BIENNIAL OPERATIONS

Essex-Windsor Landfill Site No. 3

2008-09 Report

Essex-Windsor Solid Waste Authority
360 Fairview Ave. West, Suite 211
ESSEX, Ontario N8M 3G4
Internet: www.ewswa.org

ESSEX-WINDSOR SOLID WASTE AUTHORITY

Essex Landfill Site No. 3

2008-2009

BIENNIAL OPERATIONS REPORT

TABLE OF CONTENTS

1 INTRODUCTION

Essex County Landfill Site No. 3 is located on parts of Lots 14 and 15, Concession 4 in the Town of Lakeshore, (formerly the Township of Maidstone). Landfill Site No. 3 was closed to the receipt of waste on June 30, 1997. All waste from the former landfill service area is now disposed of at the Essex-Windsor Regional Landfill in the Town of Essex.

1.1 CERTIFICATE OF APPROVAL

Landfill Site No. 3 is governed by Provisional Certificate of Approval No. A011501, as amended. The Certificate was issued on January 30, 1990 subsequent to an EPA hearing in October 1989, and was extended under the emergency provisions of the Act on December 30, 1992. The Certificate was amended on July 8, 1999 to incorporate the provisions of the Site's Closure and End Use Plan.

1.2 PURPOSE

The purpose of this report is to fulfill Condition No. 5 on the Certificate of Approval for the Site. Condition 5 requires the preparation and submission of an annual report within three months of the end of the calendar year. After a period of five years following closure, providing conditions are stable, the closure and end use plan provides for biennial reports. In December of 2004, the Ministry of the Environment endorsed a 2003 Annual Monitoring recommendation which proposed that reporting requirements be revised from an annual to biennial basis.

2 INSPECTIONS AND COMPLAINTS

2.1 SITE INSPECTIONS

Inspections were completed as per the closure plan dated August 1996 and are available at the offices of the Essex-Windsor Solid Waste Authority.

2.2 COMPLAINTS

Throughout the year the public could report complaints by calling the Essex-Windsor Solid Waste Authority at 1-800-563-3377. There were no complaints during 2008 or 2009.

3 SITE DEVELOPMENT AND MAINTENANCE

This section describes activities that took place in 2008 and 2009 relating to the maintenance of the closed Site.

3.1 VEGETATION AND COVER

Several work projects were carried out during 2008 and 2009 in the areas of vegetation and cover. During the months of September and October 2008, Rivard Excavation was contracted to load, haul and place approximately 4,000 m^3 of stockpiled clay. The clay was used to re-grade select areas of Cell B2 which had experienced a significant amount of differential settlement resulting in the ponding of precipitation and higher leachate generation rates. After re-grading and packing the landfill cap area a 100 mm lift of top soil was applied and seeded.

The seeding was completed by EWSWA staff. A broad cast seed spreader towed behind an ATV was used to apply the seed. After applying the seed, a roller towed behind an ATV was used to set the seed. An inspection of the seeding project carried out in the summer of 2009 indicated that a good germination rate could be observed for most of the area.

Upon completion of the cover project on Cell B2, Rivard Excavating was directed to grub, clear and re-grade several surface water ditches to promote surface water drainage on the landfill site. As a result of the extremely flat nature of the land in Essex County many of the drains used to carry surface water away from the landfill site have limited drainage grades. This can and does result in poor water flow rates when vegetation or sediment builds up in the bottom of the surface water ditches. Accordingly the surface water ditches require regular and ongoing maintenance.

For most of the summer in 2009, the landfill cap of Area C continued to be re-graded. As in the past the bulk of clean uncontaminated clay hauled on site was used to re-shape the cap of Cell C which had originally been landfilled to a relatively flat surface which results in higher than average leachate generation rates. The landfill cap was also experiencing a significant amount of differential settlement which was promoting higher leachate generation rates. A total of 16,000 m^3 of clay was applied, compacted and graded in Area C. The clean, uncontaminated clay originated from two projects both of which were in the Town of Lakeshore. Approximately 10,000 m^3 came from a Legacy Park Inc. project whereas the remaining 6,000 m^3 came from footing excavations for the Vista Print building addition.

For both 2008 and 2009 Dominion Tree Service was contracted to remove or trim trees as required. During 2008 a significant number of dead ash trees located on the site were taken down. The trees died as a result of the emerald ash borer infestation. In 2009 significant tree pruning and removal was carried out on the east side of the landfill to increase access and flow rates for the Fourth Concession internal drain diversion.

In order to promote a thicker growth of grass on top of the waste cells and to allow newly seeded areas the ability to out-compete weed growth, a minimum of two cuts are completed for the entire site each year. By cutting the grass more often, weed patches do not get a chance to germinate and the grass is allowed to re-establish itself in poor growth areas. A healthy, thick growth reduces erosion, surface water infiltration and cell cap desiccation. Ongoing inspection results suggest that the regular cutting of the grass has resulted in a much thicker and healthier growth of grass.

3.2 DRAINAGE

All internal drainage ditches and swales were inspected on an ongoing basis for sediment buildup and vegetation cover. During 2008 and 2009 Rivard Excavating was contracted to carry out re-grading, grubbing and vegetation removal as required.

3.3 ROADS

The on-site road maintenance program consists of minor road repairs, dust control, and grading of granular perimeter and access roads as required. Throughout 2008 & 2009, repairs to these roads were carried out.

In December 2009 the east roadway running from Pump Station #4 to the N/E corner of the site was top dressed with new stone and graded.

3.4 GENERAL MAINTENANCE

Throughout 2008 and 2009 a number of maintenance activities were carried out. These included but were not limited to the following:

- Repairs to the site perimeter fence and gates; on several occasions the perimeter fence and gates were either cut or damaged by individuals looking to gain access to the site. Staff noted that damage to the fence and gates in 2008-09 appeared to be consistent with previous years.

- Regular maintenance and repairs to Pump Station panels and pumps were completed as required. These repairs included pump rebuilds, wiring repairs, rodent proofing panels and float repairs. In March 2008, Pump Station #5 sustained significant damage as a result of vandalism. Phasor Electric was contracted to carry out repairs.

- Some clean up of yard waste at the front gate was required but staff noted that the quantity and number of occasions this happened during 2008-09 was less than previous years.

- Culverts suspected of leaking or being damaged were removed and replaced as required.

- During May 2008, Pump Station #5 was struck by lightning and totally destroyed. Temporary pipes were brought in to maintain leachate flow while the pump station was rebuilt.

4 LEACHATE MANAGEMENT

A perimeter leachate collection system was installed in 1985 along the north and east sides of the Site. The system, which includes a number of finger drains into the refuse, was installed to prevent surface outbreaks of leachate and reduce the leachate mound within the Site. In 1988/1989, the perimeter system was extended around the east and south sides of Area C and commenced operation in May, 1989.

A leachate underdrain system was installed in the waste cells excavated since 1987. These systems are in place in Area A5, Area B1 and Area B2. The Area A5 system commenced operation in November 1987. Areas B1 and B2 were connected in three phases with the final phase made operational in August 1989. All components of the leachate collection system were operational during 2008 and 2009. The total leachate catchment area is approximately 88.5 hectares.

In 1997, two new leachate ponds with a holding capacity of 15,000 m^3 were constructed in accordance with the long-term leachate management report for the site. The ponds are designed to stabilize organic and hydraulic loading of leachate.

All leachate collected from the various components of the system is drained/pumped to the leachate collection ponds at the northeast corner of Area B2. The leachate is loaded into tanker trucks and taken to the Little River Pollution Control Facility, in the City of Windsor, for treatment. During peak leachate generation events excess leachate may be hauled to the Lou Romano Water Reclamation Plant, also in the City of Windsor, for additional treatment capacity.

