6.0 CONCLUSIONS

The general conclusions of the 2022 Annual Report for the Lindsay-Ops Landfill Site are provided below.

6.1 Environmental Monitoring

6.1.1 Ground Water and Leachate

- The landfill is not creating an offsite impact and meets reasonable use criteria

- Monitoring of ground water and leachate in 2022 was carried out in accordance with the requirements of the ECA;

- The conceptual ground water flow regime at the old landfill site is vertically downward flow through the till overburden to the upper bedrock aquifer. The bedrock aquifer flows laterally toward the Scugog River;

- The old landfill has a limited "halo" effective in the overburden soils given the age of the facility. However, this lateral extent is limited given the low permeability of the overburden till soils;

- The landfill expansion is a lined site where the water levels within the waste cells are kept to a minimum using a leachate collection system. Vibrating wire transducer data confirms leachate collection system is continuing to operate effectively. Based on the Site hydraulics there is little opportunity for contaminant migration away from the landfill expansion area;

- The vertical ground water flow estimate through the overburden till under the old landfill to the upper bedrock was estimated to be about 0.8 m/a which indicate that the vertical flow through the overburden till sediments to the bedrock took about 10 years to occur. The impact to the bedrock aquifer is minor and does not create an off site impact;

- The lateral flow in the bedrock aquifer is much faster than the vertical percolation through the overburden till (*i.e.,* 100 to 1,000 m/a). As a result, the overburden till contaminant flux has limited effect on the bedrock aquifer. The bedrock aquifer is currently in a steady state condition. This occurs because the rate of flow in the bedrock is sufficiently large enough to attenuate the overburden contaminant flux such that an equilibrium state is established in the bedrock flow field. This equilibrium condition has existed for decades based on the bedrock aquifer

monitoring program and will persist into the future until the leachate contaminant flux through the overburden till is completely depleted;

- The contaminant loading calculations indicate that the mass flux in the bedrock aquifer is at least an order of magnitude below the permissible limit in the ECA. Since the contaminant plume has been in a steady state condition for over a decade, this loading will not change over time;

- Given the rate of ground water flow in the bedrock aquifer, it is expected that a steady state contaminant plume extends to the new monitoring wells nests being: 62-17, 61-17 and 61-10; however unlikely to be further such that there is no offsite impact;

- The leachate strength under the old landfill is stronger than that observed at the perimeter/ periphery. It is that the slow percolation through the waste mass accounts in part for this stronger leachate at depth. This is considered to account for the quality differences that exist between the leachate monitors situated at the base of the waste fill and the leachate collection system encircling the perimeter. Liquids captured by the leachate collection system have not had as long a residence time in the landfill and also represent a composite of younger and older waters; and

6.1.2 Surface Water

The surface water monitoring program focuses on two systems. The first is the surface water flow system in the Scugog River passing by the Site. The other is considered to be the on-Site drainage network.

Scugog River

- In the Scugog River, parameter concentrations between the upstream and the downstream are generally similar. Therefore, the Site has no environmental impact to the surface water that can be readily sourced to the landfill;

- The ground water contribution to the Embayment A is estimated to be ~100,000 m^3/year. The outflow from the WPCP was ~4,821,709 m^3 in 2022(i.e., ~0.1 m^3/s). The flow in the Trent-Severn system must exceed 17 m^3/s at Lakeview to maintain a base flow at Trenton, which infers a significant flow from Sturgeon Lake. As a result and despite the concentration differences, the flow from Embayment A is considered to be insufficient to meaningfully influence the Scugog River;

On-Site Drainage System

- Flow in the drainage system is seasonal. Flow commences with the spring freshet and is typically exhausted by June / July;

- Weekly flow monitoring in 2019 and 2021of the south drainage channel estimated that between ~5,000 m^3 (2021) & 30,000 m^3 (2019) flowed in this channel before it dries out in the summer. The same weekly flow monitoring in the north drainage channel estimated that ~150,000 m^3 (2021) and 400,000 m^3 (2019) flowed in this channel before it dried up in the summer.

