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DATE                        20 September 1999

TO/DEST.                 Chair and Members of Council

FROM/EXP.                Director, Solid Waste Division  
                              Environment and Transportation Department

SUBJECT/OBJET           **TRAIL ROAD AND NEPEAN LANDFILL SITES -  
1998 ANNUAL MONITORING REPORT**

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## INTRODUCTION

This is for the information of the Chair and members of Council.

In accordance with the terms and conditions of the certificates of approval for the Nepean Landfill Site (A461301) and the Trail Road Waste Facility (A461303), the Region of Ottawa-Carleton must submit an annual site progress and monitoring report to the Ontario Ministry of the Environment (MOE).

The *Report for the 1998 Monitoring and Operating Program* was submitted to the MOE in May 1999. The purpose of this report is to provide information on the environmental and operational status of both the Trail Road Waste Facility and the closed Nepean Landfill Site. A copy of the Executive Summary as prepared by Golder Associates is attached as Annex A. A reference map of the sites and surrounding areas is attached as Annex B.

## BACKGROUND

During 1998, the Trail Road Waste Facility and Nepean Landfill Site were in compliance with the terms and conditions of their respective Certificates of Approval. The 1998 monitoring and operating program report describes the monitoring, operating, and capital development activities at the Trail Road and Nepean sites during 1998.

Information Previously Distributed  
To Be Listed on Planning and Environment  
Committee Agenda of 26 October 1999

### Nepean Landfill Site

The Nepean Landfill Site began receiving waste in the early 1960's. It no longer receives waste and is closed. The site was regraded in 1991 to promote surface water run off and capping was completed in 1993. The final landscaping was completed in 1994.

The groundwater flow pattern is similar to that of previous years. The deep aquifer flows north towards the dewatering pond in the bufferland north of the Trail Road Waste Facility. The shallow aquifer flows south and west to spring-fed ponds in the bufferland. Leachate migration in the deep aquifer extends beneath the northwest corner of the Trail Road Landfill property and is measured in the bottom portion of the aquifer. Leachate effects from the Nepean Landfill in the shallow aquifer occur west just beyond Moodie Drive and to the south.

The surface water in the upper reaches of the agricultural drain immediately west of Moodie Drive exceeds the Provincial Water Quality Objectives (PWQO) for ammonia, boron and iron. However, farther along the agricultural drain, prior to discharge to the Leamy Drain, all provincial surface water quality objectives are met. Sampling in 1998 indicated the presence of volatile organic compounds in the upper reaches of the agricultural drain immediately west of Moodie Drive. Concentrations of these parameters are less than the PWQO criteria. These compounds are not detected farther along the drain, prior to discharge to the Leamy Drain. The surface water quality southwest of the Nepean Landfill continues to exhibit minor leachate effects that are within livestock drinking water criteria.

Surface waters flow from the spring-fed ponds to the west and the dewatering pond to the north through a series of agricultural drains and eventually to the Jock River. The absence of leachate indicator parameters indicates that the Jock River water quality remains unaffected by surface water discharges from the closed Nepean Landfill Site.

Landfill gas migration is controlled by an active gas extraction system which was installed in 1993. The landfill gas is processed at the gas flaring station at the Trail Waste Facility. Data indicates that landfill gas impacts do not extend beyond the bufferlands owned by the Region.

Water supply wells on adjacent private properties are no longer used for drinking water. Bottled water continues to be supplied as a precaution against landfill effects. The acquisition of additional bufferland and implementation of a remedial action plan as required by the MOE are underway as part of the regulatory closure plan. Over the years, several property acquisitions have been completed. The remaining properties are under negotiation and some may require expropriation and Ontario Municipal Board hearings.

### Trail Road Waste Facility

The groundwater flow pattern is similar to that of previous years. The deep aquifer flows towards the dewatering pond in the bufferland north of the Trail Road Landfill Site. Leachate migration in the deep aquifer from the Trail Road Landfill Site is contained directly beneath the landfill. The shallow aquifer flows northeast and discharges in the forested bufferland north of the filling area on the regional clay plain. Leachate effects in these areas are completely contained on the Region's property.

A study of the dewatering pond was carried out in 1998 to assess iron levels and their possible source. Orange staining is evident at the south-east corner of the pond. The study identifies a fill pile at Cambrian Road and an associated near-surface iron plume in the groundwater as the likely source of iron in the pond. It is unlikely that the elevated levels of iron in the dewatering pond originate from the Trail Road or Nepean landfills, based on the findings of this investigation.

The surface waters from the dewatering pond and the springs in the bufferland forest, which flow north through agricultural and roadside ditches and eventually to the Jock River, meet PWQO at the site boundaries. The water quality of the Jock River remains unaffected by surface water discharges from the Trail Road Landfill Site.