4.1 LEACHATE QUANTITY

A total of 87,745 m^3 of leachate was hauled from the Site for treatment in 2008. This is a 21% increase compared with the 72,468 m^3 hauled in 2007. The amount of leachate collected in 2008, as a percentage of precipitation was 8.3%. The amount was less than the 9.1% infiltration experienced in 2007.

A total of 91,173 m^3 of leachate was hauled from the Site for treatment in 2009. This is an increase of 4% compared with the 87,745 m^3 hauled in 2008. The monthly amounts are listed in Table 1 and Figure 1. The amount of leachate collected in 2009, as a percentage of precipitation was 11.2%. The historical infiltration rates are shown in Table 2.

The 2008 precipitation total is the greatest detected since 1990. Assuming a refuse disposal area of 88.5 ha, the 2008 percentage of total precipitation that would be required to infiltrate into the refuse and produce the volume of leachate generated in 2008 ranged from about 1% (September) to 60% (April) on a monthly basis and averaged about 8.3% (2.7 m^3/ha/day) on an annual basis. The overall leachate production rate during 2008 is within historic rates.

Also, in 2009 the precipitation at the landfill site was within the historic range and notably less than the peak leachate production years 2001, 2004, and 2005. The percentage of total precipitation that would be required to infiltrate into the refuse and produce the volume of leachate generated during 2009 ranged from about 1% (December) to 34% (May) on a monthly basis and averaged about 11.2% (2.8 m^3/ha/day) on an annual basis.

4.2 LEACHATE COLLECTOR ASSESSMENT

The detailed monitoring of the leachate collection system continued through 2008 and 2009. Previous work completed on the landfill site identified that leachate generation was greater than expected for a closed landfill site. To investigate the source of the leachate generation, an assessment was completed of the leachate collector system (Jagger Hims Limited, 2002). The assessment identified that the leachate flow within the collector system increased notably within one hour of a 10 mm or greater precipitation event. Thus, it was concluded that a large component of leachate generation was a result of the rapid infiltration of precipitation and surface water runoff into the collector system.

Operation changes to the collector system carried out to date have attempted to reduce the volume of leachate stored in the system. In addition, remedial activities to the surface water ditch around the woodlot appear to have reduced the amount of surface water infiltration into the system in this area. In 2004, Jagger Hims Limited was directed to complete a tracer-testing program of fluorescent dye (Rhodamine WT) to identify areas of surface water leakage into the collector system and to prioritize areas for improvement.

The infiltration study targeted ditches and swales that had the greatest potential to affect the collector system after a precipitation event or could accumulate large amounts of water during early spring and late fall. Each test section was isolated with soil dykes. To facilitate the interpretation of the findings, the response times were categorized for the ditch or swale as priority areas, secondary areas and tertiary areas.

In summary the priority areas where the collector system showed a rapid response (within less than 1 hour to 3 hours) to testing includes the area around Area C, between Areas B1 and B2, and at the South Sediment Pond, and near pumping station PS4 & PS6. Secondary areas of concern were also located around Area C and include a section of the ditch immediately north of the fence at the northeast portion of Area A1. Tertiary areas were typically located around Area A1. As noted previously four of the areas identified as primary infiltration points were worked on during 2004 and one area in 2005. In addition during 2005 one area identified as a moderate response area and one area identified as a slow response area were also modified.

During 2006 and 2007, the west and south slopes of Area C were covered with additional clean clay and regraded to mitigate the rapid and moderate response infiltration areas noted in the 2005 Jagger Hims Infiltration Report.

In 2008 and 2009 the re-grading and differential settlement repairs were continued on the landfill cap of Area C. In addition several areas on top of Area B2 were also re-graded to address differential settlement issues.

Maintenance activities are completed as part of the landfill closure plan to ensure that the closed Landfill does not adversely impact the local soil and water resources. One of the maintenance tasks involves the operation of the existing leachate management system and collection and off-site treatment of landfill leachate. The leachate collection system is made up of 60 maintenance holes, 6 pump stations and approximately 5.2 km of underground perforated collection pipe.

As of December 31, 2009 the actions that have been taken to address the leachate collection system infiltration concerns are detailed as follows:

EWSWA STUDY	CONCLUSIONS & RECOMMENDATIONS	ACTIONS TAKEN
July 2001 – Detailed site inspection	EWSWA staff complete detailed site inspections of all maintenance manholes, pump stations and surface water ditches looking for possible sources of infiltration. Staff noted small leaks in some manholes, some earth settlement around manholes and possible infiltration of surface water through desiccation cracks in the bottom of ditches near woodlot and Old Maidstone Landfill resulting in ponding or increased infiltration.	All leaks in manholes identified were filled in by Benko Sewer Services. Low areas around all manholes were re-graded with clay to remove areas of settlement, top-soiled and seeded. Three manholes north of the on site woodlot were raised so clean fill could be applied around them. Possible points of infiltration in ditches around woodlot & Old Maidstone Landfill were excavated out and virgin clay was used to reseal the ditch bottom. In October a culvert was installed under the main haul road connecting the surface water drainage ditch west and south of B2 directly to the southwest Retention Pond. As a result the surface water collected in these drains no longer has to travel over portions of the B2 leachate collection system to reach the pond.
July 2001 – Dillon Consulting was commissioned to review as built drawings of waste cells & identify and locate all finger drains as well as other possible sources of infiltration.	Dillon noted that finger drains may not be a significant source for infiltration since they are located for the most part on steep slopes which do not have a source of standing water. They also concluded that many of the surface water runoff ditches are constructed directly over the perforated leachate collection system which may experience standing water in low areas resulting in infiltration through desiccation cracks.	Low areas in surface water ditches identified were excavated out in October and filled in with virgin compacted clay and re-graded.
EWSWA conducts	Noted areas of differential settlement, large	For 2001, EWSWA staff conducted

EWSWA STUDY	CONCLUSIONS & RECOMMENDATIONS	ACTIONS TAKEN
regular on site inspections throughout 2001	desiccation cracks and standing water	an average of 3.8 inspections per month and completed minor repairs.
2002 – Jagger Hims Consulting Engineers commissioned to do detailed infiltration study using dedicated flow meters in selected manholes to identify sources of increased surface water flow.	The report confirmed that the leachate collector system was responsive to precipitation events. Typically the collector system responded within less than 8 hrs. - 10 hrs. of the commencement of a precipitation event that exceeded about 10 mm. The report also noted that the area around the Areas B1 & B2, as well as round the woodlot near PS4, were the major contributors to the leachate volumes after significant precipitation events. One other area of notable leachate contribution included the collector system section between PS5 &PS1.	During July, August & September of 2002 approximately 35,000 m^3 of virgin clay was brought into the site and placed on the north, east and south sides of the woodlot. The area was graded to allow surface water to run off through swales surrounding the woodlot and into the internal ditch running parallel to the 4th Concession. The area was then seeded in Sept. 2002.
EWSWA conducts regular on site inspections throughout 2002	Noted possible areas of infiltration into underdrains of B1 & B2 through areas of differential settlement along edge of cap where surface water run off control berms are located	Established budget to carry out remedial work in 2003. For 2002 EWSWA staff conducted an average of 3 inspections per month and continued to carry out minor repairs as required.
EWSWA conducts regular on site inspections throughout 2003	-Noted possible areas of infiltration into underdrains of B1 & B2. -Discovered major washout around culvert at the southeast corner of the woodlot draining into stone base of leachate collector system. -Noted possible sources of infiltration on south slope of Area C.	Sections of B1 & B2 were re-graded during 2003 and over 30 drainage swales were constructed in an effort to further reduce surface water infiltration for this area of the Landfill. The culvert located in the southeast corner of the woodlot was replaced with a new one and the washout was excavated out, backfilled & compacted with new clay. Gabion stone was placed on both ends to reduce potential for erosion.
Jagger Hims continues Infiltration Study in 2003	In addition to the EWSWA monitoring efforts, Jagger Hims Consulting Engineers continued their detailed infiltration assessment of the leachate collection system. The primary objective for 2003 was to evaluate the leachate flow conditions within the perimeter collector system at PS4. The flow collected in 2003 was sufficient to indicate that the collector system cover enhancement around the woodlot effectively reduced the rapid influx of surface water into the system for that area. Jagger Hims noted that PS6 may not have sufficient pumping capacity and during very heavy precipitation events was subject to potential leachate surcharging.	Jagger Hims Consulting to continue infiltration evaluation into 2004. In April 2003, the Flygt pumps located in PS6 were removed and replaced with new impellers which based on design specifications almost doubled the pumping capacity of PS6.

