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## Interim Report

From: Ryan DeVries  
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**To:** Municipality of Strathroy-Caradoc  
Paul Zuberbuhler B.Sc, B.Comm, C.E.T.

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**Re:** Closed Caradoc Landfill

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**File #:** 14067

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**Date:** May 21, 2025

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Paul:

The purpose of this Interim Report is to provide feedback on the sample results that the Ministry of the Environment, Conservation and Parks (MECP) collected from the Closed Caradoc Landfill site in the fall of 2024, as well as to summarize the action taken since that site visit was conducted.

### Background Information:

As noted above, MECP representatives visited the Closed Caradoc landfill site on November 27, 2024. It is our understanding, following several conversations with the MECP, that the MECP observed water flowing from several points along the bank (between the closed landfill and the stream) and proceeded to collect and submit samples from two of these locations to a laboratory for analysis. The approximate location of these two sample locations is shown on the attached Drawing No. 1.

It is further noted that this landfill site has been closed since 1999. The MECP has visited this site on multiple other occasions. The purpose of this Interim Report is only to provide comments on their most recent visit (Nov/24) and the action taken since that visit. Annual Monitoring Reports are completed every year for the closed landfill and may be referred to for additional background/historical information.

### Response to Sample Results:

#### March 20, 2025

The MECP forwarded the lab sample results to the Municipality who then provided them to B. M. Ross and Associates Limited (BMROSS). A virtual meeting was held on March 20, 2025 to discuss the results. In attendance at the virtual meeting were: Mark Smith (MECP), Ryan

Smith (MECP), Pawel Kucharski (MECP), Paul Zuberbuhler (Strathroy-Caradoc), Mark Ortiz (Strathroy-Caradoc) and Ryan DeVries (BMROSS). At this meeting, it was noted that many of the measured parameters from Point 1 and Point 2 had elevated concentrations which exceeded their applicable Provincial Water Quality Objectives (PWQO). For Point 1, these parameters included Total Phosphorous, Aluminum, Cobalt, Copper, Zinc, Iron, Manganese, and Lead. For Point 2, these parameters included: Total Phosphorous, Boron, Cobalt, Zinc, Alkalinity, TDS, Manganese, and Un-ionized Ammonia. BMROSS noted that while that was true, most of these same parameters had decreased to within the PWQ Objectives by the time the stream water had reached the downstream sample point (shown as Stream East Side Rear on Drawing No. 1). The MECP agreed that the results had decreased, but it was the MECP's opinion that additional investigations should still be completed.

#### April 1, 2025

BMROSS and the Municipality of Strathroy-Caradoc reached out to a third-party consultant regarding potential stream flow monitoring along the northerly watercourse. The intention with the stream flow monitoring would be to attempt to quantify the volume of groundwater being added (i.e. groundwater recharge) to the northerly watercourse from Point 1 to Point 2, approximately. A proposal was received on April 24, 2025.