- The magnitude of these flows, although variable, is insufficient to influence the Scugog River with the current contaminant levels. Furthermore, when the drainage ditch flow subsides in the summer season, there is no contaminant contribution to the Scugog River;

- The overburden till is not conducive to providing a base flow condition in the drainage ditch system(s). The soil permeability does not allow substantial flow and the hydraulic gradient in the overburden is vertical down;

- The natural condition of the overburden soils will also not facilitate significant infiltration during excess water conditions and thus promotes overland flow to the drainage ditch system;

- The parameter differences highlighted in the drainage ditches differ from those seen in the Scugog River. The flow in the south drainage channel is ~0.1-1% of that discharged by the WPCP. Similarly, flow from the north drainage channelis ~3-10% of that discharged by the WPCP. Parameter concentrations in the south drainage channel would need to be orders of magnitude larger to affect any influence. Furthermore there is no defined or consistent seasonal “shift” in the Embayment A water that would be anticipated if being influenced by the drainage channels since the drainage channels dry out in July and don’t contribute until the following spring freshet;

- Concerns of contaminant flow into Embayment A are unfounded since there is no substantial flow during these dry weather samples. In the absence of flow, there cannot be contaminant migration. Thus, the stagnant samples with an elevated chemical signature have no meaningful influence on the on-Site surface water flow system; especially as it pertains to impacts on the Scugog River;

- Seepage from the lagoon system is not influencing the south drainage water quality;

- The organic sampling in surface waters regardless of where these samples are collected are not yielding significant results. Both VOC and PCB sampling at surface water sampling stations are unnecessary and can be excluded from the monitoring program;

6.1.3 Landfill Gas

The landfill gas monitoring program is design to evaluate the migration potential of these compounds in the environment.

- The landfill gas sampling results in 2022 are consistent with the previous years;

- Landfill gas concentrations exceeding the Lower Explosive Limit (LEL) of 5% (by volume) are seen primarily at the leachate monitoring wells;

- Landfill gas concentrations are also routinely detected at two downgradient perimeter wells being 16-91 and 12-91on the west side of the old landfill, although the concentrations at 12-91 are more typically trace or non-detect. This location did not show detection the past two years. Consistent detection at 16-91 is anticipated given the monitor's proximity to the landfill edge. However, these results were not considered important in terms of off-Site migration;

- The landfill gas monitoring program indicates that methane gas from the landfill is not migrating off Site. The remaining landfill gas monitoring locations indicated insignificant methane levels;

- If the landfill gas sampling program which has been run for years yields the same results and indicates there is a negligible chance for off-Site migration then there may be little need to continue to monitor this system or at a minimum reduce the frequency of the program;

6.1.4 Biomonitoring

The biomonitoring program is intended to assess whether the Site is having an adverse influence on the host invertebrate community.

- Analysis of blackfly larvae tissue for PCBs, VOCs, and metals has not been possible since 1999. A minimum of 5 grams of black fly larvae is required for laboratory analysis of PCBs, metals and VOCs. Black fly larvae have been insufficient numbers since 2000 including during the 2022 sampling event;

- The 2022 data indicated species taxa richness was below the five year average with only four species of benthic invertebrates were identified. In contrast, an increase in diversity was observed, attributable to changes in species distribution and dominance across sample sites;
- Abundant filamentous algae was observed in 2022, with results comparable to 2021;
- Hilenshoff and BioMap Water Quality Index values reflected a decline in the benthic community and water quality when compared to 2021. However, water quality samples indicate only minor changes in water quality, well within the historical range.
- No caddisfly larvae were observed in 2022 which indicates the trigger condition in ECA (12.3(a)) has been exceeded. However, the absence of caddisfly larvae in the outfall may be attributed to fluctuations in water levels as opposed to changes in water quality. This resulted in a no bioaccumulation analysis completed in 2022. Cambium notes that the bioaccumulation portion of the monitoring program provides limited valuable information as the analysis is for a wide range of parameters, but the behaviour of each parameter regarding their fate in the environment and bioaccumulation is not fully understood. As such, it is recommended that this biomonitoring component is removed.
- The outfall channel contains a large amount of stone substrate suitable for supporting benthic invertebrate populations, however, high water velocity conditions may be a significant factor limiting population numbers, as opposed to changes in water quality.