EWSWA STUDY	CONCLUSIONS & RECOMMENDATIONS	ACTIONS TAKEN
Jagger Hims commissioned to complete Tracer-testing Program to identify and prioritize infiltration areas – 2004	In 2004 Jagger Hims carried out detailed Dye Tracer Testing Programs of all the surface water ditches located over the leachate collection systems. They were to identify areas of surface water leakage into the collector system and to prioritize areas for improvements. The infiltration study targeted ditches and swales that had the greatest potential to affect the collector system after a precipitation event or could accumulate large amounts of water during the early spring and late fall. Each test section was isolated with soil dykes. The areas where the collector system showed a rapid response to testing included the area around Area C, between Areas B1 & B2 and at the South Sediment Pond and near PS4 & PS6	In September and October of 2004 approximately half of the south slope of Area C was stripped of top soil, covered with additional clay which was packed in place, graded, covered in top soil and seeded. Test pits were dug prior to re-grading but indicated little evidence of infiltration. The South Sediment pond was filled in with clean clay and packed. The areas around PS4 & PS6 were excavated out, filled in with new clay which was packed in place and then top-soiled and seeded. Test pits were also dug to look for sources of infiltration but none were found.
EWSWA conducted regular on site inspections – 2004 Jagger Hims completes Draft Report on Landfill No.3 Infiltration complete with recommendations to reduce infiltration.	Staff noted standing water in surface water ditches after precipitation events. All standing water is a potential source for infiltration. Some sections of ditch also had some soil and vegetation build up causing restrictions.	Rivard Contracting was commissioned to clean out approximately 2,575 meters of surface water ditch. During 2003 & 2004, EWSWA carried out a detailed topographic survey of the entire landfill. The detailed survey would allow staff the ability to identify any low areas with a greater potential for infiltration. During 2005 a detailed review of the long term infiltration solutions will be reviewed culminating in 2006 Budget recommendations to complete repairs.
EWSWA conducted regular on site inspections, 2005	Staff note any areas in ditches which appear to restrict surface water drainage or promote surface water infiltration.	Clean ditch areas as required, fill in low spots to promote surface water run off.
Jagger Hims submits final draft of Infiltration Report, 2005	EWSWA continues to carry out recommended repairs to surface water infiltration hot spots	During 2005, Rivard Contracting commissioned to fill in, re-grade, pack and topsoil areas of the north slope of A1 West and East. An abandoned surface water ditch located north of A1 East and south of the Storm Water Management System is also filled in, re-graded, packed & top soiled. All seeding completed by EWSWA staff.

EWSWA STUDY	CONCLUSIONS & RECOMMENDATIONS	ACTIONS TAKEN
		MH No. 1, 2 & 3 raised by EWSWA staff approximately 4 Ft. Spurr Contracting hauls in about 10,000 m^3 of clean fill to re-grade south slope of B2 to promote surface water run off. Area will be top soiled & seeded in 2006.
EWSWA re-issues leachate hauling tender in May 2005.	EWSWA staff note steady increase in leachate generation rates and increase maximum monthly contracted haul quantities to account for the increase	New tender increases maximum monthly contract leachate quantities from 9,000 tonnes per month to 10,000 tonnes/mth. New contract will allow for an additional 1,000 m^3 of leachate to be moved per month and 12,000 m^3 per year if required.
EWSWA continues to conduct regular on site inspection for 2006 and 2007	EWSWA continues to carry out recommended repairs to surface water infiltration hot spot	June 2006 – Smith Contracting hauls in 50,000 m^3 to regrade landfill cap Area C and south slope of Area C.
	EWSWA continues to note areas of differential settlement	October 2006 – Coco Construction hauled in approximately 5,000 m^3 of clean clay which is also applied to Area C and east slope of Area A2
EWSWA continues to conduct regular on site inspections for 2008 and 2009.	EWSWA continues to carry out recommended repairs to surface water infiltration hot spots.	October 2009 – Rivard Excavating contracted to haul, place and compact approximately 4,000 m^3 of stockpiled clay to the top of Area B2 to repair differential settlement and promote surface water run-off. EWSWA staff seed approximately 6,000 m2 of new clay cap on top of Area B2. May – Sep. 2009, LaSalle Backhoe and Legacy Park Inc. haul, place and compact approximately 16,000 m^3 of clean uncontaminated clay to top of Area C to repair differential settlement and promote surface water run off.
EWSWA staff recommend purchase of additional buffer land to address surface water infiltration issues west and south of Area C.	EWSWA approves purchase of approximately 6 acres of new buffer land west and south of Area C to accommodate the construction of new surface water drains significantly removed from the site leachate collection system and re-grade exterior landfill slopes.	A 5 year budget plan is developed to carry out the construction of new surface water drains, perimeter roads, security fences and re-grade, topsoil and seed exterior landfill slopes.

TABLE 1: LEACHATE QUANTITIES HAULED FOR TREATMENT

MONTH	2009 TOTALS	2008 TOTALS	2007 TOTALS	2006 TOTALS	2005 TOTALS
January	11,016.14	8,614.19	15,812.92	6,972.19	12,647.99
February	13,255.42	10,032.81	5,869.42	15,588.88	13,172.73
March	17,233.59	11,157.80	8,883.10	16,419.19	15,678.23
April	11,911.41	13,872.61	9,217.51	11,113.49	13,122.12
May	16,587.44	9,158.79	7,577.18	5,514.77	12,280.20
June	5,721.56	5,562.81	6,960.99	5,775.46	10,525.23
July	4,309.14	6,958.98	5,703.31	4,159.63	7,972.87
August	2,730.43	6,082.88	5,751.86	5,495.28	6,138.79
September	2,785.93	1,514.26	0.00	4,297.87	5,799.80
October	2,675.62	4,960.10	2,160.84	2,821.89	3,212.02
November	2,338.78	3,703.31	3,038.75	6,473.26	1,064.67
December	607.48	6,126.49	1,491.75	9,691.67	3,039.25
TOTALS (TONNES or m^3)	**91,172.94**	**87,745.03**	**72,467.63**	**94,323.58**	**104,653.90**