In 1991, the landfill gas control system was switched from a passive venting system to an active gas extraction system that flares the gas at the flaring station. The active landfill gas extraction and flaring system continues to reduce greenhouse gas emissions. Landfill gas migration patterns are similar to that of previous years with movement south into an area where additional bufferland was acquired. The landfill gas collection system was expanded in 1998 to include Stage 3 of the landfill site. A series of gas collection wells was installed into the refuse and modifications to the existing leachate underdrain collection system were made to allow for the collection of landfill gas generated in the active stage (Stage 3) of the Trail Road Landfill Site.

Water supply wells on site and on adjacent private properties are no longer used for drinking water. As a precaution, bottled water is provided. Several private water supply wells near the Landfill Site were tested at the owners' request. No leachate indicators were found in any of the wells.

The Trail Road Landfill Site received 254,211 tonnes of waste in 1998, of which 148,903 tonnes were landfilled. In 1997, the Trail Road Landfill Site received 219,879 tonnes of waste, of which 144,011 tonnes were landfilled. It is estimated that the site will reach approved capacity by late 2008 to early 2009.

A permanent composting facility has been in operation on the bufferland north of the Trail Road Landfill Site since 1994. In 1998, 42,752 tonnes of residential leaf and yard material and brush were received at the permanent composting facility and an additional 591 tonnes of commercial leaf and yard material. The large quantities of leaf and yard waste received in 1998 are directly attributed to the January 1998 ice storm. In 1997, 16,983 tonnes of residential leaf and yard waste were received at the composting facility, and an additional 560 tonnes of commercial leaf and yard waste and 382 tonnes of Christmas trees were also received. All compost is sampled prior to leaving the site to ensure that MOE requirements are met. All of the compost produced in 1998 met the MOE requirements.

During its operation in 1998 from 18 April to 5 December, the permanent Household Special Waste Depot accepted material from 11,459 vehicles. During its operation in 1997, material was received from 11,447 vehicles.

## Capital and Operating Projects

The following projects were initiated or completed in 1998:

- completion of Stage 3 Interim Landfill Gas Collection System;
- installation of several new groundwater monitoring wells;
- continuation of evaluation and approvals process of the off-site leachate forcemain;
- peer review of leachate and leachate impacted groundwater remediation/treatment technologies;
- installation of stand-by odour control misting system for Stage 3;
- landfill optimization study completed;
- study to determine the source of iron at the dewatering pond;
- environmental site assessment on a neighbouring property;
- application for a revised Certificate of Approval for the Composting Facility;
- continuation of the property acquisition program to provide bufferland, where required; and
- operation of an interim organic transfer station.

## CONSULTATION

The public consultation process is not applicable. A presentation on the Trail Road Waste Facility and Nepean Landfill Site, however, was given to the City of Nepean Public Works Committee in July 1998. A copy of the *Final Report for the 1998 Monitoring and Operating Program* for the Trail Road Waste Facility and the Nepean Landfill Site has been filed with the Regional Clerk's Department. Although not specific to the annual monitoring report, there was considerable contact and dialogue with the public regarding issues related to the proposed routing for a leachate pipeline and the treatment and handling of both contaminated groundwater and leachate.

## FINANCIAL IMPLICATIONS

The monitoring program and subsequent report were prepared through a contract with Golder Associates Limited for 1998. Funds for the contract are budgeted for annually in the Solid Waste Division Operating Budget.

## CONCLUSION

The Trail Waste Facility and Nepean Landfill Site continue to operate in accordance with the terms and conditions of their respective certificates of approval.

*Approved by*  
*P. McNally, P.Eng.*

MH/DR/PM

Attach. (2)

**GOLDER ASSOCIATES****TRAIL ROAD AND NEPEAN LANDFILL SITES  
REPORT FOR THE 1998 MONITORING AND OPERATING PROGRAM****EXECUTIVE SUMMARY**

The Trail Road and Nepean Landfill were both in compliance with their Certificates of Approval during 1998.

The Region of Ottawa-Carleton (The Region) owns and operates both the Trail Road and Nepean Landfill sites. The Trail Road Landfill receives waste from most of Ottawa-Carleton.

The Nepean Landfill has not received municipal solid waste since 1980. The Nepean Landfill received final cover in 1993 incorporating an engineered geomembrane hydraulic barrier cap and active gas collection system.

The Trail Road Landfill has operated since 1980 to receive municipal solid waste. The Trail Road Landfill is divided into distinct stages of operation. Stages 1 and 2 were designed based on a natural attenuation landfill. These stages were covered in 1988 and 1991, respectively, with a low permeability geomembrane cap to reduce leachate generation through infiltration. Stages 3 and 4, the approved final stages of the Trail Road Landfill, were both designed based on engineered containment and have a composite bottom liner (clay and geomembrane) and leachate collection system. Landfilling in 1998 took place in Stage 3. Landfill gas is controlled at the site through an active gas collection system and flaring station for all capped stages, the active Stage 3 and the closed Nepean Site. A groundwater and surface water monitoring program documents changes in groundwater and surface water quality and determines how they are being influenced by the landfill site.

