0442	0.00	0.00	0.0000	0.0000	0.0000	0.0549		0.0714	261	1.02	6.45	6.45
313.90	2061	0.00	0.86	0.0114	0.07	0.15	0.0764	0.00	0.00	0.0000	0.0000	0.0000	0.0878		0.0993	270	0.75	5.43	5.43
314.00	2330	0.00	0.96	0.0121	0.07	0.25	0.0986	0.00	0.00	0.0000	0.0000	0.0000	0.1107		0.1201	278	0.64	4.68	4.68
314.10	2609	0.00	1.06	0.0127	0.07	0.35	0.1167	0.00	0.00	0.0000	0.0000	0.0000	0.1294		0.1375	287	0.58	4.04	4.04
314.20	2895	0.00	1.16	0.0133	0.07	0.45	0.1323	0.00	0.00	0.0000	0.0000	0.0000	0.1456		0.1529	295	0.54	3.46	3.46
314.30	3191	0.00	1.26	0.0139	0.07	0.55	0.1463	0.00	0.00	0.0000	0.0000	0.0000	0.1601		0.1668	304	0.51	2.92	2.92
314.40	3495	0.00	1.36	0.0144	0.07	0.65	0.1590	0.00	0.00	0.0000	0.0000	0.0000	0.1734		0.1796	313	0.48	2.41	2.41
314.50	3808	0.00	1.46	0.0149	0.07	0.75	0.1708	0.00	0.00	0.0000	0.0000	0.0000	0.1857		0.1915	328	0.48	1.93	1.93
314.60	4136	0.00	1.56	0.0154	0.07	0.85	0.1819	0.00	0.00	0.0000	0.0000	0.0000	0.1973		0.2027	343	0.47	1.45	1.45
314.70	4479	0.00	1.66	0.0159	0.07	0.95	0.1923	0.00	0.00	0.0000	0.0000	0.0000	0.2082		0.2385	361	0.42	0.98	0.98
314.80	4840	0.00	1.76	0.0164	0.07	1.05	0.2021	0.00	0.00	0.0000	0.0504	0.0000	0.2689		0.3252	379	0.32	0.56	0.56
314.90	5219	0.00	1.86	0.0168	0.07	1.15	0.2115	0.00	0.00	0.0000	0.1532	0.0000	0.3815		0.4601	397	0.24	0.24	0.24
315.00	5615	0.00	1.96	0.0173	0.07	1.25	0.2205	0.00	0.00	0.0000	0.3008	0.0000	0.5386		0.2693	-5615			

3027 Cedar Creek Rd
STORMWATER MANAGEMENT
Township of North Dumfries, Ontario

Project Number: 55566-100
Date: 12/23/2024
Design By: JHN
File: Q:\55566\100\SWM\JHN Master SWM Facility Design Sheet.xlsx

FOREBAY DESIGN CALCULATIONS

MOE SWM Planning and Design Manual, 2003

Forebay Design Flows

Flow into forebay during the 1:5-year return period event	1.940	m^3/s
Flow into forebay during the 25 mm - 4 hour design storm event	0.846	m^3/s
Peak flow from main pond outlet for the 25mm design storm (from MIDUSS)	0.026	m^3/s

Forebay Characteristics

b =	2.5	*m*	bottom width
y =	2.5	*m*	depth
z =	3	:1	side slope
w =	10.0	*m*	average width
R =	1.37	*m*	hydraulic radius
A =	25.0	m^2	cross-sectional area

1. Length Calculation Based on Settling Velocity

L = forebay flow length *(m)*
r = length-to-width ratio
Q_p = peak flow rate through forebay *(m^3/s)*
v_s = settling velocity *(m/s)*

Equation 4.5: Forebay Settling Length

a) Required Settling Length (assuming Q_p = forebay through-flow & v_s = 0.0055 m/s)

Q_p =	0.85	m^3/s	peak flow rate through forebay
v_s =	0.0055	*m/s*	settling velocity
r =	1.50		length-to-width ratio
L =	15.2	*m*	required settling length
L =	*15.0*	*m*	*trial length*

b) Required Settling Length (assuming Q_p = pond discharge & v_s = 0.0003 m/s)

Q_p =	0.026	m^3/s	peak flow rate through forebay
v_s =	0.0003	*m/s*	settling velocity
r =	0.85		length-to-width ratio
L =	8.6	*m*	required settling length
L =	*8.5*	*m*	*trial length*

Table 1: Average settling velocities

	Mass Removed	Particle Size Range	Average Settling Velocity
	%	*µm*	*m/s*
	80 - 100	x ≤ 20	0.00000254
Enhanced:	70 - 80	20 < x ≤ 40	0.00001300
Normal:	60 - 70	40 < x ≤ 60	0.00002540
Basic:	40 - 60	60 < x ≤ 130	0.00012700
Medium Sand:	20 - 40	130 < x ≤ 400	0.00059267
Gross Grit:	0 - 20	400 < x ≤ 4000	0.00550333

2. Length Calculation Based on Flow Dispersion Length

Q =	1.94	m^3/s	inlet flow rate
d =	2.5	*m*	depth of permanent pool in forebay
V_f =	0.50	*m/s*	desired velocity in forebay (typical value ≤ 0.50 *m/s*)
L =	12.4	m	required length of dispersion

Equation 4.6: Dispersion Length

3. Required Forebay Length

L =	**33.0**	***m***	**design length**
r =	3.30		design length-to-width ratio (typical minimum of 2.0)

4. Scour Velocity

v_s =	0.15	*m/s*	scour velocity (typical value = 0.15 *m/s*)
v =	**0.078**	***m/s***	**actual velocity**

OK The actual velocity through the forebay is less than the scour velocity.

5. Weir Flow From Forebay

L =	17	*m*	length of crest of weir
α =	1.65		coefficient
H =	0.3	*m*	head
Q =	**4.61**	***m^3/s***	**discharge**

Equation 4.4: Weir Flow

OK The weir flow from the forebay exceeds the flow entering the forebay

6. Estimated Cleanout Frequencies

a) Forebay

Forebay volume	681	m^3
Estimated TSS removal efficiency	50%	
Impervious level	98%	
Estimated annual sediment loading	3.8	m^3/ha
Contributing area	7.28	*ha*
Annual sediment volume	14	m^3/yr
Cleanout frequency for 33% volume reduction	**16.2**	***years***

Table 2: Annual sediment loading

Impervious Level	Annual Loading
%	m^3/ha
35%	0.6
55%	1.9
70%	2.8
85%	3.8

b) Stormwater Management Pond

Wetpond volume (excluding forebay)	1173	m^3
Estimated TSS removal efficiency	30%	
Impervious level	98%	
Estimated annual sediment loading	3.8	m^3/ha
Contributing area	7.28	*ha*
Annual sediment volume	8	m^3/yr
Cleanout frequency for 33% volume reduction	**46.6**	***years***

3027 Cedar Creek Rd
STORMWATER MANAGEMENT
Township of North Dumfries, Ontario

Project Number:	55566-100
Date:	12/23/2024
Design By:	JHN
File:	Q:\55566\100\SWM\JHN Master SWM Facility Design Sheet.xlsx

FALLING HEAD DRAWDOWN CALCULATION
MOE SWM Planning and Design Manual, 2003

$$t = \frac{0.66C_2h^{1.5} + 2C_3h^{0.5}}{2.75A_O}$$ Equation 4.11

where

t =	191998.776	*s*	
	53.3	*hr*	drawdown time
A_p =	2193.99672	m^2	surface area of the pond
C =	0.63		discharge coefficient
d =	75	*mm*	diameter of the orifice
A_O =	0.00441786	m^2	cross-sectional area of the orifice
g =	9.81	m/s^2	gravitational acceleration constant
h_1 =	313.340	*m*	starting water elevation above the orifice
h_2 =	313.000	*m*	ending water elevation above the orifice
h =	0.34	*m*	maximum water elevation above the orifice
C_2 =	850.718		slope coefficient from the area-depth linear regression
C_3 =	1904.7526		intercept from the area-depth linear regression

	ELEVATION *m*	STAGE *m*	AREA m^2	COMMENTS
1	313.000	0	1889.0	Permanent pool
2	313.100	0.1	2006.0	
3	313.200	0.2	2082.3	
4	313.300	0.3	2159.5	
5	313.400	0.4	2237.7	

DRAWDOWN TIME: 191999 *s*
53.3 *hr*

Regression Output:

m_1 =	850.72	slope coefficient from the area-depth linear regression
b =	1904.75	intercept from the area-depth linear regression
se_1 =	45.45	standard error for coefficient m_1
se_b =	11.13	standard error for constant b
R^2 =	0.9915	coefficient of determination
se_y =	14.37	standard error of the *y* estimate
F =	350.41	F statistic
df =	3	degrees of freedom
ss_{reg} =	72372	regression sum of squares
ss_{resid} =	620	residual sum of squares

Appendix C

MIDUSS Output

Pre-Development

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                            Version 2.25  rev. 473"
"                MIDUSS created                          Sunday, February 7, 2010"
"           10   Units used:                                            ie METRIC"
"                Job folder:        Q:\55566\100\SWM\MIDUSS\2024-12-17 JHN\Pre\"
"                                                                        CN = 65"
"                Output filename:                                          2.out"
"                Licensee name:                                                A"
"                Company                                                        "
"                Date & Time last used:                 12/18/2024 at 4:42:55 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      743.000   Coefficient A"
"        6.000   Constant B"
"        0.799   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           109.374    mm/hr"
"             Total depth                  34.259    mm"
"            6   002hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          101   Area to Wetland 1"
"        1.000   % Impervious"
"       12.476   Total Area"
"      160.000   Flow length"
"        3.000   Overland Slope"
"       12.351   Pervious Area"
"      160.000   Pervious length"
"        3.000   Pervious slope"
"        0.125   Impervious Area"
"      160.000   Impervious length"
"        3.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       65.000   Pervious SCS Curve No."
"        0.079   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       13.677   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.851   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
```