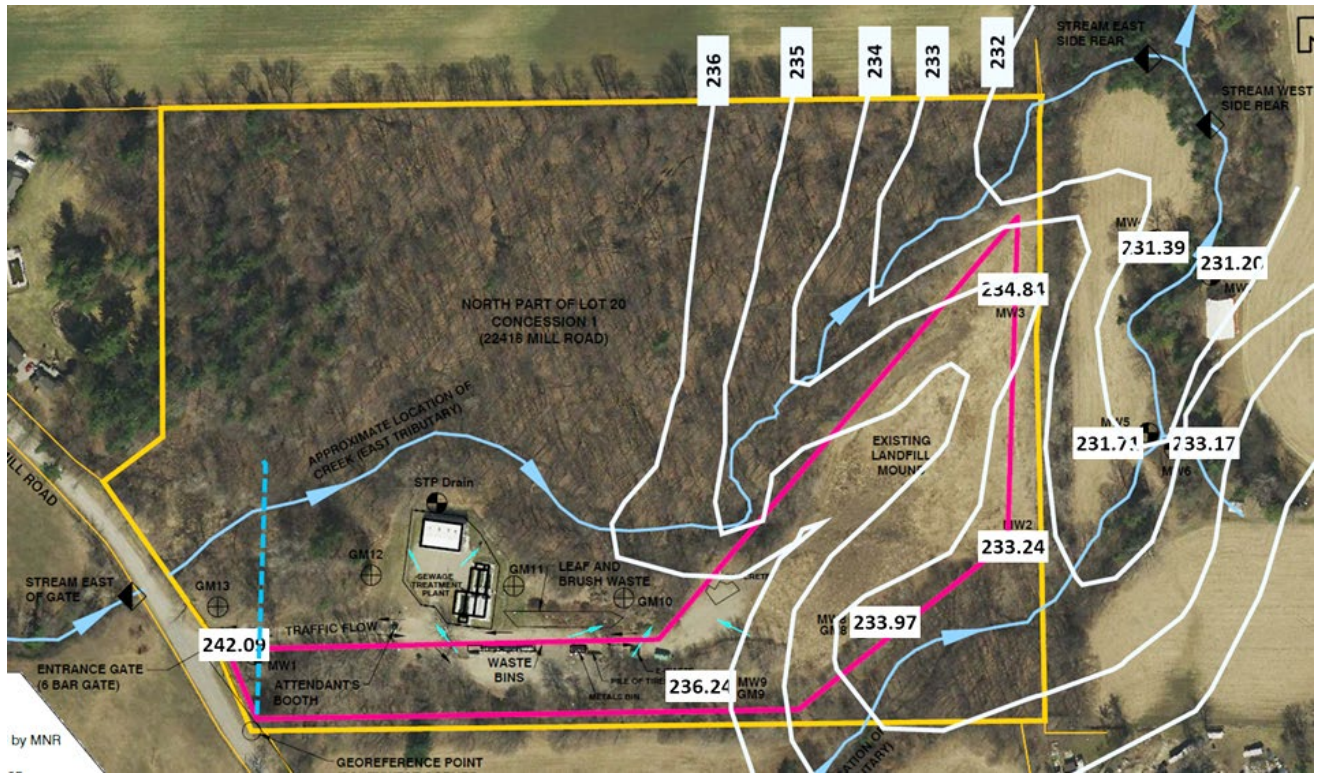
#### April 23, 2025

Ryan DeVries of BMROSS visited the closed landfill site with Paul Zuberbuhler of the Municipality of Strathroy-Caradoc along with one of Strathroy's Operators. All parties proceeded to walk the northerly stream from approximately the limits of Point 1 to Point 2. Point 1 was located and based on some rip-rap in the area, and the amount of flow coming out of one particular area of the embankment, it was determined likely that the flow is moving through an old (abandoned) field tile or buried culvert at this location. Point 2 was located using GPS coordinates on a phone. Unlike Point 1, Point 2 had no noticeable flow during this visit. Following the site visit, the MECP was contacted to discuss the site observations, and given the different observations at Point 2 (i.e. flow versus no-flow), the MECP agreed to join BMROSS and the Municipality for a return visit to the site to confirm conditions at Point 2.

#### Apr 28, 2025

The MECP, via email, provided their interpretation of the likely direction of groundwater movement across this site. Below (Figure 1) is a figure created based on that interpretation. This figure assumes that groundwater is moving radially away from the landfill but also recognizes that the water table elevations suggest a northwest-to-southeast flow direction. BMROSS agrees with the MECP's interpretation and accepts the below figure as a reasonable interpretation of groundwater flow direction at this site.

**Figure 1**  
**Estimated Groundwater Contours at the Closed Caradoc Landfill Site**



May 1, 2025

BMROSS (Ryan DeVries) joined the Municipality (Paul Zuberbuhler) and the MECP (Pawel Kucharski) and proceeded to walk the northerly watercourse from approximately Point 2 to Point 1. The MECP confirmed the location of Point 2 was the same as what we had suspected during the April 23, 2025 visit. Although the soil at Point 2 was much more saturated than during the April 23, 2025 visit, flow was still not obvious. It is noted that some rain had occurred prior to the May 1, 2025 visit, and it was also raining during this site visit as all parties walked the northerly watercourse.

The MECP provided some of the background which originally led them to collect samples from Point 1 and Point 2 during the Nov/24 site visit:

- The MECP had a multi-meter when they originally walked the watercourse and the multi-metered had elevated levels at several locations (~4) along the northerly stretch of stream. The elevated concentrations were measured in the stream but typically dissipated approximately 10m downstream of the point they were first discovered.
- Another visual indicator was that there was less observed vegetation (particularly skunk cabbage) growing in these same four areas.