6.2 Wetland Assessment

The wetland assessment is completed on a five-year frequency and was last updated in 2018.

- Cambium's interpretation of 2018 data suggests that potential impacts associated with the operation of the landfill are minor and have stabilized;

6.3 Site Operations

The Conditions associated with the landfill operations are to ensure the facility is being properly operated. The City of Kawartha Lake is diligent in their operations and protocols.

- The Site is being operated well and has no significant problems. Complaints were not received in 2022 relating to any operational items at the Site. Overall,

operational protocols are effective in remaining attentive to the Site requirements, which are addressed as identified;

- The amount of waste material (including soil received, segregated, stockpiled and used for daily cover) disposed in the landfill in 2022 was 30,660 tonnes, which is comparable to previous years;

- Gull control measures continued to be used in 2022, including pyrotechnics as historically outsourced methods were not proving effective.These methods proved effective and will be continued in 2023;

- The total recorded volume of leachate and sewage (combined) pumped from the landfill to the Lindsay WPCP in 2022was approximately 37,556 m^3. This total leachate pumping volume consists of 11,756 m^3 from Leachate Pumping Station No. 1 (Old Landfill) and 25,800 m^3 from Leachate Pumping Station No. 2 (North Expansion Area), which is comparable to previous years;

- The average daily flow volume of leachate pumped to the WPCP from the Lindsay Ops Landfill for each month of 2022did not exceed the maximum allowable average daily flow of 300 m^3/day specified in the ECA. The peak permissible flow rate is set at 750 m^3/day (8.7 L/s) at any time for the combined pump station contributions to the WPCP. The instantaneous rate measured at each location was not exceeded in 2022 at either LPS No. 1 or No.2;

- Construction of the eastern portion of Cells 4 and 5 were completed in 2019 such that filling in 2022 was in the north half of these cells;

6.4 Public Consultation

- The Public Review Committee (PRC) continued its activities and mandate in 2022. In 2022, six meetings of the PRC were held;

7.0 RECOMMENDATIONS

The following are the recommendations of the 2022 Annual Report for the Lindsay-Ops Landfill Site:

7.1 Environmental Monitoring

7.1.1 Ground Water/Leachate

The environmental monitoring program is to evaluate the key contaminant flow pathways that exist at the Site.

- The sampling for organic priority pollutants has not detected a significant contaminant threat in the decades this program has been conducted:

    - PCBs are considered immobile in the environment. Decades of sampling have not yielded significant results. PCBs were banned from use in 1977. Further evaluation for this parameter is unwarranted. A few key monitoring wells(*i.e.,* 20-91-III, 21-91-III, 25-96 & 61-10-I) detecting the leachate influence in the bedrock flow system should be sampled infrequently (*i.e.,* once every three to five years);

- Decades of sampling for VOC's have not yielded significant results. BTEX concentrations have degraded over time to trace or non-detectable levels. Only limited trace detections were observed at a few monitoring wells in 2022 beyond those at7-90-II. Given the limited and inconsistent detections over the period of record, further evaluation for these parametersis unwarranted.

- The five primary historic indicator parameters used in the landfill evaluation are not considered to be the best parameters for this assessment. Therefore the following recommendations are:

    - Discontinue BTEX monitoring since, the BTEX signature in the ground water environment has degraded over time;
    - Discontinue Phenols monitoring since, the phenols concentrations tend not be consistently detected and appear to have degraded over time;
    - Discontinue phosphorus monitoring since the phosphorus concentrations tended not to be consistently detected such that they can be relied upon to monitor trends.
    - Continue using chloride and total ammonia parameters in assessment as they are considered to be appropriate for the performance monitoring program;
    - Continue using other parameters (i.e. sulphate, iron, DOC) in assessment as suggested in Section 2.1.3.1;

- Decades of quarterly water quality monitoring results have suggested that changes at the landfill site occurs slowly and the landfill is now stable. The system is considered to be in a steady state equilibrium. The contaminant flux toward the Scugog River is an order of magnitude below any level of concern.