```
"                    0.032     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           12.351     0.125      12.476     hectare"
"             Time of concentration  99.514     5.342      90.227     minutes"
"             Time to Centroid       220.453    96.042     208.184    minutes"
"             Rainfall depth         34.259     34.259     34.259     mm"
"             Rainfall volume        4231.36    42.74      4274.10    c.m"
"             Rainfall losses        31.567     5.103      31.302     mm"
"             Runoff depth           2.692      29.156     2.957      mm"
"             Runoff volume          332.48     36.37      368.86     c.m"
"             Runoff coefficient     0.079      0.851      0.086      "
"             Maximum flow           0.031      0.026      0.032      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.032     0.032     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.032     0.032     0.032     0.000"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                To Wetland 1"
"             Maximum flow                 0.032    c.m/sec"
"             Hydrograph volume          368.855    c.m"
"                    0.032     0.032     0.032     0.032"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.032     0.000     0.032     0.032"
" 33          CATCHMENT 102"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          102   Area to Wetland 2"
"        0.000   % Impervious"
"        5.190   Total Area"
"      100.000   Flow length"
"        5.000   Overland Slope"
"        5.190   Pervious Area"
"      100.000   Pervious length"
"        5.000   Pervious slope"
"        0.000   Impervious Area"
"      100.000   Impervious length"
"        5.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       65.000   Pervious SCS Curve No."
"        0.079   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       13.677   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
```

```
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.018     0.000     0.032     0.032 c.m/sec"
"             Catchment 102          Pervious   Impervious Total Area "
"             Surface Area           5.190      0.000      5.190      hectare"
"             Time of concentration  64.396     3.457      64.395     minutes"
"             Time to Centroid       181.567    93.271     181.566    minutes"
"             Rainfall depth         34.259     34.259     34.259     mm"
"             Rainfall volume        1778.02    0.00       1778.02    c.m"
"             Rainfall losses        31.567     5.565      31.567     mm"
"             Runoff depth           2.692      28.694     2.692      mm"
"             Runoff volume          139.70     0.00       139.70     c.m"
"             Runoff coefficient     0.079      0.000      0.079      "
"             Maximum flow           0.018      0.000      0.018      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.018     0.018     0.032     0.032"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.018     0.018     0.018     0.032"
" 40          HYDROGRAPH   Combine    2"
"            6   Combine "
"            2   Node #"
"                To Wetland 2"
"             Maximum flow                  0.018    c.m/sec"
"             Hydrograph volume           139.705    c.m"
"                     0.018     0.018     0.018     0.018"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.018     0.000     0.018     0.018"
" 33          CATCHMENT 103"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          103   Area to Southwest Neighboring Property"
"        0.000   % Impervious"
"        3.660   Total Area"
"      140.000   Flow length"
"        8.000   Overland Slope"
"        3.660   Pervious Area"
"      140.000   Pervious length"
"        8.000   Pervious slope"
"        0.000   Impervious Area"
"      140.000   Impervious length"
"        8.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       65.000   Pervious SCS Curve No."
"        0.079   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
```

```
"       13.677   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.012     0.000     0.018     0.018 c.m/sec"
"             Catchment 103          Pervious   Impervious Total Area "
"             Surface Area           3.660      0.000      3.660      hectare"
"             Time of concentration  68.438     3.674      68.437     minutes"
"             Time to Centroid       186.044    93.632     186.043    minutes"
"             Rainfall depth         34.259     34.259     34.259     mm"
"             Rainfall volume        1253.86    0.00       1253.86    c.m"
"             Rainfall losses        31.567     5.652      31.567     mm"
"             Runoff depth           2.692      28.607     2.692      mm"
"             Runoff volume          98.52      0.00       98.52      c.m"
"             Runoff coefficient     0.079      0.000      0.079      "
"             Maximum flow           0.012      0.000      0.012      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.012     0.012     0.018     0.018"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.012     0.012     0.012     0.018"
" 40          HYDROGRAPH   Combine    3"
"            6   Combine "
"            3   Node #"
"                To southest property"
"             Maximum flow                  0.012    c.m/sec"
"             Hydrograph volume            98.525    c.m"
"                     0.012     0.012     0.012     0.012"
" 38          START/RE-START TOTALS 103"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                      21.326    hectare"
"             Total Impervious area                      0.125    hectare"
"             Total % impervious                         0.585"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                       Sunday, February 7, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:        Q:\55566\100\SWM\MIDUSS\2024-12-17 JHN\Pre\"
"                                                                      CN = 65"
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"                Licensee name:                                              A"
"                Company                                                      "
"                Date & Time last used:               12/18/2024 at 4:44:52 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1593.000   Coefficient A"
"       11.000   Constant B"
"        0.879   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          139.288    mm/hr"
"             Total depth                 47.265    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          101   Area to Wetland 1"
"        1.000   % Impervious"
"       12.476   Total Area"
"      160.000   Flow length"
"        3.000   Overland Slope"
"       12.351   Pervious Area"
"      160.000   Pervious length"
"        3.000   Pervious slope"
"        0.125   Impervious Area"
"      160.000   Impervious length"
"        3.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       65.000   Pervious SCS Curve No."
"        0.140   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       13.677   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.883   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
```

```
"                    0.121     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           12.351     0.125      12.476     hectare"
"             Time of concentration  64.920     4.788      61.322     minutes"
"             Time to Centroid       176.130    92.965     171.154    minutes"
"             Rainfall depth         47.265     47.265     47.265     mm"
"             Rainfall volume        5837.78    58.97      5896.74    c.m"
"             Rainfall losses        40.643     5.549      40.292     mm"
"             Runoff depth           6.621      41.716     6.972      mm"
"             Runoff volume          817.82     52.04      869.87     c.m"
"             Runoff coefficient     0.140      0.883      0.148      "
"             Maximum flow           0.119      0.036      0.121      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.121     0.121     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.121     0.121     0.121     0.000"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                To Wetland 1"
"             Maximum flow                 0.121    c.m/sec"
"             Hydrograph volume          869.865    c.m"
"                    0.121     0.121     0.121     0.121"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.121     0.000     0.121     0.121"
" 33          CATCHMENT 102"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          102   Area to Wetland 2"
"        0.000   % Impervious"
"        5.190   Total Area"
"      100.000   Flow length"
"        5.000   Overland Slope"
"        5.190   Pervious Area"
"      100.000   Pervious length"
"        5.000   Pervious slope"
"        0.000   Impervious Area"
"      100.000   Impervious length"
"        5.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       65.000   Pervious SCS Curve No."
"        0.140   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       13.677   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
```

```
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.068     0.000     0.121     0.121 c.m/sec"
"             Catchment 102          Pervious   Impervious Total Area "
"             Surface Area           5.190      0.000      5.190      hectare"
"             Time of concentration  42.010     3.098      42.010     minutes"
"             Time to Centroid       150.158    90.502     150.158    minutes"
"             Rainfall depth         47.265     47.265     47.265     mm"
"             Rainfall volume        2453.03    0.00       2453.04    c.m"
"             Rainfall losses        40.645     5.945      40.645     mm"
"             Runoff depth           6.620      41.319     6.620      mm"
"             Runoff volume          343.58     0.00       343.58     c.m"
"             Runoff coefficient     0.140      0.000      0.140      "
"             Maximum flow           0.068      0.000      0.068      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.068     0.068     0.121     0.121"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.068     0.068     0.068     0.121"
" 40          HYDROGRAPH   Combine    2"
"            6   Combine "
"            2   Node #"
"                To Wetland 2"
"             Maximum flow                  0.068    c.m/sec"
"             Hydrograph volume           343.585    c.m"
"                     0.068     0.068     0.068     0.068"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.068     0.000     0.068     0.068"
" 33          CATCHMENT 103"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          103   Area to Southwest Neighboring Property"
"        0.000   % Impervious"
"        3.660   Total Area"
"      140.000   Flow length"
"        8.000   Overland Slope"
"        3.660   Pervious Area"
"      140.000   Pervious length"
"        8.000   Pervious slope"
"        0.000   Impervious Area"
"      140.000   Impervious length"
"        8.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       65.000   Pervious SCS Curve No."
"        0.140   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
```