At the May 1, 2025 visit, the MECP pointed out where the other two locations of potential interest were (located between Point 1 and Point 2 and identified on Drawing No. 1 as Point 3 and Point 4). It was also noted to the MECP that the Municipality had received a proposal from a consultant to conduct stream flow monitoring along this stretch of the watercourse. The

MECP would discuss this internally, but the general consensus among those present at site was that the accuracy of this testing is not precise enough to likely give meaningful results given:

- that flow contributions along this stretch of the stream are anticipated to be minimal compared to normal stream flow rates.
- that flow is coming from both sides of the banks, not just the side of the landfill (evident by skunk cabbage on both sides of the stream).
- that the Consultant also commented in their proposal about the inability to accurately measure flow contributions resulting from local groundwater recharge.

It was acknowledged by the MECP, that the Nov/24 samples provide a snapshot that does not take into account the volume of water being discharged or potential annual or seasonal variation in quality. It was suggested that additional sampling would help provide a better understanding of whether there are currently any impacts on the watercourse at Points 1 or 2 (or somewhere in between) and that once we have a better understanding of whether or not there are any notable impacts at these locations, then a further action plan could be developed.

#### May 12, 2025

It was brought to the Municipality's attention that the adjacent landowners had requested the MECP return to the Closed Landfill site to investigate another suspected groundwater seepage area that was suggested to be discharging into the watercourse. The MECP revisited the site on May 12, 2025. The Municipality and BMROSS were informed by the adjacent property owners that they would not be able to attend this visit as it would occur on the adjacent, private lands. The adjacent property owners provided a video of what appears to be the suspected seepage area. No formal site report or sample results were provided, and no additional details were provided to indicate exactly where the suspected seepage was located.

#### May 15, 2025

Following this communication, BMROSS and Municipal staff proceeded to walk the south and north watercourse to complete additional investigations focused on areas of the south and north watercourse not previously explored during the site visits indicated in the above sections. The adjacent property owners were contacted to request access to the adjacent private lands where the two watercourses also traverse. The adjacent property owners again noted that access to these lands was not permitted. As a result, the Municipality (Paul Zuberbuhler and Mark Ortiz) met with BMROSS (Ryan DeVries) on May 15, 2025 and walked the south and north watercourses within the Closed Landfill site property limits only. Observations from that site visit were provided to the Municipality in a separate report. In summary, there were no large groundwater seepage areas suspected or areas where there was a reduction in vegetative cover (as noticed on the north watercourse in the above sections). Stakes were installed for additional proposed monitoring locations (refer to the proposed Increased Monitoring Program).

There is another meeting with the MECP planned in the upcoming weeks to review their findings on May 12, BMROSS/Municipal findings on May 15, as well as to review and get feedback on the Increased Monitoring Program being proposed.

### **Additional Discussion on Historical Sample Results:**

As indicated on Drawing No. 1, there are four stream monitoring locations that the Municipality has been sampling at this site since 2006. They are as follows:

- Stream East of Gate (SEG)
- Stream East Side Rear (ESR)
- Stream West of Gate (SWG)
- Stream West Side Rear (WSR)

SEG and ESR are used to monitor stream quality upstream and downstream of the landfill mound along the watercourse that traverses the site north of the landfill mound. SWG and WSR are used to monitor stream quality upstream and downstream of the landfill mound along the watercourse that traverses the site south of the closed landfill mound. Looking at only the downstream result from WSR, the only parameter that typically exceeds the PWQ Objectives is iron and occasionally phosphorous. The average downstream concentration of iron (2006 – 2024) was 0.8 mg/L. The average upstream concentration of iron during the same period was 1.4 mg/L. In other words, iron concentrations (although they exceed PWQO at WSR) generally have shown an improvement from the upstream to downstream location or as water moves across the closed landfill site.

Similar observations can be made along the SEG to ESR stretch where the upstream monitoring results have demonstrated PWQO exceedances in iron, aluminum and phosphorous. The same parameters are routinely exceeding PWQO at downstream monitoring location ESR. Unlike the SWG to WSR stream, the SEG to ESR stream does appear to demonstrate some degree of degradation as water moves across the site, at least as it relates to aluminum, iron and phosphorous. Between 2006 – 2024, the average concentrations of aluminum, iron and phosphorous at the upstream monitoring location SEG have been 0.03, 0.16 and 0.02 mg/L, respectively. The averages at downstream monitoring location ESR over the same period of time are 0.09, 0.38 and 0.05 mg/L, respectively. For perspective, the PWQO limits for the same parameters are 0.075 mg/L (aluminum), 0.3 mg/L (iron) and 0.03 mg/L (phosphorous).