FIGURE 1: 2008/2009 LEACHATE COMPARISON

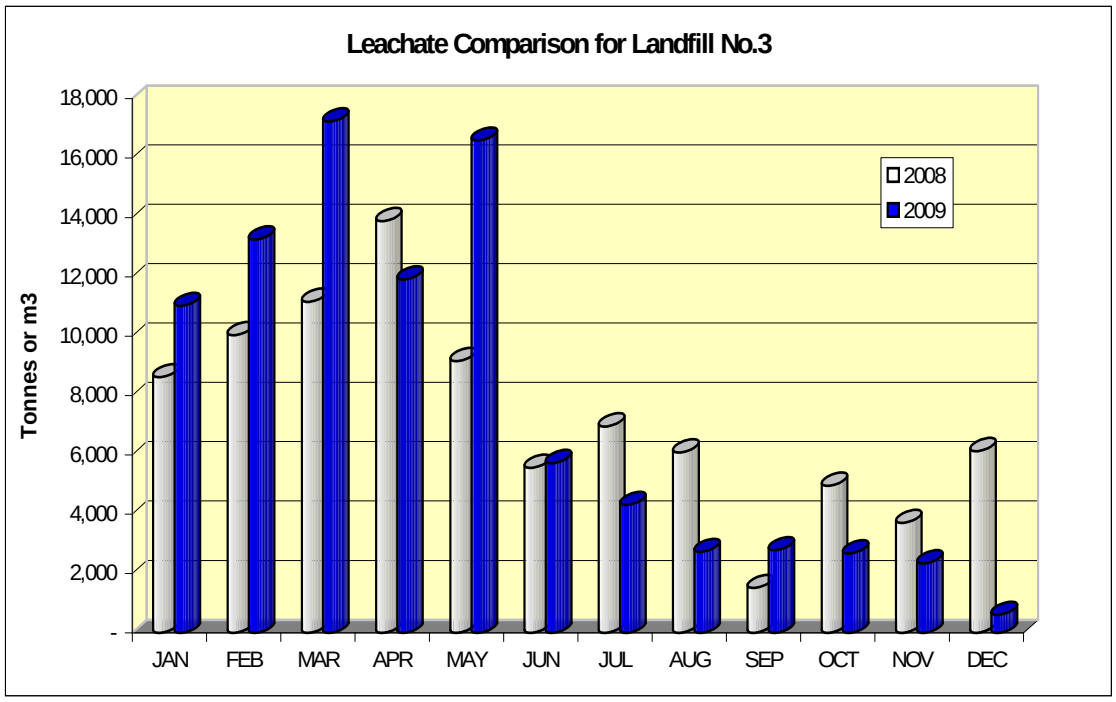


TABLE 2A: INFILTRATION RATE 2001-2009

Year	2009	2008	2007	2006	2005	2004	2003	2002	2001
Infiltration Rate	11.2%	8.3%	9.1%	9.4%	15.3%	12.1%	11.2%	14.1%	15.1%
Precipitation (MM)	923.3	1,198.4	898.2	1,134	773.0	930.3	701.6	707.0	798.7

TABLE 2B: INFILTRATION RATE 1991-2000

Year	2000	1999	1998	1997	1996	1995	1994	1993	1992	1991
Infiltration Rate	7.3%	9.4%	11.7%	9.1%	10.6%	10%	9.6%	9%	8.1%	8.5%
Precipitation (MM)	847.3	669.4	705.9	876.0	827.2	743.2	832.5	913.5	1,303	848.9

4.3 LEACHATE QUALITY

A total of 29,696.25 m^3 of leachate was sent from Landfill Site No. 3 to the Lou Romano Water Reclamation Plant and 58,048.78 m^3 was sent to Little River for treatment in 2008. A total of 45,713.40 m^3 of leachate was sent from Landfill Site No. 3 to the Lou Romano Water Reclamation Plant and 45,459.54 m^3 was sent to Little River for treatment in 2009.

The City of Windsor Pollution Control Division samples the leachate for analysis of general chemistry parameters, including COD; BOD; pH; NH3; TKN; TSS; Total Phosphorous; and Chloride, as well as a select list of ICP metals. The number of samples analyzed for each parameter is shown as the "n" value in Table 3. The average quantities for Chloride, TSS, BOD, COD and NH3-N, from 1986 to 2009 are plotted in Figures 2 and 3.

Leachate is produced at the landfill primarily from infiltrating precipitation percolating through the refuse. The rate of infiltration will vary across the landfill depending on factors such as the thickness and condition of the refuse clay cover; the slopes of the refuse and the vegetative cover.

In 2008 and 2009 the leachate quality within the leachate collector system was generally within the lower to mid historic collector system leachate concentration range for inorganic and organic analytes. Organic chemicals detected in 2008 and 2009 were also detected historically. The continued variable leachate quality within the collector system is expected and reflects influences related to temperature, flow conditions, precipitation and surface water infiltration, atmospheric exposure and refuse composition.

TABLE 3: LEACHATE QUALITY COMPARISON 2005 - 2009

		Year 2009 Analysis				Year 2008 Analysis				*Year 2007 Analysis*				Year 2006 Analysis				*Year 2005 Analysis*			
Parameter	**Units**	**N**	Avg	Min	Max	**N**	Avg	Min	Max	**N**	Avg	Min	Max	**N**	Avg	Min	Max	**N**	Avg	Min	Max
COD	µmhos/cm	8	395.13	189	755	17	421.19	210	1048	19	522.11	170	1816	19	522.31	192	1248	23	601.60	83	1076
pH	units	8	7.44	7.1	8	17	7.52	7.1	8.6	19	7.62	7	8.2	21	7.65	7.3	8.1	24	7.61	6.8	8.1
Ammonia+ Ammonium	mg/L	8	135.85	80.5	213.15	16	129.38	89.25	207	18	139.35	16.98	229.7	20	135.37	17.35	182	23	170.43	94.5	307
TKN	mg/L	8	149.13	81.03	235.48	17	144.64	99.8	245	18	164.31	107.5	245.225	20	150.55	18.7	215.55	23	186.55	105.7	339.3
TP	mg/L	8	0.25	0.11	0.58	17	0.67	0.11	5.3	19	0.45	0.07	2.33	21	0.19	0.11	0.36	23	0.33	0.16	2.28
TSS	mg/L	8	51.75	16	96	17	45.31	18	116	19	70.34	18	290	21	30.48	10	46	24	70.42	13	145
BOD	mg/L	8	21.50	12	45	16	22.40	1	81	19	19.83	1	122	20	19.46	3	90	24	160.48	6	639
Chloride	mg/L	7	2902.14	1450	4950	17	2611.81	1394	3950	16	2512.81	800	4604	18	3105.14	1850	4789	15	3396.15	961	5350
Metals																					
Aluminum	mg/L	8	0.10	0.025	0.337	17	0.79	0.0255	6.82	19	0.37	0.025	1.147	17	1.91	0.095	9.5	21	0.31	0.008	1.292
Boron	mg/L	8	2.39	1.24	4.14	17	2.49	1.56	3.36	19	2.56	0.9862	4.404	17	2.82	0.35	4.978	21	2.56	0	3.954
Cadmium	mg/L	8	0.002	0.001	0.0104	17	0.002	0.001	0.0026	19	0.001	0.001	0.0019	17	0.183	0	1.018	21	0.005	0	0.018
Chromium	mg/L	8	0.002	0.002	0.0023	17	0.006	0.002	0.032	19	0.002	0.001	0.002	17	0.07	0	0.725	21	0.00	0	0.011
Cobalt	mg/L	8	0.004	0.002	0.0074	17	0.006	0.0033	0.0089	16	0.01	0.0026	0.0107	17	0.01	0	0.043	21	0.00	0.001	0.008
Copper	mg/L	8	0.003	0.001	0.0111	17	0.24	0.0015	2.15	19	0.02	0.001	0.0348	17	0.02	0.001	0.07	21	0.03	0.006	0.156
Iron	mg/L	8	5.94	2.93	10.9	17	6.09	2.48	11.7	19	4.38	1.55	8.8	17	5.40	0.715	12.89	21	11.06	0.951	36.015
Nickel	mg/L	8	0.05	0.0298	0.0719	17	0.06	0.0415	0.126	19	0.06	0.0141	0.162	17	0.05	0.007	0.123	21	0.05	0.009	0.086
Lead	mg/L	8	0.07	0.0318	0.0858	17	0.05	0.0229	0.1	19	0.04	0.001	0.0717	17	0.14	0	0.824	21	0.01	0	0.029
Zinc	mg/L	8	0.03	0.002	0.0463	17	0.17	0.0182	1.21	19	0.05	0.0158	0.1053	17	0.04	0	0.122	21	0.06	0.008	0.292