```
"       13.677   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.046     0.000     0.068     0.068 c.m/sec"
"             Catchment 103          Pervious   Impervious Total Area "
"             Surface Area           3.660      0.000      3.660      hectare"
"             Time of concentration  44.647     3.292      44.647     minutes"
"             Time to Centroid       153.148    90.817     153.148    minutes"
"             Rainfall depth         47.265     47.265     47.265     mm"
"             Rainfall volume        1729.89    0.00       1729.89    c.m"
"             Rainfall losses        40.644     5.962      40.644     mm"
"             Runoff depth           6.620      41.303     6.620      mm"
"             Runoff volume          242.30     0.00       242.30     c.m"
"             Runoff coefficient     0.140      0.000      0.140      "
"             Maximum flow           0.046      0.000      0.046      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.046     0.046     0.068     0.068"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.046     0.046     0.046     0.068"
" 40          HYDROGRAPH   Combine    3"
"            6   Combine "
"            3   Node #"
"                To southest property"
"             Maximum flow                  0.046    c.m/sec"
"             Hydrograph volume           242.302    c.m"
"                     0.046     0.046     0.046     0.046"
" 38          START/RE-START TOTALS 103"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                      21.326    hectare"
"             Total Impervious area                      0.125    hectare"
"             Total % impervious                         0.585"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                       Sunday, February 7, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:        Q:\55566\100\SWM\MIDUSS\2024-12-17 JHN\Pre\"
"                                                                       CN = 65"
"                Output filename:                                       100.out"
"                Licensee name:                                               A"
"                Company                                                       "
"                Date & Time last used:               12/18/2024 at 4:52:42 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     4688.000   Coefficient A"
"       17.000   Constant B"
"        0.962   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          239.354    mm/hr"
"             Total depth                 87.079    mm"
"            6   100hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          101   Area to Wetland 1"
"        1.000   % Impervious"
"       12.476   Total Area"
"      160.000   Flow length"
"        3.000   Overland Slope"
"       12.351   Pervious Area"
"      160.000   Pervious length"
"        3.000   Pervious slope"
"        0.125   Impervious Area"
"      160.000   Impervious length"
"        3.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       65.000   Pervious SCS Curve No."
"        0.294   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       13.677   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.921   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
```

```
"                    0.794     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           12.351     0.125      12.476     hectare"
"             Time of concentration  34.765     3.808      33.815     minutes"
"             Time to Centroid       137.211    89.275     135.741    minutes"
"             Rainfall depth         87.079     87.079     87.079     mm"
"             Rainfall volume        1.0755     0.0109     1.0864     ha-m"
"             Rainfall losses        61.461     6.844      60.915     mm"
"             Runoff depth           25.618     80.236     26.165     mm"
"             Runoff volume          3164.19    100.10     3264.29    c.m"
"             Runoff coefficient     0.294      0.921      0.300      "
"             Maximum flow           0.785      0.064      0.794      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.794     0.794     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.794     0.794     0.794     0.000"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                To Wetland 1"
"             Maximum flow                 0.794    c.m/sec"
"             Hydrograph volume         3264.295    c.m"
"                    0.794     0.794     0.794     0.794"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.794     0.000     0.794     0.794"
" 33          CATCHMENT 102"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          102   Area to Wetland 2"
"        0.000   % Impervious"
"        5.190   Total Area"
"      100.000   Flow length"
"        5.000   Overland Slope"
"        5.190   Pervious Area"
"      100.000   Pervious length"
"        5.000   Pervious slope"
"        0.000   Impervious Area"
"      100.000   Impervious length"
"        5.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       65.000   Pervious SCS Curve No."
"        0.294   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       13.677   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
```

```
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.448     0.000     0.794     0.794 c.m/sec"
"             Catchment 102          Pervious   Impervious Total Area "
"             Surface Area           5.190      0.000      5.190      hectare"
"             Time of concentration  22.496     2.464      22.496     minutes"
"             Time to Centroid       122.483    87.300     122.483    minutes"
"             Rainfall depth         87.079     87.079     87.079     mm"
"             Rainfall volume        4519.41    0.00       4519.41    c.m"
"             Rainfall losses        61.481     6.897      61.481     mm"
"             Runoff depth           25.598     80.182     25.598     mm"
"             Runoff volume          1328.54    0.00       1328.54    c.m"
"             Runoff coefficient     0.294      0.000      0.294      "
"             Maximum flow           0.448      0.000      0.448      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.448     0.448     0.794     0.794"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.448     0.448     0.448     0.794"
" 40          HYDROGRAPH   Combine    2"
"            6   Combine "
"            2   Node #"
"                To Wetland 2"
"             Maximum flow                  0.448    c.m/sec"
"             Hydrograph volume          1328.543    c.m"
"                     0.448     0.448     0.448     0.448"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.448     0.000     0.448     0.448"
" 33          CATCHMENT 103"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          103   Area to Southwest Neighboring Property"
"        0.000   % Impervious"
"        3.660   Total Area"
"      140.000   Flow length"
"        8.000   Overland Slope"
"        3.660   Pervious Area"
"      140.000   Pervious length"
"        8.000   Pervious slope"
"        0.000   Impervious Area"
"      140.000   Impervious length"
"        8.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       65.000   Pervious SCS Curve No."
"        0.294   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
```