    - A quarterly ground water monitoring program would appear excessive under these conditionsand semi-annual monitoring (or less) should be considered;

- The existing database could be used to establish normal steady state conditions or slow trending conditions at targeted monitoring locations. This could permit less frequent sampling under a specified condition based on the past year or more of sampling. Similarly, a perceived departure from the norm could necessitate a return to the quarterly to confirm the trend or refute the anomalous data;

- Hydraulic evaluation (*i.e.* slug testing) of all monitoring wells could be completed. This could help to assist in determining low yielding monitors which are not targeting leachate migration pathways and thus support their removal from the monitoring program;

- Reduce frequency of leachate collection system inspection and flushing to every three years, or as required based on operational requirements

7.1.2 Surface Water

The surface water monitoring program is to assess any influence the Site may have on the adjacent Scugog River. The monitoring program is also intended to detect contaminant migration via the Site drainage channel network.

- the sampling for organic priority pollutants has not detected a significant contaminant threat in the decades this program has been conducted:

  - Decades of sampling have not yielded significant PCB results. Further evaluation for PCBsis unwarranted;

  - Decades of sampling have not yielded significant VOC results.
    - BTEX concentrations have degraded over time to trace or non-detectable levels. Further evaluation for this parameter would appear unwarranted with the exception of confirmatory sampling of the WPCP effluent outflow in the spring 2022 monitoring event to confirm the 2021 toluene detections is advisable;

    - trihalomethanes is a by-product of WPCP processing and therefore need not be assessed as it does not relate to the landfill;

- the Scugog River sampling program is recommended for the inorganic suite of parameters currently being used;

- Establish an interim / temporary sampling location at the exit of Embayment A and the entrance to Embayment C to assess the mechanism(s) for the mixing of embayment waters with the Scugog River;

- The nearshore samples collected from 2019 to 2022 have yielded results that indicate generally consistent results for iron and ammonia between the inlets and Embayment B sampling point at the opening to river. This would indicate that seepage of the lagoons into these inlets is negligible and not creating a measurable influence in the embayment / river. As such, it is recommended that the nearshore samples be removed from the monitoring program;

- The on-Site drainage sampling program is recommended for the inorganic suite of parameters currently being used;

    - The database needs to be separated between wet weather / active flow conditions and dry weather conditions;
    - The value of the dry weather sampling program is minimal due to significant sediment entrainment. Stagnant/ pooled waters should not be sampled;
    - It is recommended that filtering of surface water samples (field or lab) could be completed to address the low flow sampling deficiencies so that the information can be reliably used to remove the bias created by entrained sediments, whichskews water quality results if TSS values exceeds an established trigger value;

7.1.3 Landfill Gas

The landfill gas monitoring program is design to evaluate the migration potential of these compounds in the environment.

- The findings from the landfill gas monitoring suggest that there is no meaningful gas migration at this Site. A monitoring program needs to be maintained as a safeguard; but should reflect the relative risk given the current understanding;

    - It is proposed that if monitoring wells have not shown any detection in the past five years then sampling should be reduced to an annual late winter measurement;
    - If a detection occurs during the annual monitoring then quarterly sampling should be re-established or if source concentrations increase abruptly by more than 25%;
    - If a monitoring well has shown no detection for a decade then monitoring should be terminated;

7.2 Wetland Assessment

The wetland assessment was not conducted in 2022 and therefore no recommendation is necessary.

7.3 Site Operation

The Conditions associated with the landfill operations are to ensure the facility is being operated according to Site specifications outlined by the MECP.

- The City of Kawartha Lakes has been issued a new ECA license and there are new conditions for Site operations;
    - The peak maximum flow of 750 m^3/day (at any time) for leachate transfer to the WPCP appears to be anomalously low if related to the peak instantaneous flows which have historically occurred based on the past operating data. However, when the average daily data is reviewed, the thresholds are met throughout 2022;
    - The City should enter into discussions with the MECP if this peak maximum flow rate is set too low for the Site conditions, or whether the intent is to review the daily averagedata, for which the Site remains in compliance with;

7.4 Public Consultation

No new recommendations.