It is also worth noting that the Sewage Treatment Plant (STP) discharges to the stream between SEG and ESR. Impacts to the stream at ESR may be, at least in part, attributed to the STP discharge. Furthermore, we understand the STP uses a product called Clarion to improve the filter performance and to reduce Total Suspended Solids (TSS) concentrations in the discharge. A key component in Clarion is aluminum.

### **Potential of Leachate Impact:**

During the previous site visits (Nov/24, and Apr/May, 2025) a number of areas along the watercourse were discovered where there was brown staining evident in the soils. This suggests that groundwater seepage is occurring at these locations, for at least a portion of the year. Given the lack of obvious flow during several site visits, it can also be concluded that this seepage appears to only be occurring under specific site conditions. Additional monitoring results from the proposed Increased Monitoring Program will be needed to reach a conclusion on whether leachate may be impacting the groundwater seepage and if so, to what degree.

It is further noted that based on elevated iron, aluminum and phosphorous concentrations at upstream water sample locations, the native soils or other factors in this area may also be affecting the water quality along both the north and south watercourses.

### **Caradoc Landfill Operations Implications:**

It is noted that this is a closed landfill and no future waste deposits are planned or approved at this site. The Municipality continues to have an obligation to monitor site conditions and report annually to the MECP on the results of that monitoring work. Should monitoring results suggest the closed landfill is contributing to unacceptable offsite adverse impacts, then remediation options would need to be discussed with the MECP.

We note that should it be found that remediation/mitigation is desired, this would be very challenging at this site given the following considerations:

- There are no accurate historical details for this site to suggest, with any certainty, the exact limits of waste disposal.
- There were no previous restrictions on where wastes could be deposited at this site. As a result, there is a minimal offset/buffer between existing waste deposits and the watercourse embankment and site boundaries. This means that there is also minimal real estate to install remedial/mitigation measures.
- The adjacent Sewage Treatment Plant has a relatively small approved rated capacity and, as a result, would have limited available leachate treatment capacity.
- Most conventional remediation/mitigation techniques (i.e. interceptor trench or cutoff wall) will result in the removal of a significant number of established trees in order to be effective. Those trees provide some level of treatment through uptake and are also, aesthetically, providing a visual barrier to the closed landfill. The reduction in uptake would be counterintuitive to the remediation/mitigation measures.
- Related to the above bullet, conventional remediation/mitigation measures would be very difficult to implement given there is an elevation difference between the watercourse and the top of mound of approximately 8m and given that the sandy and saturated soils that exist at this site would likely require more than a 1:1 slope in order to avoid collapse in an open excavation.

### **Mount Brydges Wastewater Servicing Environmental Assessment:**

It is our understanding that the Municipality is intending on completing a Mount Brydges Wastewater Servicing Environmental Assessment in relation to the existing Sewage Treatment Plant located at the Closed Landfill site property. It is anticipated that the results of the IMP will be incorporated into that study.

### **Natural Attenuation Landfill:**

It is important to note that the Closed Caradoc Landfill was approved (back in 1967) as a natural attenuation landfill and that it continued to operate as such, until the time it was ultimately closed in 1999. A natural attenuation landfill does not have a liner system. Instead, precipitation is meant to percolate through the landfill and the strength of the waste (and leachate) is reduced over time as the water is filtered through the subsurface and surrounding soils. The movement of landfill impacted groundwater away from the landfill mound is typical of what would be expected for a natural attenuation landfill, especially one constructed within sandy soils.