```
"       13.677   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.298     0.000     0.448     0.448 c.m/sec"
"             Catchment 103          Pervious   Impervious Total Area "
"             Surface Area           3.660      0.000      3.660      hectare"
"             Time of concentration  23.909     2.619      23.908     minutes"
"             Time to Centroid       124.173    87.544     124.173    minutes"
"             Rainfall depth         87.079     87.079     87.079     mm"
"             Rainfall volume        3187.10    0.00       3187.10    c.m"
"             Rainfall losses        61.470     7.054      61.470     mm"
"             Runoff depth           25.609     80.026     25.609     mm"
"             Runoff volume          937.29     0.00       937.30     c.m"
"             Runoff coefficient     0.294      0.000      0.294      "
"             Maximum flow           0.298      0.000      0.298      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.298     0.298     0.448     0.448"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.298     0.298     0.298     0.448"
" 40          HYDROGRAPH   Combine    3"
"            6   Combine "
"            3   Node #"
"                To southest property"
"             Maximum flow                  0.298    c.m/sec"
"             Hydrograph volume           937.296    c.m"
"                     0.298     0.298     0.298     0.298"
" 38          START/RE-START TOTALS 103"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                      21.326    hectare"
"             Total Impervious area                      0.125    hectare"
"             Total % impervious                         0.585"
" 19          EXIT"
```

Post-Development

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                            Version 2.25  rev. 473"
"                MIDUSS created                          Sunday, February 7, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:           Q:\55566\100\SWM\MIDUSS\2024-12-17 JHN\"
"                                                                          Post"
"                Output filename:                                    2 c.out"
"                Licensee name:                                            A"
"                Company                                                    "
"                Date & Time last used:                12/18/2024 at 5:45:43 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      743.000   Coefficient A"
"        6.000   Constant B"
"        0.799   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          109.374    mm/hr"
"             Total depth                 34.259    mm"
"            6   002hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 201"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          201   Area to SWMF"
"       98.000   % Impervious"
"        6.736   Total Area"
"       50.000   Flow length"
"        3.000   Overland Slope"
"        0.135   Pervious Area"
"       50.000   Pervious length"
"        3.000   Pervious slope"
"        6.601   Impervious Area"
"       50.000   Impervious length"
"        3.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       65.000   Pervious SCS Curve No."
"        0.079   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       13.677   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       91.000   Impervious SCS Curve No."
"        0.507   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        2.512   Impervious Initial abstraction"
```

```
"                    0.816     0.000     0.000     0.000 c.m/sec"
"            Catchment 201          Pervious   Impervious Total Area "
"            Surface Area           0.135      6.601      6.736      hectare"
"            Time of concentration  49.521     3.300      3.446      minutes"
"            Time to Centroid       165.095    99.443     99.649     minutes"
"            Rainfall depth         34.259     34.259     34.259     mm"
"            Rainfall volume        46.15      2261.50    2307.66    c.m"
"            Rainfall losses        31.567     16.873     17.167     mm"
"            Runoff depth           2.691      17.385     17.091     mm"
"            Runoff volume          3.63       1147.66    1151.28    c.m"
"            Runoff coefficient     0.079      0.507      0.499      "
"            Maximum flow           0.001      0.816      0.816      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.816     0.816     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.816     0.816     0.816     0.000"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    0.816     0.816     0.816     0.000"
" 33          CATCHMENT 202"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          202   SWMF"
"      100.000   % Impervious"
"        0.547   Total Area"
"       25.000   Flow length"
"       10.000   Overland Slope"
"        0.000   Pervious Area"
"       25.000   Pervious length"
"       10.000   Pervious slope"
"        0.547   Impervious Area"
"       25.000   Impervious length"
"       10.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       65.000   Pervious SCS Curve No."
"        0.000   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       13.677   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.835   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.129     0.816     0.816     0.000 c.m/sec"
"            Catchment 202          Pervious   Impervious Total Area "
"            Surface Area           0.000      0.547      0.547      hectare"
"            Time of concentration  22.767     1.222      1.222      minutes"
```

```
"             Time to Centroid       135.475    89.722     89.722     minutes"
"             Rainfall depth         34.259     34.259     34.259     mm"
"             Rainfall volume        0.00       187.39     187.39     c.m"
"             Rainfall losses        31.571     5.667      5.667      mm"
"             Runoff depth           2.688      28.592     28.592     mm"
"             Runoff volume          0.00       156.40     156.40     c.m"
"             Runoff coefficient     0.000      0.835      0.835      "
"             Maximum flow           0.000      0.129      0.129      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.129     0.897     0.816     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.129     0.897     0.897     0.000"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.129     0.897     0.897     0.000"
" 54          POND DESIGN"
"        0.897   Current peak flow    c.m/sec"
"        0.600   Target outflow    c.m/sec"
"       1307.7   Hydrograph volume    c.m"
"         19.   Number of stages"
"      313.000   Minimum water level    metre"
"      314.800   Maximum water level    metre"
"      313.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                313.000     0.000     0.000"
"                313.100   0.00276   196.000"
"                313.200   0.00478   401.000"
"                313.300   0.00616   615.000"
"                313.400   0.00729   836.000"
"                313.500   0.00827  1065.000"
"                313.600   0.00914  1301.000"
"                313.700   0.01626  1546.000"
"                313.800   0.03292  1799.000"
"                313.900   0.05552  2061.000"
"                314.000    0.1002  2330.000"
"                314.100    0.1207  2609.000"
"                314.200    0.1380  2895.000"
"                314.300    0.1533  3191.000"
"                314.400    0.1671  3495.000"
"                314.500    0.1799  3808.000"
"                314.600    0.1918  4136.000"
"                314.700    0.2030  4479.000"
"                314.800    0.2621  4840.000"
"           1.   WEIRS"
"                  Crest      Weir     Crest      Left     Right"
"              elevation coefficie   breadth sideslope sideslope"
"                314.700     0.900     1.000     0.000     0.000"
```

```
"           2.   ORIFICES"
"                Orifice   Orifice   Orifice Number of"
"                 invert coefficie  diameter  orifices"
"                313.000     0.630    0.0750     1.000"
"                313.600     0.630    0.3000     1.000"
"             Peak outflow                  0.009    c.m/sec"
"             Maximum level               313.577    metre"
"             Maximum storage            1245.993    c.m"
"             Centroidal lag               28.115   hours"
"                  0.129     0.897     0.009     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                To Wetland 1"
"             Maximum flow                  0.009    c.m/sec"
"             Hydrograph volume           659.019    c.m"
"                     0.129     0.897     0.009     0.009"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.129     0.000     0.009     0.009"
" 33          CATCHMENT 203"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          203   Uncontrolled area to wetland 1"
"        0.000   % Impervious"
"        7.044   Total Area"
"      120.000   Flow length"
"        3.000   Overland Slope"
"        7.044   Pervious Area"
"      120.000   Pervious length"
"        3.000   Pervious slope"
"        0.000   Impervious Area"
"      120.000   Impervious length"
"        3.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       65.000   Pervious SCS Curve No."
"        0.079   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       13.677   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.020     0.000     0.009     0.009 c.m/sec"
"             Catchment 203          Pervious   Impervious Total Area "
"             Surface Area           7.044      0.000      7.044      hectare"
"             Time of concentration  83.737     4.495      83.737     minutes"
"             Time to Centroid       202.985    94.804     202.983    minutes"
```

```
"             Rainfall depth         34.259     34.259     34.259     mm"
"             Rainfall volume        2413.17    0.00       2413.17    c.m"
"             Rainfall losses        31.567     5.300      31.567     mm"
"             Runoff depth           2.692      28.959     2.692      mm"
"             Runoff volume          189.62     0.00       189.62     c.m"
"             Runoff coefficient     0.079      0.000      0.079      "
"             Maximum flow           0.020      0.000      0.020      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.020     0.020     0.009     0.009"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.020     0.020     0.020     0.009"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                To Wetland 1"
"             Maximum flow                  0.029    c.m/sec"
"             Hydrograph volume           848.643    c.m"
"                    0.020     0.020     0.020     0.029"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.020     0.000     0.020     0.029"
" 33          CATCHMENT 204"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          204   Uncontrolled area to offsite"
"        0.000   % Impervious"
"        0.587   Total Area"
"       10.000   Flow length"
"        8.000   Overland Slope"
"        0.587   Pervious Area"
"       10.000   Pervious length"
"        8.000   Pervious slope"
"        0.000   Impervious Area"
"       10.000   Impervious length"
"        8.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       65.000   Pervious SCS Curve No."
"        0.078   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       13.677   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.005     0.000     0.020     0.029 c.m/sec"
"             Catchment 204          Pervious   Impervious Total Area "
```

```
"             Surface Area           0.587      0.000      0.587      hectare"
"             Time of concentration  14.048     0.754      14.048     minutes"
"             Time to Centroid       125.822    89.304     125.821    minutes"
"             Rainfall depth         34.259     34.259     34.259     mm"
"             Rainfall volume        201.10     0.00       201.10     c.m"
"             Rainfall losses        31.572     6.550      31.572     mm"
"             Runoff depth           2.686      27.709     2.686      mm"
"             Runoff volume          15.77      0.00       15.77      c.m"
"             Runoff coefficient     0.078      0.000      0.078      "
"             Maximum flow           0.005      0.000      0.005      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.005     0.005     0.020     0.029"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.005     0.005     0.005     0.029"
" 40          HYDROGRAPH   Combine    2"
"            6   Combine "
"            2   Node #"
"                Offiste"
"             Maximum flow                  0.005    c.m/sec"
"             Hydrograph volume            15.770    c.m"
"                     0.005     0.005     0.005     0.005"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.005     0.000     0.005     0.005"
" 33          CATCHMENT 205"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          205   Area to wetland 2"
"        0.000   % Impervious"
"        2.752   Total Area"
"      100.000   Flow length"
"        5.000   Overland Slope"
"        2.752   Pervious Area"
"      100.000   Pervious length"
"        5.000   Pervious slope"
"        0.000   Impervious Area"
"      100.000   Impervious length"
"        5.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       65.000   Pervious SCS Curve No."
"        0.079   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       13.677   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
```

```
"        0.518   Impervious Initial abstraction"
"                     0.010     0.000     0.005     0.005 c.m/sec"
"             Catchment 205          Pervious   Impervious Total Area "
"             Surface Area           2.752      0.000      2.752      hectare"
"             Time of concentration  64.396     3.457      64.395     minutes"
"             Time to Centroid       181.567    93.271     181.566    minutes"
"             Rainfall depth         34.259     34.259     34.259     mm"
"             Rainfall volume        942.79     0.00       942.80     c.m"
"             Rainfall losses        31.567     5.565      31.567     mm"
"             Runoff depth           2.692      28.694     2.692      mm"
"             Runoff volume          74.08      0.00       74.08      c.m"
"             Runoff coefficient     0.079      0.000      0.079      "
"             Maximum flow           0.010      0.000      0.010      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.010     0.010     0.005     0.005"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.010     0.010     0.010     0.005"
" 40          HYDROGRAPH   Combine    3"
"            6   Combine "
"            3   Node #"
"                To Wetland 2"
"             Maximum flow                  0.010    c.m/sec"
"             Hydrograph volume            74.079    c.m"
"                     0.010     0.010     0.010     0.010"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.010     0.000     0.010     0.010"
" 33          CATCHMENT 206"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          206   Area to southwest property"
"        0.000   % Impervious"
"        3.660   Total Area"
"      140.000   Flow length"
"        8.000   Overland Slope"
"        3.660   Pervious Area"
"      140.000   Pervious length"
"        8.000   Pervious slope"
"        0.000   Impervious Area"
"      140.000   Impervious length"
"        8.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       65.000   Pervious SCS Curve No."
"        0.079   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       13.677   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
```

```
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.012     0.000     0.010     0.010 c.m/sec"
"             Catchment 206          Pervious   Impervious Total Area "
"             Surface Area           3.660      0.000      3.660      hectare"
"             Time of concentration  68.438     3.674      68.437     minutes"
"             Time to Centroid       186.044    93.632     186.043    minutes"