Note: BDL = Below Detection Level

FIGURE 2: LEACHATE ANALYSIS FOR TSS, BOD & NH3-HISTORICAL DATA

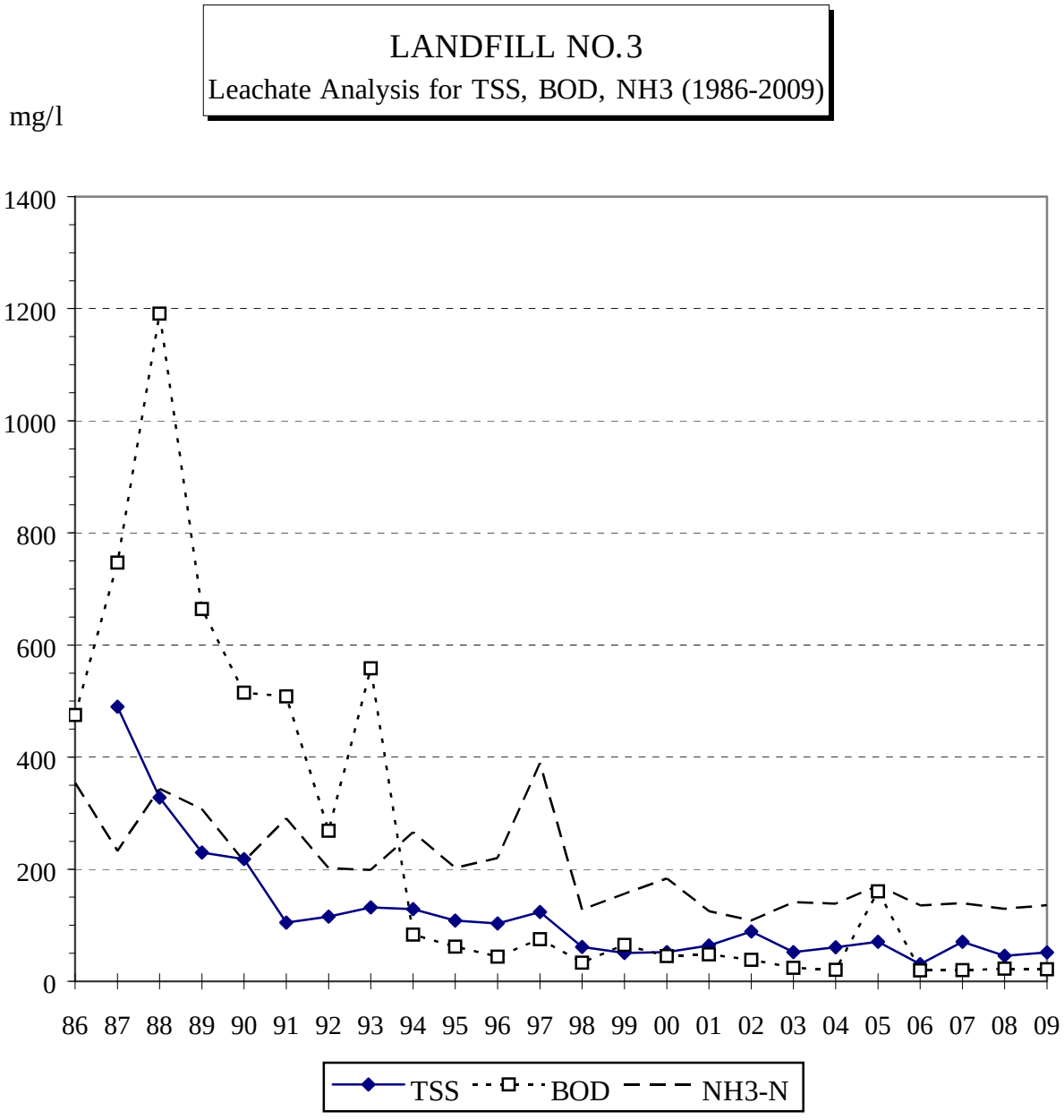


FIGURE 3: LEACHATE ANALYSIS FOR COD & CHLORIDE – HISTORICAL DATA

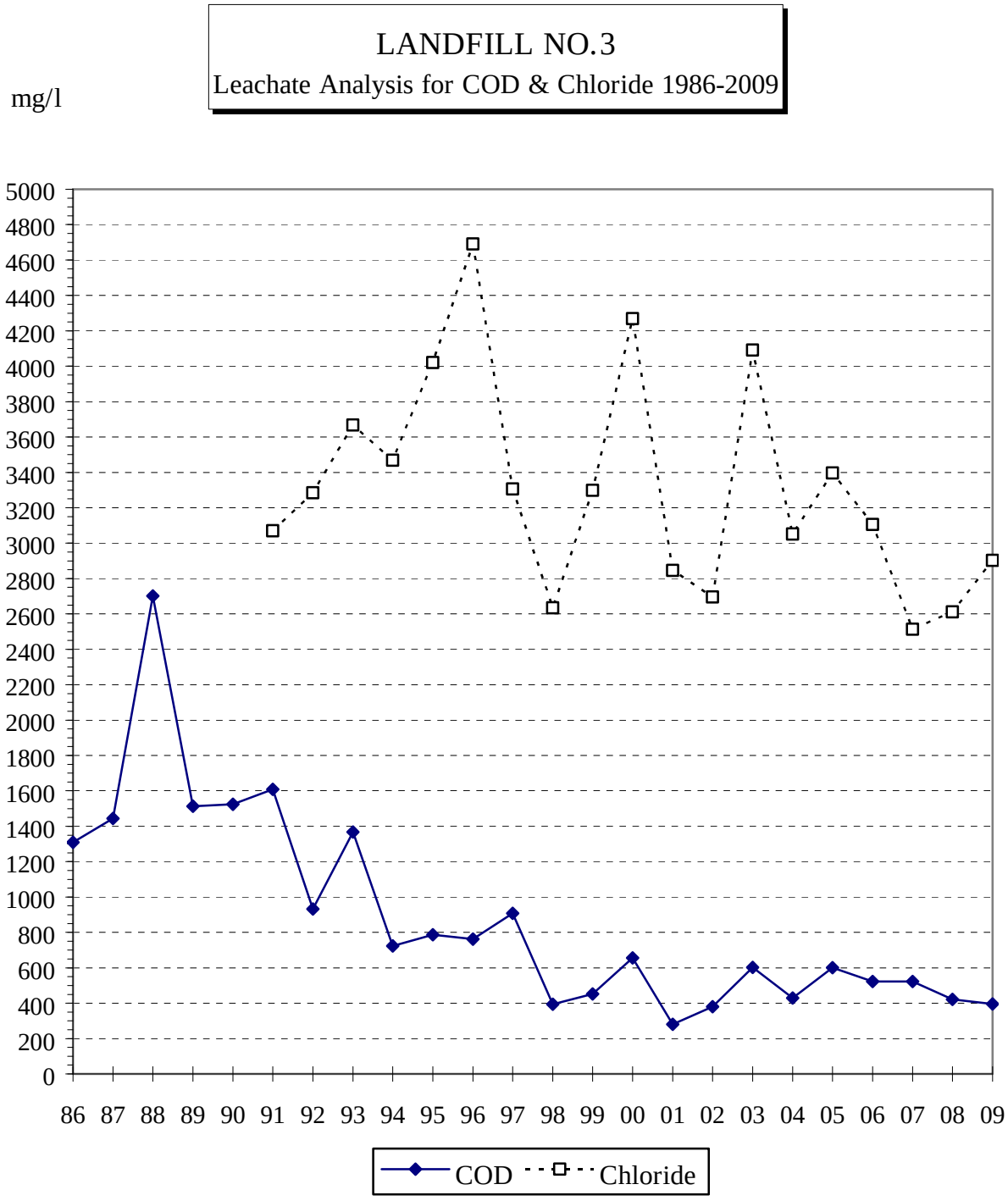


FIGURE 4: LEACHATE ANALYSIS FOR ALUMINUM, BORON AND IRON – HISTORICAL DATA

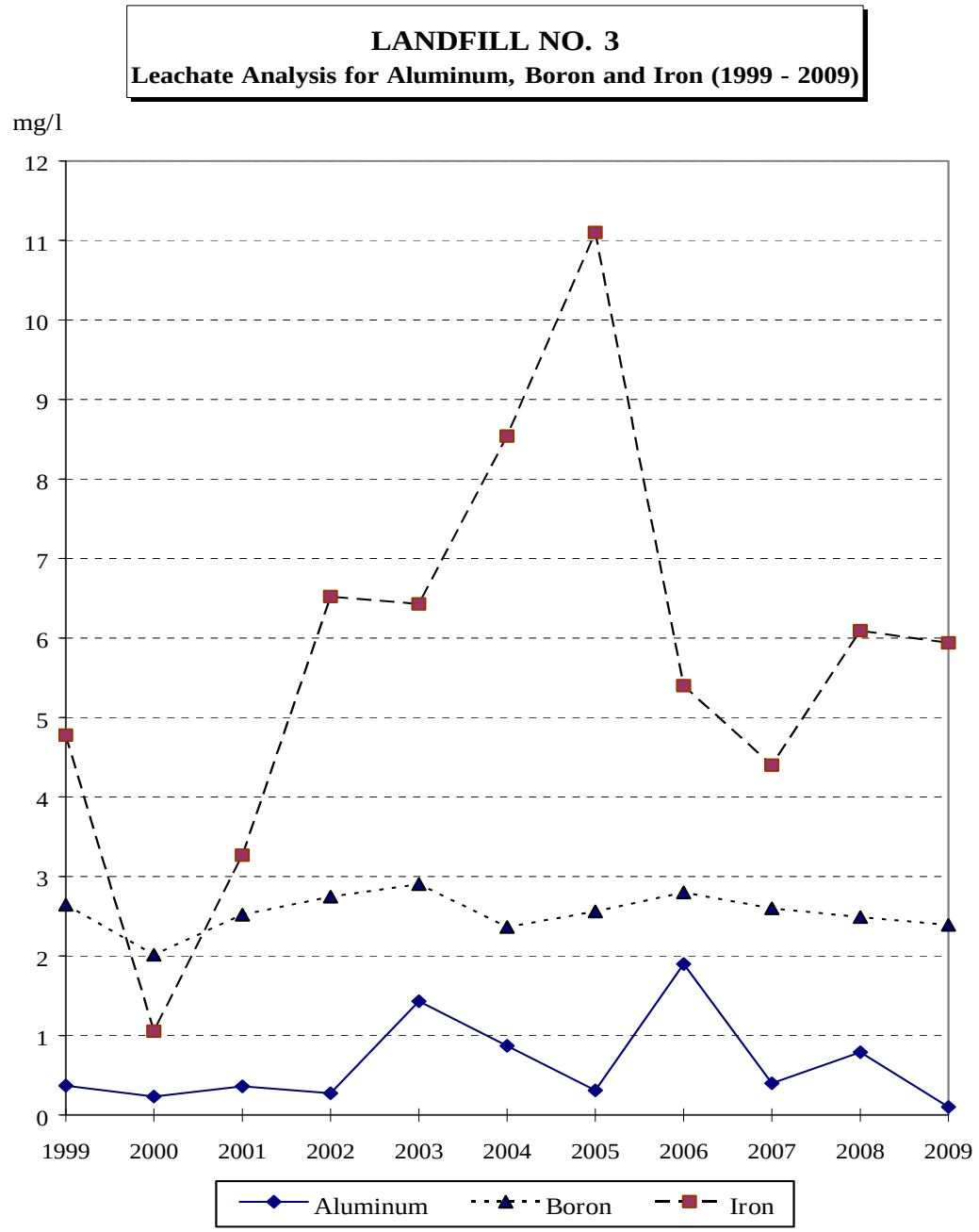


FIGURE 5: LEACHATE ANALYSIS FOR CADMIUM, COPPER, NICKEL, LEAD & ZINC

HISTORICAL DATA

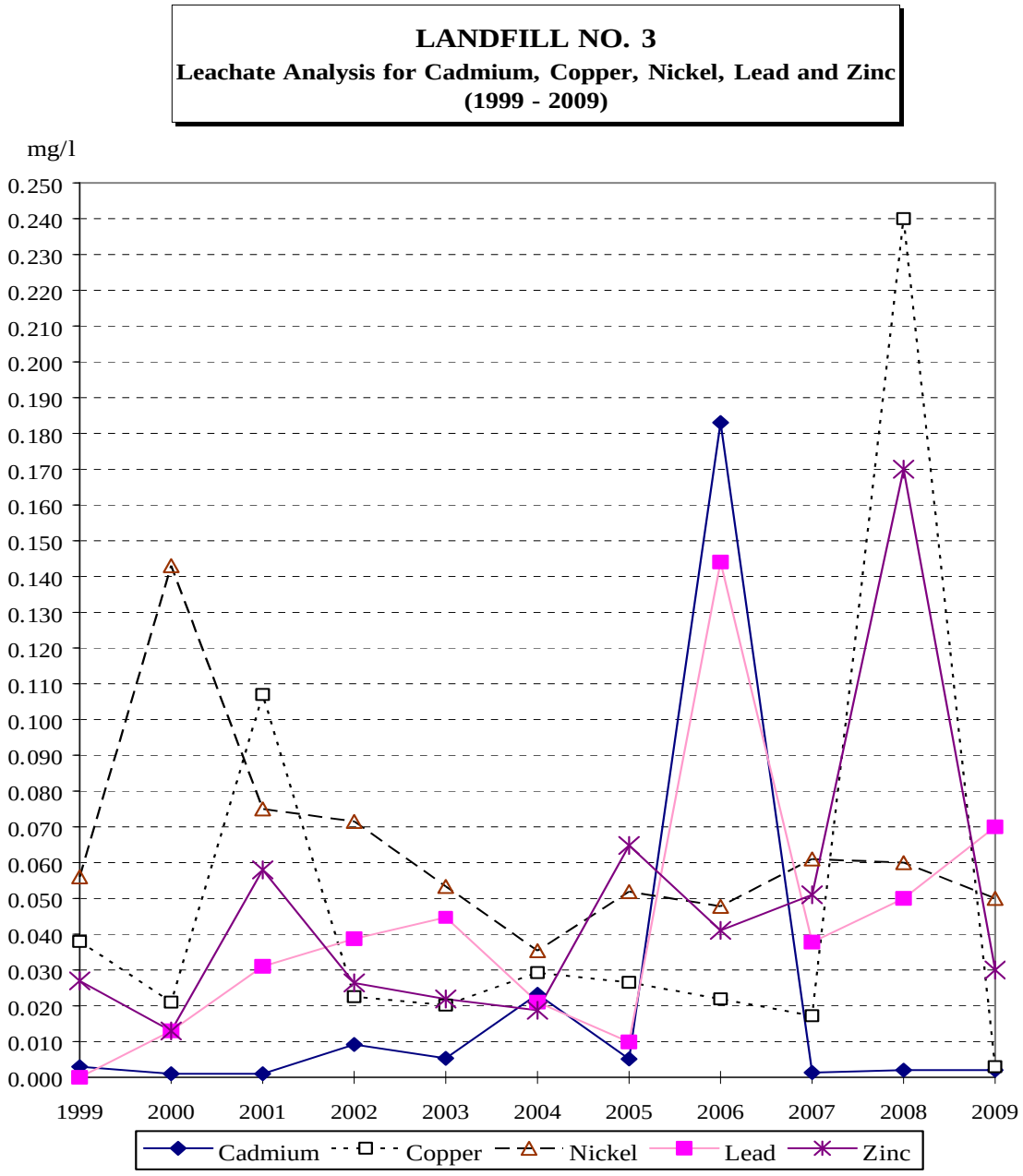


TABLE 4: POSITIVE ORGANIC DETERMINATIONS IN LEACHATE—LANDFILL NO. 3

Group	Compound	May-00	May-01	May-02	Apr-03	May-04	May-05	Apr-06	May-07	Apr-08	Apr-09
11	Hexavalent Chromium (mg/l)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
14	Phenolics (mg/l)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
16	1,1 Dichloroethane (ug/l)	0.8	3.4	2.0	3.5	ND	0.6	1.5	0.7	0.6	ND
	1,4- Dichlorobenzene (ug/l)	1.7	4.5	4.4	2.4	0.4	4.1	4.4	6.0	4.1	5.2
	1,2- Dichlorobenzene (ug/l)	ND	ND	0.9	ND	ND	0.5	0.6	1.0	0.4	0.6
	Dichloromethane (Methylene Chloride) (ug/l)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Chlorobenzene (ug/l)	ND	ND	1.9	0.5	0.1	ND	N/A	N/A	N/A	N/A
	Chloroethane (ug/l)	4.1	19.0	9.9	8.4	0.2	7	6.0	7.8	7.8	ND
	1,3- Dichlorobenzene (ug/l)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Vinyl Chloride (ug/l)	ND	ND	0.5	ND	ND	ND	ND	0.3	ND	0.6
	1,1,1- Trichloroethane (ug/l)	0.2	-	0.2	ND	ND	ND	ND	ND	ND	ND
	Perchlorethylene (ug/l)	-	0.5	ND	N/A	N/A	N/A	N/A	N/A	N/A	N/A
17	Benzene (ug/l)	ND	0.5	3.0	TR	0.2	ND	1.0	5.5	ND	1.2
	Ethylbenzene (ug/l)	ND	ND	10.8	0.9	0.8	ND	1.5	ND	ND	ND
	Toluene (ug/l)	ND	ND	7.3	0.6	0.9	ND	1.3	4.5	ND	1.3
	Styrene (ug/l)	ND	ND	ND	ND	ND	ND	ND	0.9	ND	0.5