**OPERATIONS**

Gross waste received in 1998 was 254,211 tonnes. The net amount of waste landfilled was 148,903 tonnes. Waste diverted from the landfill was 43,715 tonnes. Clean fill (61,593 tonnes) was used at the site for daily and interim waste cover, dykes, roads and slopes, and makes up the balance of gross waste.

As of November, 1998 the remaining theoretical air space in Stage 3 for waste material is 366,000 cubic metres. The Stage 4 design capacity is 1,920,000 cubic metres without final cover.

The estimated remaining capacity of Stages 3 and 4 is as follows:

## ESTIMATED REMAINING CAPACITY OF STAGES 3 AND 4\*

	<b>Volume Remaining Below Approved Final Waste Contours (cu.m.)</b>	<b>Theoretical Stage Life from January 1, 1999 (years)</b>	<b>Theoretical Completion Date</b>
Stage 3	366,000	1.3 to 1.8	Mid 2000
Stage 4	1,920,000	8 to 8.5	Late 2008 to early 2009

\*Based on the 1990 development and operation plan.

The theoretical date includes the west sideslope area of Stage 3 which can only be filled on initiation of Stage 4.

Based on previous site experience, **landfilling in Stage 4 will likely commence** at least 12 months prior to the theoretical completion of Stage 3; that is, **by mid 1999**.

Activities and capital works at Trail Road Landfill during 1998 included:

- Installation of Stage 3 Gas Collection System;
- Continuation of evaluation and approvals process of the off-site leachate forcemain, including alternative routing options;
- Installation of additional groundwater monitors;
- Operation of a misting system to control odours from the Stage 3 cell.;
- A peer review of leachate and leachate impacted groundwater remediation/treatment technologies; and,
- Application for a revised Certificate of Approval for the Composting Facility.

During 1998, the **Trail Road Landfill operated in compliance** with its Provisional Certificate of Approval.

There were no operations or capital works ongoing at the Nepean Landfill Site during 1998. During 1998, **the Nepean Landfill was in compliance** with its Provisional Certificate of Approval.

## ENVIRONMENTAL CONCLUSIONS

Leachate influence on groundwater is assessed on the basis of: 1) a physical hydrogeology approach that addresses the flow path and rate of groundwater moving in the groundwater system; 2) a chemical hydrogeology approach that addresses the alteration of groundwater quality by leachate influences. These two approaches must be combined to provide conclusive scientific evidence of influence of landfill leachate. This methodology was used to determine how surface water and groundwater quality are influenced by the landfill sites.

In the assessment of landfill influence, the study area was subdivided into discussion areas for the surface water and groundwater monitoring locations. The surface water discussion areas are

shown on Figures 3.18, 3.19 and 3.20. The groundwater discussion areas are shown on Figure 3.13.

Two principal overburden aquifers, one shallow, one deep, are identified at Nepean and Trail Road Landfill sites. The groundwater monitoring program documents leachate influence in these aquifers.

Careful review of monitoring data and spatial analysis has shown that bromide and to some degree boron are key parameters in the assessment of leachate influences at the sites. In the absence of boron and bromide, and together with the physical hydrogeology interpretation, elevated chloride, alkalinity, iron, hardness, organic carbon and nitrogen compounds in much of the groundwater near Trail Road and Nepean Landfills are attributed to artificial sources such as fertilizer, road salt (dust control and de-icer) and septic systems or changes in recharge conditions due to landscaping/land use changes leading to a change in mineral dissolution. Organic carbon in groundwater near Trail Road Landfill is attributed to high organic content of subsurface materials.

Upper bounds of linear groundwater flow velocity in the vicinity of both landfill sites have been determined to be in the order of several metres per year in the deep and shallow aquifer. Localized higher linear velocities of groundwater flow may occur due to increased horizontal gradients brought about by topography and geology.

The Nepean Landfill has existed since about 1960 or some 39 years, whereas Trail Road Stages 1 and 2 have existed since about 1980 or some 19 years. These landfill areas are natural attenuation facilities, without engineered bottom containment. The estimated groundwater velocity, together with the age of the landfills, provides an indication of the maximum distance which leachate could have migrated in the groundwater beyond the waste. Therefore, under similar hydrogeologic conditions, leachate influences from Nepean Landfill would have migrated farther than those from Trail Road Landfill Stages 1 and 2.