"             Rainfall depth         34.259     34.259     34.259     mm"
"             Rainfall volume        1253.86    0.00       1253.86    c.m"
"             Rainfall losses        31.567     5.652      31.567     mm"
"             Runoff depth           2.692      28.607     2.692      mm"
"             Runoff volume          98.52      0.00       98.52      c.m"
"             Runoff coefficient     0.079      0.000      0.079      "
"             Maximum flow           0.012      0.000      0.012      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.012     0.012     0.010     0.010"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.012     0.012     0.012     0.010"
" 40          HYDROGRAPH   Combine    4"
"            6   Combine "
"            4   Node #"
"                To Southwest Property"
"             Maximum flow                 0.012    c.m/sec"
"             Hydrograph volume           98.525    c.m"
"                     0.012     0.012     0.012     0.012"
" 38          START/RE-START TOTALS 206"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                    21.326    hectare"
"             Total Impervious area                    7.148    hectare"
"             Total % impervious                      33.519"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                            Version 2.25  rev. 473"
"                MIDUSS created                          Sunday, February 7, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:           Q:\55566\100\SWM\MIDUSS\2024-12-17 JHN\"
"                                                                          Post"
"                Output filename:                                    5 c.out"
"                Licensee name:                                            A"
"                Company                                                    "
"                Date & Time last used:                12/18/2024 at 5:49:22 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1593.000   Coefficient A"
"       11.000   Constant B"
"        0.879   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          139.288    mm/hr"
"             Total depth                 47.265    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 201"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          201   Area to SWMF"
"       98.000   % Impervious"
"        6.736   Total Area"
"       50.000   Flow length"
"        3.000   Overland Slope"
"        0.135   Pervious Area"
"       50.000   Pervious length"
"        3.000   Pervious slope"
"        6.601   Impervious Area"
"       50.000   Impervious length"
"        3.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       65.000   Pervious SCS Curve No."
"        0.140   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       13.677   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       91.000   Impervious SCS Curve No."
"        0.595   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        2.512   Impervious Initial abstraction"
```

```
"                    1.271     0.000     0.000     0.000 c.m/sec"
"            Catchment 201          Pervious   Impervious Total Area "
"            Surface Area           0.135      6.601      6.736      hectare"
"            Time of concentration  32.306     2.782      2.923      minutes"
"            Time to Centroid       139.163    95.260     95.470     minutes"
"            Rainfall depth         47.265     47.265     47.265     mm"
"            Rainfall volume        63.67      3120.07    3183.75    c.m"
"            Rainfall losses        40.646     19.141     19.571     mm"
"            Runoff depth           6.619      28.123     27.693     mm"
"            Runoff volume          8.92       1856.50    1865.41    c.m"
"            Runoff coefficient     0.140      0.595      0.586      "
"            Maximum flow           0.002      1.271      1.271      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    1.271     1.271     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    1.271     1.271     1.271     0.000"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    1.271     1.271     1.271     0.000"
" 33          CATCHMENT 202"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          202   SWMF"
"      100.000   % Impervious"
"        0.547   Total Area"
"       25.000   Flow length"
"       10.000   Overland Slope"
"        0.000   Pervious Area"
"       25.000   Pervious length"
"       10.000   Pervious slope"
"        0.547   Impervious Area"
"       25.000   Impervious length"
"       10.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       65.000   Pervious SCS Curve No."
"        0.000   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       13.677   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.866   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.175     1.271     1.271     0.000 c.m/sec"
"            Catchment 202          Pervious   Impervious Total Area "
"            Surface Area           0.000      0.547      0.547      hectare"
"            Time of concentration  14.853     1.095      1.095      minutes"
```

```
"             Time to Centroid       119.386    87.526     87.526     minutes"
"             Rainfall depth         47.265     47.265     47.265     mm"
"             Rainfall volume        0.00       258.54     258.54     c.m"
"             Rainfall losses        40.654     6.318      6.318      mm"
"             Runoff depth           6.611      40.947     40.947     mm"
"             Runoff volume          0.00       223.98     223.98     c.m"
"             Runoff coefficient     0.000      0.866      0.866      "
"             Maximum flow           0.000      0.175      0.175      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.175     1.385     1.271     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.175     1.385     1.385     0.000"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.175     1.385     1.385     0.000"
" 54          POND DESIGN"
"        1.385   Current peak flow    c.m/sec"
"        0.600   Target outflow    c.m/sec"
"       2089.4   Hydrograph volume    c.m"
"         19.   Number of stages"
"      313.000   Minimum water level    metre"
"      314.800   Maximum water level    metre"
"      313.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                313.000     0.000     0.000"
"                313.100   0.00276   196.000"
"                313.200   0.00478   401.000"
"                313.300   0.00616   615.000"
"                313.400   0.00729   836.000"
"                313.500   0.00827  1065.000"
"                313.600   0.00914  1301.000"
"                313.700   0.01626  1546.000"
"                313.800   0.03292  1799.000"
"                313.900   0.05552  2061.000"
"                314.000    0.1002  2330.000"
"                314.100    0.1207  2609.000"
"                314.200    0.1380  2895.000"
"                314.300    0.1533  3191.000"
"                314.400    0.1671  3495.000"
"                314.500    0.1799  3808.000"
"                314.600    0.1918  4136.000"
"                314.700    0.2030  4479.000"
"                314.800    0.2621  4840.000"
"           1.   WEIRS"
"                  Crest      Weir     Crest      Left     Right"
"              elevation coefficie   breadth sideslope sideslope"
"                314.700     0.900     1.000     0.000     0.000"
```

```
"           2.   ORIFICES"
"                Orifice   Orifice   Orifice Number of"
"                 invert coefficie  diameter  orifices"
"                313.000     0.630    0.0750     1.000"
"                313.600     0.630    0.3000     1.000"
"             Peak outflow                  0.040    c.m/sec"
"             Maximum level               313.833    metre"
"             Maximum storage            1886.469    c.m"
"             Centroidal lag               26.261   hours"
"                  0.175     1.385     0.040     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                To Wetland 1"
"             Maximum flow                  0.040    c.m/sec"
"             Hydrograph volume          1171.329    c.m"
"                     0.175     1.385     0.040     0.040"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.175     0.000     0.040     0.040"
" 33          CATCHMENT 203"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          203   Uncontrolled area to wetland 1"
"        0.000   % Impervious"
"        7.044   Total Area"
"      120.000   Flow length"
"        3.000   Overland Slope"
"        7.044   Pervious Area"
"      120.000   Pervious length"
"        3.000   Pervious slope"
"        0.000   Impervious Area"
"      120.000   Impervious length"
"        3.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       65.000   Pervious SCS Curve No."
"        0.140   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       13.677   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.077     0.000     0.040     0.040 c.m/sec"
"             Catchment 203          Pervious   Impervious Total Area "
"             Surface Area           7.044      0.000      7.044      hectare"
"             Time of concentration  54.628     4.029      54.627     minutes"
"             Time to Centroid       164.465    91.877     164.465    minutes"
```

```
"             Rainfall depth         47.265     47.265     47.265     mm"
"             Rainfall volume        3329.32    0.00       3329.32    c.m"
"             Rainfall losses        40.644     5.741      40.644     mm"
"             Runoff depth           6.621      41.524     6.621      mm"
"             Runoff volume          466.35     0.00       466.36     c.m"
"             Runoff coefficient     0.140      0.000      0.140      "
"             Maximum flow           0.077      0.000      0.077      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.077     0.077     0.040     0.040"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.077     0.077     0.077     0.040"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                To Wetland 1"
"             Maximum flow                  0.106    c.m/sec"
"             Hydrograph volume          1637.686    c.m"
"                    0.077     0.077     0.077     0.106"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.077     0.000     0.077     0.106"
" 33          CATCHMENT 204"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          204   Uncontrolled area to offsite"
"        0.000   % Impervious"
"        0.587   Total Area"
"       10.000   Flow length"
"        8.000   Overland Slope"
"        0.587   Pervious Area"
"       10.000   Pervious length"
"        8.000   Pervious slope"
"        0.000   Impervious Area"
"       10.000   Impervious length"
"        8.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       65.000   Pervious SCS Curve No."
"        0.139   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       13.677   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.017     0.000     0.077     0.106 c.m/sec"
"             Catchment 204          Pervious   Impervious Total Area "
```

```
"             Surface Area           0.587      0.000      0.587      hectare"
"             Time of concentration  9.165      0.676      9.165      minutes"
"             Time to Centroid       112.946    87.252     112.945    minutes"
"             Rainfall depth         47.265     47.265     47.265     mm"
"             Rainfall volume        277.44     0.00       277.44     c.m"
"             Rainfall losses        40.677     7.998      40.677     mm"
"             Runoff depth           6.587      39.266     6.587      mm"
"             Runoff volume          38.67      0.00       38.67      c.m"
"             Runoff coefficient     0.139      0.000      0.139      "
"             Maximum flow           0.017      0.000      0.017      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.017     0.017     0.077     0.106"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.017     0.017     0.017     0.106"
" 40          HYDROGRAPH   Combine    2"
"            6   Combine "
"            2   Node #"
"                Offiste"
"             Maximum flow                  0.017    c.m/sec"
"             Hydrograph volume            38.668    c.m"
"                     0.017     0.017     0.017     0.017"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.017     0.000     0.017     0.017"
" 33          CATCHMENT 205"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          205   Area to wetland 2"
"        0.000   % Impervious"
"        2.752   Total Area"
"      100.000   Flow length"
"        5.000   Overland Slope"
"        2.752   Pervious Area"
"      100.000   Pervious length"
"        5.000   Pervious slope"
"        0.000   Impervious Area"
"      100.000   Impervious length"
"        5.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       65.000   Pervious SCS Curve No."
"        0.140   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       13.677   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
```

```
"        0.518   Impervious Initial abstraction"
"                     0.036     0.000     0.017     0.017 c.m/sec"
"             Catchment 205          Pervious   Impervious Total Area "
"             Surface Area           2.752      0.000      2.752      hectare"
"             Time of concentration  42.010     3.098      42.010     minutes"
"             Time to Centroid       150.158    90.502     150.158    minutes"
"             Rainfall depth         47.265     47.265     47.265     mm"
"             Rainfall volume        1300.72    0.00       1300.72    c.m"
"             Rainfall losses        40.645     5.945      40.645     mm"
"             Runoff depth           6.620      41.319     6.620      mm"
"             Runoff volume          182.19     0.00       182.19     c.m"
"             Runoff coefficient     0.140      0.000      0.140      "
"             Maximum flow           0.036      0.000      0.036      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.036     0.036     0.017     0.017"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.036     0.036     0.036     0.017"
" 40          HYDROGRAPH   Combine    3"
"            6   Combine "
"            3   Node #"
"                To Wetland 2"
"             Maximum flow                  0.036    c.m/sec"
"             Hydrograph volume           182.186    c.m"
"                     0.036     0.036     0.036     0.036"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.036     0.000     0.036     0.036"
" 33          CATCHMENT 206"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          206   Area to southwest property"
"        0.000   % Impervious"
"        3.660   Total Area"
"      140.000   Flow length"
"        8.000   Overland Slope"
"        3.660   Pervious Area"
"      140.000   Pervious length"
"        8.000   Pervious slope"
"        0.000   Impervious Area"
"      140.000   Impervious length"
"        8.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       65.000   Pervious SCS Curve No."
"        0.140   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       13.677   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
```

```
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.046     0.000     0.036     0.036 c.m/sec"
"             Catchment 206          Pervious   Impervious Total Area "
"             Surface Area           3.660      0.000      3.660      hectare"
"             Time of concentration  44.647     3.292      44.647     minutes"
"             Time to Centroid       153.148    90.817     153.148    minutes"
"             Rainfall depth         47.265     47.265     47.265     mm"
"             Rainfall volume        1729.89    0.00       1729.89    c.m"
"             Rainfall losses        40.644     5.962      40.644     mm"
"             Runoff depth           6.620      41.303     6.620      mm"
"             Runoff volume          242.30     0.00       242.30     c.m"
"             Runoff coefficient     0.140      0.000      0.140      "