	m,p-Xylene (ug/l)	1.8	2.8	34.3	13.1	2.8	1.6	27.1	46.4	ND	4.2
	o-Xylene (ug/l)	0.9	0.9	11.3	2.4	0.8	1.2	4.6	9.8	0.6	5.7
	cis-1,2- Dichloroethene (ug/l)	0.2	0.6	0.4	ND	ND	0.2	ND	ND	ND	ND
	Acetone (ug/l)	11.6	43.6	ND	ND	ND	ND	N/A	N/A	N/A	N/A
17	Methyl-t-butyl Ether (ug/l)	0.5	ND	ND	ND	ND	0.8	N/A	N/A	N/A	N/A
	Methyl Ethyl Ketone (ug/l)	10.8	24.8	ND	20.3	ND	9.0	N/A	N/A	N/A	N/A
19	Bis (2-ethylhexyl) Phthalate (ug/l)	2.4	ND	ND	ND	ND	ND	ND	0.8	ND	ND
	Naphthalene (ug/l)	0.3	5.0	ND	ND	ND	ND	1.0	0.8	ND	0.2
	Acenaphthylene (ug/l)	ND	TR	ND	ND	ND	0.3	ND	ND	ND	ND
	Benzo (a) Pyrene (ug/l)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Benzo (k) Fluoranthene (ug/l)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Dibenzo (a,h) Anthracene (ug/l)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	2- Methylnaphthalene (ug/l)	ND	1.0	ND	ND	ND	ND	N/A	N/A	N/A	N/A
	Phenanthrene (ug/l)	ND	TR	ND	ND	ND	ND	ND	ND	ND	ND

Group	Compound	May-00	May-01	May-02	Apr-03	May-04	May-05	Apr-06	May-07	Apr-08	Apr-09
	Di-N-octyl Phthalate (ug/l)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
19	Diethyl Phthalate (ug/l)	ND	ND	ND	1.7	ND	1.2	0.3	0.4	ND	ND
	1- Methylnaphthalene	ND	TR	ND	ND	ND	ND	N/A	N/A	N/A	N/A
	Fluorene (ug/l)	ND	TR	ND	0.3	ND	0.3	ND	ND	ND	ND
	N-Nitroso-diphenylmanine/Diphenylamine (ug/l)	ND	TR	ND	ND	ND	ND	ND	ND	ND	ND
	Anthracene (ug/l)	ND	ND	N/A	ND	ND	ND	ND	ND	ND	ND
20	m-,p-Cresol (ug/l)	ND	8.9	ND	ND	ND	ND	N/A	N/A	N/A	N/A
	Phenol (ug/l)	ND	TR	ND	ND	ND	ND	ND	ND	ND	ND
	o-Cresol (ug/l)	ND	TR	ND	ND	ND	ND	N/A	N/A	N/A	N/A
	2,4-Dimethylphenol (ug/l)	ND	4.4	6.9	ND	ND	ND	ND	ND	ND	ND

Note: Sampling was taken on April 24, 2008 and April 6, 2009. Pre-2000 results are available upon request from EWSWA.

ND = Below Detection Limits	ug/l = Parts Per Billion