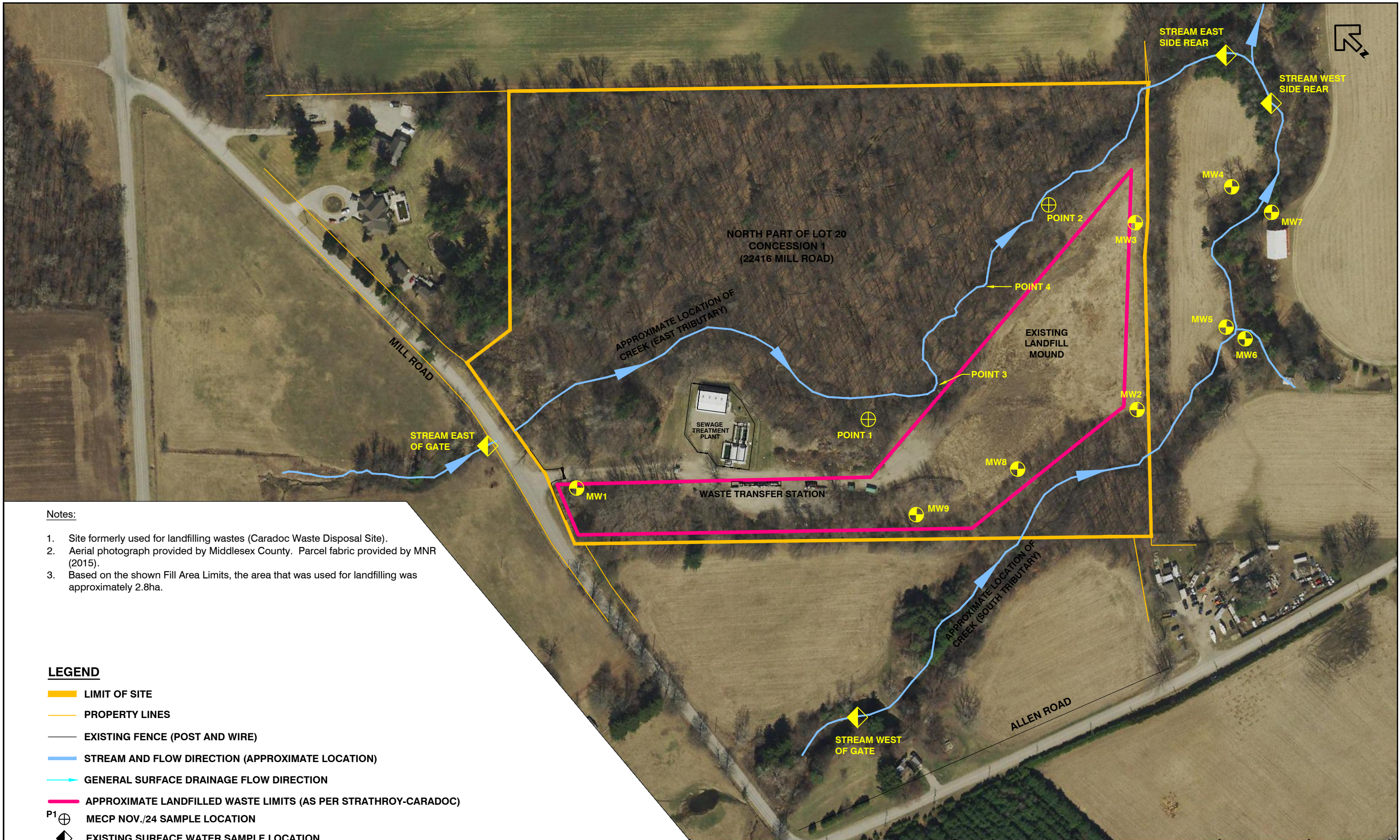
**Next Steps:**

BMROSS has provided the Municipality with a suggested increased monitoring program for the remainder of 2025 (and possibly into 2026). The Monitoring program will include monthly samples from Point 1, Point 2 and other locations to help provide a better understanding of the groundwater quality within the soils adjacent to the stream (landfill side). Additionally, sample observations will be used to help provide a better understanding of the amount of groundwater seepage occurring along the bank and sample results will help to determine the potential degree to which the groundwater seepage might be impacted by leachate. Once the Increased Monitoring Program (2025) has been drafted, a copy will be provided to the MECP for their feedback, prior to implementation.

Ryan DeVries, P.Eng.

Encl.  
RPD:hv





- Notes:
- 1. Site formerly used for landfilling wastes (Caradoc Waste Disposal Site).
  - 2. Aerial photograph provided by Middlesex County. Parcel fabric provided by MNR (2015).
  - 3. Based on the shown Fill Area Limits, the area that was used for landfilling was approximately 2.8ha.

- LEGEND**
- LIMIT OF SITE
  - PROPERTY LINES
  - EXISTING FENCE (POST AND WIRE)
  - STREAM AND FLOW DIRECTION (APPROXIMATE LOCATION)
  - GENERAL SURFACE DRAINAGE FLOW DIRECTION
  - APPROXIMATE LANDFILLED WASTE LIMITS (AS PER STRATHROY-CARADOC)
  - ⊕ MECP NOV./24 SAMPLE LOCATION
  - ◀ EXISTING SURFACE WATER SAMPLE LOCATION
  - ⊕ MW1 MONITORING WELL LOCATION AND NUMBER



Municipality of Strathroy-Caradoc  
Closed Caradoc Landfill Site

General Site Plan  
(Existing Conditions)

DATE  
MaY 16, 2025

SCALE  
NTS

PROJECT No.  
14067

Drawing No.  
1