"             Maximum flow           0.046      0.000      0.046      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.046     0.046     0.036     0.036"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.046     0.046     0.046     0.036"
" 40          HYDROGRAPH   Combine    4"
"            6   Combine "
"            4   Node #"
"                To Southwest Property"
"             Maximum flow                 0.046    c.m/sec"
"             Hydrograph volume          242.302    c.m"
"                     0.046     0.046     0.046     0.046"
" 38          START/RE-START TOTALS 206"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                    21.326    hectare"
"             Total Impervious area                    7.148    hectare"
"             Total % impervious                      33.519"
" 19          EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                            Version 2.25  rev. 473"
"                MIDUSS created                          Sunday, February 7, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:           Q:\55566\100\SWM\MIDUSS\2024-12-17 JHN\"
"                                                                          Post"
"                Output filename:                                    25mm c.out"
"                Licensee name:                                              A"
"                Company                                                      "
"                Date & Time last used:               12/20/2024 at 10:22:14 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      509.000   Coefficient A"
"        6.000   Constant B"
"        0.799   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity            74.946    mm/hr"
"             Total depth                  23.481    mm"
"            6   000hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 201"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          201   Area to SWMF"
"       98.000   % Impervious"
"        6.736   Total Area"
"       50.000   Flow length"
"        3.000   Overland Slope"
"        0.135   Pervious Area"
"       50.000   Pervious length"
"        3.000   Pervious slope"
"        6.601   Impervious Area"
"       50.000   Impervious length"
"        3.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       65.000   Pervious SCS Curve No."
"        0.028   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       13.677   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       91.000   Impervious SCS Curve No."
"        0.402   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        2.512   Impervious Initial abstraction"
```

```
"                    0.416     0.000     0.000     0.000 c.m/sec"
"            Catchment 201          Pervious   Impervious Total Area "
"            Surface Area           0.135      6.601      6.736      hectare"
"            Time of concentration  107.203    4.314      4.459      minutes"
"            Time to Centroid       219.190    102.811    102.975    minutes"
"            Rainfall depth         23.481     23.481     23.481     mm"
"            Rainfall volume        31.63      1550.08    1581.71    c.m"
"            Rainfall losses        22.826     14.033     14.209     mm"
"            Runoff depth           0.656      9.448      9.272      mm"
"            Runoff volume          0.88       623.70     624.58     c.m"
"            Runoff coefficient     0.028      0.402      0.395      "
"            Maximum flow           0.000      0.416      0.416      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.416     0.416     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.416     0.416     0.416     0.000"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    0.416     0.416     0.416     0.000"
" 33          CATCHMENT 202"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          202   SWMF"
"      100.000   % Impervious"
"        0.547   Total Area"
"       25.000   Flow length"
"       10.000   Overland Slope"
"        0.000   Pervious Area"
"       25.000   Pervious length"
"       10.000   Pervious slope"
"        0.547   Impervious Area"
"       25.000   Impervious length"
"       10.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       65.000   Pervious SCS Curve No."
"        0.000   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       13.677   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.785   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.081     0.416     0.416     0.000 c.m/sec"
"            Catchment 202          Pervious   Impervious Total Area "
"            Surface Area           0.000      0.547      0.547      hectare"
"            Time of concentration  49.286     1.456      1.456      minutes"
```

```
"             Time to Centroid       166.426    91.342     91.342     minutes"
"             Rainfall depth         23.481     23.481     23.481     mm"
"             Rainfall volume        0.00       128.44     128.44     c.m"
"             Rainfall losses        22.826     5.052      5.052      mm"
"             Runoff depth           0.656      18.430     18.430     mm"
"             Runoff volume          0.00       100.81     100.81     c.m"
"             Runoff coefficient     0.000      0.785      0.785      "
"             Maximum flow           0.000      0.081      0.081      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.081     0.472     0.416     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.081     0.472     0.472     0.000"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.081     0.472     0.472     0.000"
" 54          POND DESIGN"
"        0.472   Current peak flow    c.m/sec"
"        0.600   Target outflow    c.m/sec"
"        725.4   Hydrograph volume    c.m"
"          19.   Number of stages"
"      313.000   Minimum water level    metre"
"      314.800   Maximum water level    metre"
"      313.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                313.000     0.000     0.000"
"                313.100   0.00276   196.000"
"                313.200   0.00478   401.000"
"                313.300   0.00616   615.000"
"                313.400   0.00729   836.000"
"                313.500   0.00827  1065.000"
"                313.600   0.00914  1301.000"
"                313.700   0.01626  1546.000"
"                313.800   0.03292  1799.000"
"                313.900   0.05552  2061.000"
"                314.000    0.1002  2330.000"
"                314.100    0.1207  2609.000"
"                314.200    0.1380  2895.000"
"                314.300    0.1533  3191.000"
"                314.400    0.1671  3495.000"
"                314.500    0.1799  3808.000"
"                314.600    0.1918  4136.000"
"                314.700    0.2030  4479.000"
"                314.800    0.2621  4840.000"
"           1.   WEIRS"
"                  Crest      Weir     Crest      Left     Right"
"              elevation coefficie   breadth sideslope sideslope"
"                314.700     0.900     1.000     0.000     0.000"
```

```
"           2.   ORIFICES"
"                Orifice   Orifice   Orifice Number of"
"                 invert coefficie  diameter  orifices"
"                313.000     0.630    0.0750     1.000"
"                313.600     0.630    0.3000     1.000"
"             Peak outflow                  0.007    c.m/sec"
"             Maximum level              313.330    metre"
"             Maximum storage            681.213    c.m"
"             Centroidal lag              22.826   hours"
"                  0.081     0.472     0.007     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                To Wetland 1"
"             Maximum flow                  0.007    c.m/sec"
"             Hydrograph volume           441.666    c.m"
"                     0.081     0.472     0.007     0.007"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.081     0.000     0.007     0.007"
" 33          CATCHMENT 203"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          203   Uncontrolled area to wetland 1"
"        0.000   % Impervious"
"        7.044   Total Area"
"      120.000   Flow length"
"        3.000   Overland Slope"
"        7.044   Pervious Area"
"      120.000   Pervious length"
"        3.000   Pervious slope"
"        0.000   Impervious Area"
"      120.000   Impervious length"
"        3.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       65.000   Pervious SCS Curve No."
"        0.028   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       13.677   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.003     0.000     0.007     0.007 c.m/sec"
"             Catchment 203          Pervious   Impervious Total Area "
"             Surface Area           7.044      0.000      7.044      hectare"
"             Time of concentration  181.273    5.356      181.268    minutes"
"             Time to Centroid       286.663    97.246     286.657    minutes"
```

```
"             Rainfall depth         23.481     23.481     23.481     mm"
"             Rainfall volume        1654.03    0.00       1654.03    c.m"
"             Rainfall losses        22.826     4.812      22.826     mm"
"             Runoff depth           0.656      18.669     0.656      mm"
"             Runoff volume          46.20      0.00       46.20      c.m"
"             Runoff coefficient     0.028      0.000      0.028      "
"             Maximum flow           0.003      0.000      0.003      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.003     0.003     0.007     0.007"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.003     0.003     0.003     0.007"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                To Wetland 1"
"             Maximum flow                 0.010    c.m/sec"
"             Hydrograph volume          487.864    c.m"
"                    0.003     0.003     0.003     0.010"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.003     0.000     0.003     0.010"
" 33          CATCHMENT 204"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          204   Uncontrolled area to offsite"
"        0.000   % Impervious"
"        0.587   Total Area"
"       10.000   Flow length"
"        8.000   Overland Slope"
"        0.587   Pervious Area"
"       10.000   Pervious length"
"        8.000   Pervious slope"
"        0.000   Impervious Area"
"       10.000   Impervious length"
"        8.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       65.000   Pervious SCS Curve No."
"        0.028   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       13.677   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.001     0.000     0.003     0.010 c.m/sec"
"             Catchment 204          Pervious   Impervious Total Area "
```

```
"             Surface Area           0.587      0.000      0.587      hectare"
"             Time of concentration  30.411     0.899      30.410     minutes"
"             Time to Centroid       149.230    90.480     149.229    minutes"
"             Rainfall depth         23.481     23.481     23.481     mm"
"             Rainfall volume        137.84     0.00       137.84     c.m"
"             Rainfall losses        22.826     5.518      22.826     mm"
"             Runoff depth           0.655      17.964     0.655      mm"
"             Runoff volume          3.85       0.00       3.85       c.m"
"             Runoff coefficient     0.028      0.000      0.028      "
"             Maximum flow           0.001      0.000      0.001      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.001     0.001     0.003     0.010"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.001     0.001     0.001     0.010"
" 40          HYDROGRAPH   Combine    2"
"            6   Combine "
"            2   Node #"
"                Offiste"
"             Maximum flow                  0.001    c.m/sec"
"             Hydrograph volume             3.847    c.m"
"                     0.001     0.001     0.001     0.001"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.001     0.000     0.001     0.001"
" 33          CATCHMENT 205"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          205   Area to wetland 2"
"        0.000   % Impervious"
"        2.752   Total Area"
"      100.000   Flow length"
"        5.000   Overland Slope"
"        2.752   Pervious Area"
"      100.000   Pervious length"
"        5.000   Pervious slope"
"        0.000   Impervious Area"
"      100.000   Impervious length"
"        5.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       65.000   Pervious SCS Curve No."
"        0.028   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       13.677   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
```

```
"        0.518   Impervious Initial abstraction"
"                     0.002     0.000     0.001     0.001 c.m/sec"
"             Catchment 205          Pervious   Impervious Total Area "
"             Surface Area           2.752      0.000      2.752      hectare"
"             Time of concentration  139.402    4.119      139.398    minutes"
"             Time to Centroid       248.523    95.493     248.518    minutes"
"             Rainfall depth         23.481     23.481     23.481     mm"
"             Rainfall volume        646.21     0.00       646.21     c.m"
"             Rainfall losses        22.826     5.005      22.826     mm"
"             Runoff depth           0.656      18.476     0.656      mm"
"             Runoff volume          18.05      0.00       18.05      c.m"
"             Runoff coefficient     0.028      0.000      0.028      "
"             Maximum flow           0.002      0.000      0.002      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.002     0.002     0.001     0.001"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.002     0.002     0.002     0.001"
" 40          HYDROGRAPH   Combine    3"
"            6   Combine "
"            3   Node #"
"                To Wetland 2"
"             Maximum flow                  0.002    c.m/sec"
"             Hydrograph volume            18.049    c.m"
"                     0.002     0.002     0.002     0.002"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.002     0.000     0.002     0.002"
" 33          CATCHMENT 206"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          206   Area to southwest property"
"        0.000   % Impervious"
"        3.660   Total Area"
"      140.000   Flow length"
"        8.000   Overland Slope"
"        3.660   Pervious Area"
"      140.000   Pervious length"
"        8.000   Pervious slope"
"        0.000   Impervious Area"
"      140.000   Impervious length"
"        8.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       65.000   Pervious SCS Curve No."
"        0.028   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       13.677   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
```

```
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.002     0.000     0.002     0.002 c.m/sec"
"             Catchment 206          Pervious   Impervious Total Area "
"             Surface Area           3.660      0.000      3.660      hectare"
"             Time of concentration  148.153    4.377      148.149    minutes"
"             Time to Centroid       256.494    95.868     256.489    minutes"
"             Rainfall depth         23.481     23.481     23.481     mm"
"             Rainfall volume        859.42     0.00       859.42     c.m"
"             Rainfall losses        22.826     4.945      22.826     mm"
"             Runoff depth           0.656      18.536     0.656      mm"
"             Runoff volume          24.00      0.00       24.00      c.m"
"             Runoff coefficient     0.028      0.000      0.028      "
"             Maximum flow           0.002      0.000      0.002      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.002     0.002     0.002     0.002"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.002     0.002     0.002     0.002"
" 40          HYDROGRAPH   Combine    4"
"            6   Combine "
"            4   Node #"
"                To Southwest Property"
"             Maximum flow                 0.002    c.m/sec"