mg/l = Parts Per Million	- = Not Detected
ng/l = Parts Per Trillion	TR = Trace level greater than detection limit,
NA = Not Analyzed	but less than limit of quantification

4.4 LEACHATE SPRINGS

A definition of a leachate spring and leachate stain was developed in 1992, and accepted by the Technical Review Committee, to assist in the description of leachate identified on an outside slope of the Site. For reference, a leachate stain represents discolouration of the soil that extends less than 1.0 metre from its source, while a leachate spring is defined as an active movement of leachate that extends beyond 1.0 metres from its source.

Monthly post-closure inspections completed June through March in addition to weekly post-closure inspections for the months of April and May identified one leachate spring in 2009 and none in 2008. The 2009 spring occurred on the south west corner of Area A4.

4.5 LEACHATE SYSTEM OPERATIONS

The annual hydrogeological monitoring report for the site indicates that the perimeter collection system is controlling leachate levels as designed.

Leachate elevations within the landfill vary across the site. In Areas A1, A2, A4 and C, leachate elevations are generally highest in the central portions of the refuse and decrease toward the perimeter leachate collector system.

Leachate elevations within the refuse generally show stable conditions with minor fluctuations since 2001. Leachate monitors L5 and L6 within Area C, Monitor L12 within Area A2, and Monitor L28-31 within Area A, continue to show slow fluctuating and increasing trends over the long term. The leachate elevations within Areas B1 and B2 continue to show the influence of the refuse underdrains.