The natural attenuation stages of the Trail Road Landfill influence groundwater quality in the shallow and deep aquifer. Leachate influence on the shallow aquifer extends to the north and is entirely contained on the Regional property, as the shallow aquifer pinches out to the north on the Regional property. Surface water discharge from the property to the northeast does not show any evidence of leachate. Leachate effects on the upper part of the deep aquifer are identified directly below the landfill. Leachate effects on the deep aquifer from Trail Road Landfill have not been identified elsewhere. Interpretation of groundwater flow information suggests that maximum extent of leachate effects from the Trail Road Landfill in the deep aquifer is somewhere beneath lined Stages 3 and 4. The chemical interpretation is consistent with the physical hydrogeology flow patterns and linear flow velocities. Water quality in other areas of the deep aquifer have elevated key parameters that are not necessarily attributed to the landfill site. These areas are on Regional property and are included in the ongoing monitoring program.

Leachate effects from Nepean Landfill occur in the shallow aquifer to the west just beyond Moodie Drive and also to the south. However, groundwater flow interpretation suggests that the main direction of leachate affected groundwater movement is to the southwest. The shallow aquifer pinches out on the clay plain west of Moodie Drive and the groundwater discharges to the surface water system at this location.

Concentrations of unionized ammonia (ammonium), boron and iron in excess of Provincial Water Quality Objectives (PWQO) are measured at the headwaters of the surface water system west of Moodie Drive. Also some volatile organic compounds are encountered in this surface water system. The volatile organic compounds are no longer detectable prior to discharge in Leamy Drain. This surface water system is a series of agricultural ditches connected to Leamy Drain that discharges to the Jock River. The total dissolved inorganic load in the surface water in Leamy Drain is increased, however, input from leachate effects does not exceed PWQO.

No effects of leachate from the Nepean Landfill are measured in the deep aquifer at monitoring locations beneath the landfill or to the west and south. Leachate effects exist to the northeast of Nepean Landfill in the deep aquifer and extend beneath the northwest corner of the Trail Road Landfill buffer, and are measured in the bottom portion of the aquifer. Monitors completed in the middle portion of the deep aquifer beyond the northwest corner of the Trail Road Landfill property suggest that leachate effects have not reached Cambrian Road. The chemical interpretation is consistent with the physical hydrogeology flow patterns and linear flow velocities.

Dilute leachate effects at monitoring well M40 (situated just north of Stage 4) in the upper deep aquifer have been measured since 1994. Based on the groundwater flow velocity and time frame of landfilling, the measured leachate influence is likely from the Nepean Landfill.

Landfill gas generation from the Trail Road and Nepean Landfill sites continues as in previous years. Landfill gas levels continue to be elevated along Trail Road south of Stages 1 and 2. However, structures that are present are equipped with methane gas alarms in these areas.

In 1998, the downward trend in iron concentration in excess of PWQO at the dewatering pond remained similar to those observed in 1997. The average concentrations are lower than those measured in the last four years.

Iron concentrations in the shallow groundwater flow system are increasing in the general area between the dewatering pond and Cambrian Road. A special study report is appended to this report with regard to a subsurface investigation completed near the end of 1998 in the dewatering pond area. The study concludes that in the shallow groundwater a dissolved iron plume originates from a large fill pile on dewatering pond property near Cambrian Road. This shallow plume is identified to be the major source of iron staining on the southeast shore of the dewatering pond and is identified to be the principal source of elevated iron in the dewatering pond.

## **RECOMMENDATIONS**

Some reductions to the groundwater and surface water monitoring program are warranted. Reductions mainly involve a scaling back of frequency of monitoring at a location rather than eliminating locations from the monitoring program. It is proposed that April remain annually the largest monitoring event. The reductions are justified in Appendix N of this report.



Additions to the monitoring program are proposed as well, and include volatile organic compound sampling at selected locations. It is proposed that these additions be completed on a one time basis subject to revision the following year.

Flow monitoring is recommended in the Agricultural Drain and the dewatering pond outlet to obtain a calibration of actual flow quantities with water levels.

An investigation completed in early 1999 of the dewatering pond area indicates a shallow dissolved iron plume in the groundwater approaching the dewatering pond. This shallow dissolved iron plume is interpreted to be responsible for the iron staining along the south east shore of the pond, and likely the main source of elevated iron in the pond and its discharge outlet. The source of this iron is not from the landfills but originates from a fill pile at the property.

During 1998, it was found that the two monitoring wells at BH12 had silted in and were not functioning. Although there are no additional groundwater monitors further downgradient, BH12 is of great assistance in tracking the position of the leachate affected groundwater plume from Nepean Landfill. It is recommended that this be replaced by new installations. There is also a need to re-survey all staff gauges including G6A at the dewatering pond, and replace staff gauge G5 in SWP4 north of Nepean Landfill.