"             Hydrograph volume           24.004    c.m"
"                     0.002     0.002     0.002     0.002"
" 38          START/RE-START TOTALS 206"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                    21.326    hectare"
"             Total Impervious area                    7.148    hectare"
"             Total % impervious                      33.519"
" 19          EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                            Version 2.25  rev. 473"
"                MIDUSS created                          Sunday, February 7, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:           Q:\55566\100\SWM\MIDUSS\2024-12-17 JHN\"
"                                                                          Post"
"                Output filename:                                    100 c.out"
"                Licensee name:                                             A"
"                Company                                                     "
"                Date & Time last used:                12/18/2024 at 5:51:18 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     4688.000   Coefficient A"
"       17.000   Constant B"
"        0.962   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          239.354    mm/hr"
"             Total depth                 87.079    mm"
"            6   100hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 201"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          201   Area to SWMF"
"       98.000   % Impervious"
"        6.736   Total Area"
"       50.000   Flow length"
"        3.000   Overland Slope"
"        0.135   Pervious Area"
"       50.000   Pervious length"
"        3.000   Pervious slope"
"        6.601   Impervious Area"
"       50.000   Impervious length"
"        3.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       65.000   Pervious SCS Curve No."
"        0.294   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       13.677   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       91.000   Impervious SCS Curve No."
"        0.739   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        2.512   Impervious Initial abstraction"
```

```
"                    2.935     0.000     0.000     0.000 c.m/sec"
"            Catchment 201          Pervious   Impervious Total Area "
"            Surface Area           0.135      6.601      6.736      hectare"
"            Time of concentration  17.300     2.042      2.165      minutes"
"            Time to Centroid       116.228    90.433     90.641     minutes"
"            Rainfall depth         87.079     87.079     87.079     mm"
"            Rainfall volume        117.31     5748.34    5865.66    c.m"
"            Rainfall losses        61.468     22.768     23.542     mm"
"            Runoff depth           25.611     64.311     63.537     mm"
"            Runoff volume          34.50      4245.37    4279.88    c.m"
"            Runoff coefficient     0.294      0.739      0.730      "
"            Maximum flow           0.013      2.933      2.935      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    2.935     2.935     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    2.935     2.935     2.935     0.000"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    2.935     2.935     2.935     0.000"
" 33          CATCHMENT 202"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          202   SWMF"
"      100.000   % Impervious"
"        0.547   Total Area"
"       25.000   Flow length"
"       10.000   Overland Slope"
"        0.000   Pervious Area"
"       25.000   Pervious length"
"       10.000   Pervious slope"
"        0.547   Impervious Area"
"       25.000   Impervious length"
"       10.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       65.000   Pervious SCS Curve No."
"        0.000   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       13.677   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.896   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.315     2.935     2.935     0.000 c.m/sec"
"            Catchment 202          Pervious   Impervious Total Area "
"            Surface Area           0.000      0.547      0.547      hectare"
"            Time of concentration  7.954      0.871      0.871      minutes"
```

```
"             Time to Centroid       105.041    85.145     85.145     minutes"
"             Rainfall depth         87.079     87.079     87.079     mm"
"             Rainfall volume        0.00       476.32     476.32     c.m"
"             Rainfall losses        61.542     9.040      9.040      mm"
"             Runoff depth           25.537     78.039     78.039     mm"
"             Runoff volume          0.00       426.87     426.87     c.m"
"             Runoff coefficient     0.000      0.896      0.896      "
"             Maximum flow           0.000      0.315      0.315      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.315     3.250     2.935     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.315     3.250     3.250     0.000"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.315     3.250     3.250     0.000"
" 54          POND DESIGN"
"        3.250   Current peak flow    c.m/sec"
"        0.600   Target outflow    c.m/sec"
"       4706.7   Hydrograph volume    c.m"
"          19.   Number of stages"
"      313.000   Minimum water level    metre"
"      314.800   Maximum water level    metre"
"      313.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                313.000     0.000     0.000"
"                313.100   0.00276   196.000"
"                313.200   0.00478   401.000"
"                313.300   0.00616   615.000"
"                313.400   0.00729   836.000"
"                313.500   0.00827  1065.000"
"                313.600   0.00914  1301.000"
"                313.700   0.01626  1546.000"
"                313.800   0.03292  1799.000"
"                313.900   0.05552  2061.000"
"                314.000    0.1002  2330.000"
"                314.100    0.1207  2609.000"
"                314.200    0.1380  2895.000"
"                314.300    0.1533  3191.000"
"                314.400    0.1671  3495.000"
"                314.500    0.1799  3808.000"
"                314.600    0.1918  4136.000"
"                314.700    0.2030  4479.000"
"                314.800    0.2621  4840.000"
"           1.   WEIRS"
"                  Crest      Weir     Crest      Left     Right"
"              elevation coefficie   breadth sideslope sideslope"
"                314.700     0.900     1.000     0.000     0.000"
```

```
"           2.   ORIFICES"
"                Orifice   Orifice   Orifice Number of"
"                 invert coefficie  diameter  orifices"
"                313.000     0.630    0.0750     1.000"
"                313.600     0.630    0.3000     1.000"
"             Peak outflow                  0.180    c.m/sec"
"             Maximum level               314.500    metre"
"             Maximum storage            3808.390    c.m"
"             Centroidal lag               15.661   hours"
"                  0.315     3.250     0.180     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                To Wetland 1"
"             Maximum flow                  0.180    c.m/sec"
"             Hydrograph volume          3659.444    c.m"
"                     0.315     3.250     0.180     0.180"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.315     0.000     0.180     0.180"
" 33          CATCHMENT 203"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          203   Uncontrolled area to wetland 1"
"        0.000   % Impervious"
"        7.044   Total Area"
"      120.000   Flow length"
"        3.000   Overland Slope"
"        7.044   Pervious Area"
"      120.000   Pervious length"
"        3.000   Pervious slope"
"        0.000   Impervious Area"
"      120.000   Impervious length"
"        3.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       65.000   Pervious SCS Curve No."
"        0.294   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       13.677   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.508     0.000     0.180     0.180 c.m/sec"
"             Catchment 203          Pervious   Impervious Total Area "
"             Surface Area           7.044      0.000      7.044      hectare"
"             Time of concentration  29.253     3.204      29.253     minutes"
"             Time to Centroid       130.590    88.407     130.590    minutes"
```

```
"             Rainfall depth         87.079     87.079     87.079     mm"
"             Rainfall volume        6133.85    0.01       6133.86    c.m"
"             Rainfall losses        61.461     7.042      61.461     mm"
"             Runoff depth           25.618     80.037     25.618     mm"
"             Runoff volume          1804.56    0.01       1804.56    c.m"
"             Runoff coefficient     0.294      0.000      0.294      "
"             Maximum flow           0.508      0.000      0.508      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.508     0.508     0.180     0.180"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.508     0.508     0.508     0.180"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                To Wetland 1"
"             Maximum flow                  0.676    c.m/sec"
"             Hydrograph volume          5464.013    c.m"
"                     0.508     0.508     0.508     0.676"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.508     0.000     0.508     0.676"
" 33          CATCHMENT 204"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          204   Uncontrolled area to offsite"
"        0.000   % Impervious"
"        0.587   Total Area"
"       10.000   Flow length"
"        8.000   Overland Slope"
"        0.587   Pervious Area"
"       10.000   Pervious length"
"        8.000   Pervious slope"
"        0.000   Impervious Area"
"       10.000   Impervious length"
"        8.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       65.000   Pervious SCS Curve No."
"        0.293   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       13.677   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.087     0.000     0.508     0.676 c.m/sec"
"             Catchment 204          Pervious   Impervious Total Area "
```

```
"             Surface Area           0.587      0.000      0.587      hectare"
"             Time of concentration  4.908      0.538      4.908      minutes"
"             Time to Centroid       101.371    84.961     101.371    minutes"
"             Rainfall depth         87.079     87.079     87.079     mm"
"             Rainfall volume        511.15     0.00       511.15     c.m"
"             Rainfall losses        61.587     13.501     61.587     mm"
"             Runoff depth           25.492     73.578     25.492     mm"
"             Runoff volume          149.64     0.00       149.64     c.m"
"             Runoff coefficient     0.293      0.000      0.293      "
"             Maximum flow           0.087      0.000      0.087      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.087     0.087     0.508     0.676"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.087     0.087     0.087     0.676"
" 40          HYDROGRAPH   Combine    2"
"            6   Combine "
"            2   Node #"
"                Offiste"
"             Maximum flow                  0.087    c.m/sec"
"             Hydrograph volume           149.637    c.m"
"                    0.087     0.087     0.087     0.087"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.087     0.000     0.087     0.087"
" 33          CATCHMENT 205"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          205   Area to wetland 2"
"        0.000   % Impervious"
"        2.752   Total Area"
"      100.000   Flow length"
"        5.000   Overland Slope"
"        2.752   Pervious Area"
"      100.000   Pervious length"
"        5.000   Pervious slope"
"        0.000   Impervious Area"
"      100.000   Impervious length"
"        5.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       65.000   Pervious SCS Curve No."
"        0.294   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       13.677   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
```

```
"        0.518   Impervious Initial abstraction"
"                     0.238     0.000     0.087     0.087 c.m/sec"
"             Catchment 205          Pervious   Impervious Total Area "
"             Surface Area           2.752      0.000      2.752      hectare"
"             Time of concentration  22.496     2.464      22.496     minutes"
"             Time to Centroid       122.483    87.300     122.483    minutes"
"             Rainfall depth         87.079     87.079     87.079     mm"
"             Rainfall volume        2396.42    0.00       2396.42    c.m"
"             Rainfall losses        61.481     6.897      61.481     mm"
"             Runoff depth           25.598     80.182     25.598     mm"
"             Runoff volume          704.46     0.00       704.46     c.m"
"             Runoff coefficient     0.294      0.000      0.294      "
"             Maximum flow           0.238      0.000      0.238      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.238     0.238     0.087     0.087"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.238     0.238     0.238     0.087"
" 40          HYDROGRAPH   Combine    3"
"            6   Combine "
"            3   Node #"
"                To Wetland 2"
"             Maximum flow                  0.238    c.m/sec"
"             Hydrograph volume           704.460    c.m"
"                     0.238     0.238     0.238     0.238"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.238     0.000     0.238     0.238"
" 33          CATCHMENT 206"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          206   Area to southwest property"
"        0.000   % Impervious"
"        3.660   Total Area"
"      140.000   Flow length"
"        8.000   Overland Slope"
"        3.660   Pervious Area"
"      140.000   Pervious length"
"        8.000   Pervious slope"
"        0.000   Impervious Area"
"      140.000   Impervious length"
"        8.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       65.000   Pervious SCS Curve No."
"        0.294   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       13.677   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
```

```
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.298     0.000     0.238     0.238 c.m/sec"
"             Catchment 206          Pervious   Impervious Total Area "
"             Surface Area           3.660      0.000      3.660      hectare"
"             Time of concentration  23.909     2.619      23.908     minutes"
"             Time to Centroid       124.173    87.544     124.173    minutes"
"             Rainfall depth         87.079     87.079     87.079     mm"
"             Rainfall volume        3187.10    0.00       3187.10    c.m"
"             Rainfall losses        61.470     7.054      61.470     mm"
"             Runoff depth           25.609     80.026     25.609     mm"
"             Runoff volume          937.29     0.00       937.30     c.m"
"             Runoff coefficient     0.294      0.000      0.294      "
"             Maximum flow           0.298      0.000      0.298      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.298     0.298     0.238     0.238"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.298     0.298     0.298     0.238"
" 40          HYDROGRAPH   Combine    4"
"            6   Combine "
"            4   Node #"
"                To Southwest Property"
"             Maximum flow                 0.298    c.m/sec"
"             Hydrograph volume          937.296    c.m"
"                     0.298     0.298     0.298     0.298"
" 38          START/RE-START TOTALS 206"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                    21.326    hectare"
"             Total Impervious area                    7.148    hectare"
"             Total % impervious                      33.519"
" 19          EXIT"
```

Appendix D

Annual Water Balance Calculations

3027 Cedar Creek Road

WATER BALANCE (SURFACE RUNOFF) ANALYSIS

Ayr, Ontario

Project Number:	55566-100
Date:	February 13, 2025
Design By:	AJS
File:	Q:\55566\100\SWM\2024-12-17 Micro Drainage Analysis_Rev3.xlsx

	Pre-Development	Post-Development
Topography:	Rolling Lands	Flat Lands
Coverage:	Moderately Rooted Crop	Urban Lawns
Soil Type:	Fine Sandy Loam	Fine Sandy Loam

Weather Station:	Waterloo Wellington Airport	ET:	574 / 559
Total Precipitation:	916.5mm	Runoff:	137 / 125
		Infiltration:	205 / 232

SURFACE RUNOFF

Location	Pre-development			Post-development						Comments
				Pervious			Impervious			
	Area Draining to Location	Runoff Rate	Runoff Volume	Area Draining to Location	Runoff Rate	Runoff Volume	Area Draining to Location	Runoff Rate	Runoff Volume	
	ha	*mm/yr/m^2*	*m^3/yr*	*ha*	*mm/yr/m^2*	*m^3/yr*	*ha*	*mm/yr/m^2*	*m^3/yr*	
Wetland #1	12.476	137.0	17092	7.179	125.0	8974	6.173	750	46298	Impervious area excludes the proposed roof area which is infiltrated
Wetland #2	5.190	137	7110	2.752	125.00	3440	0.000		0	
Rest of Site	3.660	137	5014	4.247	125.00	5309	0.000		0	
Total	21.326	411.0	**29217**	14.178	375.0	**17723**	6.173	750	**46298**	

SUMMARY

Post-development Runoff Volume

Pervious		17723	*m^3/yr*
Impervious	+	46298	*m^3/yr*
		64020	*m^3/yr*
Pre-development Runoff Volume	-	29217	*m^3/yr*
Net Gain of Surface Runoff		**34,803**	***m^3/yr***

3027 Cedar Creek Road

WATER BALANCE (INFILTRATION) ANALYSIS

Ayr, Ontario

Project Number:	55566-100
Date:	February 13, 2025
Design By:	AJS
File:	Q:\55566\100\SWM\2024-12-17 Micro Drainage Analysis_Rev3.xlsx

	Pre-Development	Post Development (uncontrolled)
Topography:	Flat land	Flat land
Coverage:	Moderately Rooted Crop	Moderately Rooted Crop
Soil Type:	Fine Sandy Loam	Fine Sandy Loam

Weather Station:	Waterloo Wellington Airport
Total Precipitation:	916.5mm

ET:	574	559
Runoff:	137	125
Infiltration:	205	232

INFILTRATION

Location	Pre-development			Post-development						Comments
				Pervious			Impervious			
	Area Draining to Location	Infiltration Rate	Infiltration Volume	Area Draining to Location	Infiltration Rate	Infiltration Volume	Area Draining to Location	Infiltration Rate	Infiltration Volume	
	ha	*mm/yr/m^2*	*m^3/yr*	*ha*	*mm/yr/m^2*	*m^3/yr*	*ha*	*mm/yr/m^2*	*m^3/yr*	
Entire Site	21.326	205.0	43718	14.178	205.0	29065	0.975	750	7313	Runoff from roof is directed to gallery. Most pervious is remaining from existing therefore same infiltration rate is used in the post-development condition.
Total	21.326	205.0	**43718**	14.178	205.0	**29065**	0.975	750	**7313**	

SUMMARY

Post-development Infiltration Volume			
Pervious		29065	*m^3/yr*
Impervious	+	7313	*m^3/yr*
		36377	*m^3/yr*
Pre-development Infiltration Volume	-	43718	*m^3/yr*
Net Loss of Infiltration		**7341**	***m^3/yr***