The leachate mound within the refuse of Areas A1, A2, A4 and C induces a downward groundwater flow direction. The refuse underdrains in Areas B1 and B2 are effective in maintaining low leachate levels, which induces groundwater movement into the two refuse areas.

During normal operations, the leachate collector system is effective in controlling leachate levels around the perimeter of Areas A1, A2, A4, and C and intercepts leachate moving from the refuse through the soil.

A collector system backfill assessment adjacent to Monitors 22A-II and 18-II was conducted in September 2008 by Genivar Consultants LP. The assessment noted thick soil backfill (>3m) with no detectable odours or evidence of staining within the soil fractures that would be indicative of leachate migration. Genivar concluded that based on their investigation the system was operating as designed.

Ongoing operational modifications to the collector system appear to be effective during 2008 and 2009 and will be continued into 2010 and 2011.

4.6 LEACHATE SYSTEM MAINTENANCE

Condition 3 of the Certificate of Approval required the development of a maintenance and clean-out protocol for the leachate collector system. The protocol requires biennial flushing and vacuuming of the system. This work was carried out in 2008 by Benko

Sewer Systems Ltd. There were no significant problems detected with the system. The system is scheduled to be flushed and cleaned out again in the year 2010.

Pump station repairs and maintenance were carried out as required during 2008 and 2009. This included replacing damaged pumps with spare pumps as required, adjusting floats as required and trouble shooting electrical problems from time to time.

4.7 LEACHATE POND OPERATIONS

There was no odour or other significant problems associated with the operation of the leachate collection pond during 2008 or 2009.

5 MONITORING PROGRAMS

The 2008-09 ground and surface water monitoring program was undertaken in accordance with the terms and conditions in the current Certificate of Approval for the site, as amended by the recommendations contained in the Biennial Monitoring Reports prepared by Genivar and approved biennially by the Technical Review Committee for the site.

Condition 4 of the Certificate of Approval requires that a number of monitoring programs be carried out at the Landfill site. These include monitoring of the ground and surface water, leachate, precipitation and gas. Each of the programs carried out in 2008-09 is described in more detail in the following sections.

5.1 GROUND AND SURFACE WATER MONITORING

Liquid level measurements at ground water monitors are completed semi-annually in February and August. They are also completed prior to monitor purging during the April sampling event. A total of 102 monitors are measured. Select monitors in each hydrostratigraphic unit are tested for general chemical and organic parameters as required.

5.2 LEACHATE MONITORING

Leachate levels within leachate wells are measured on a semi-annual basis and prior to monitor purging during a sampling event. Levels of the parameter leachate collection system are measured monthly. Samples are taken within the perimeter leachate collection system annually and are tested for general and organic parameters as required.

5.3 SURFACE WATER COURSE INSPECTION

Surface water ponds are monitored once per month and field tested for select general chemistry and organic parameters. Periodically the surface water courses and ponds within the Landfill Site No. 3 property boundaries and between the off site monitoring stations are inspected for bank stability, water course blockage, water/soil discolouration and odour, stressed vegetation, refuse and erosion. With the exception of sediment and vegetation build up in some surface water drainage ditch locations, no other areas of concern were noted.

5.4 PRECIPITATION EVENT SURFACE WATER SAMPLING

After each precipitation event of 30 mm or greater during a 24-hour period, three surface water monitoring locations are sampled, where flow is available, and analyzed for select chemical parameters. A maximum of one precipitation event per quarter is carried out with all sampling completed within 8 to 16 hours of achieving 30 mm or greater of precipitation. If the first precipitation event does not generate flow conditions for at least one (1) surface water monitoring station, then monitoring after the next precipitation event greater than 30 mm was attempted. Similarly, if there was not flow conditions after the second precipitation event greater than 30 mm, then monitoring after the third precipitation event was attempted, and so on. However, if at least one (1) surface water monitoring station had flow conditions and was sampled after a precipitation event greater than 30 mm, additional sampling after precipitation events in the same calendar quarter was not required. Precipitation events occurred during each of the four quarters during 2008: January 8, 2008 (31.2 mm), June 3, 2008 (31 mm),

July 2, 2008 (42.4 mm) and November 15, 2008 (36.8 mm). Surface water samples were collected within the required window in each quarter.

In 2009, precipitation events occurred on February 11, 2009 (48.8 mm), May 13, 2009 (35 mm), and August 8, 2009 (37 mm). There was no precipitation event in the fourth quarter of 2009. Surface water samples were collected within the 8-hr to 16-hr window after precipitation events in each quarter.

Surface water quality during 2008 and 2009 complied with the Provincial Water Quality objective for the most part with the exception of some of the naturally occurring heavy metals such as aluminum, iron and total phosphorus. The elevated chemical concentrations detected within the surface water in 2008 and 2009 typically occurred in the summer or fall when sediment loading within the surface water is greatest. In summary, the elevated chemical concentrations detected are attributed to native soil erosion, natural concentration and/or run off from local agricultural land. A landfill leachate effect of surface water quality was not identified.

5.5 SEDIMENT SAMPLING

Sediment samples were collected from within the sediment traps located at the base of the watercourses at each of the surface water monitoring stations in May 2008, as well as from the additional sediment traps located at the mouth of the Stormwater Retention Pond (SW26) and at the northeast inlet to the southwest Retention Pond (SW27). However, there was insufficient sediment sample volume at station SW4, therefore, samples were collected in April and May and collated to create one sample for laboratory submission. As recommended in the 2006/2007 Biennial Monitoring Program Report sediment samples were collected in the fall of 2008. However, upon delivery at the laboratory the sample jars for PC8 and SW26 was discovered to be broken. In response, supplemental samples were also collected in November 2008. Insufficient sample volume was available in the sediment trap at PC8 for collection and, therefore, could not be analyzed.

Sediment samples were collected from within the sediment traps at SW4, PC8, SW25, SW26, and SW27 in April 2009. Owing to insufficient sample volume at station SW4,

samples were collected in April, May, and June 2009 and collated to create one sample for laboratory analysis. Upon arrival at the laboratory, the sample jar for SW26 was discovered to be broken and, therefore, not analyzed. A supplemental sediment sample for SW26 was collected in May and June and collated to create one sample for laboratory submission. Insufficient sediment volume was available in the fall of 2009.

In general, sediment quality during 2008 and 2009 is within the historic range of analyte concentrations for each respective monitoring station. Exceptions occurred at least once during 2008/2009 for the following: 1) boron at station SW4; and 2) copper, phosphorus, and nickel at station SW25. Variations are attributed to the natural heterogeneity of sediment.

Based on the time-concentration graphs for chromium, copper, nickel, phosphorus, zinc, and sodium as presented in Figures F-1 to F-6, Appendix F, most concentrations fluctuated and increased between 1997 and early 2007, then decreased to historic concentrations through 2008 and 2009. This pattern occurred at each sediment station: SW4, SW8, and SW25. Sediment station SW4 is located close to the influence of the refuse (Area C) and the recent site cap remediation construction activities (Area C). The sediment quality at station SW4 is similar to the sediment quality at stations SW8 and SW25, which are distantly removed from the waste areas with leachate mounds or from the waste areas overall, respectively. Therefore, the detected metals concentrations within the sediment at stations SW4, SW8, and SW25 are likely representative of normal sediment quality or effects of cap remediation activities from 2004 to 2007 and 2009 and do not represent a landfill leachate related impact.

Parameter concentrations for sediment samples collected from supplemental stations SW26 and SW27 were compared to sediment samples collected from their downstream locations at SW25 and SW8, respectively. Sediment quality typically shows improvement at downstream locations which confirmed the effectiveness of the sedimentation/retention ponds.

Within the sediment samples, chromium, copper, iron and nickel typically exceeded their respective NBLs or LELs in 2008 and 2009. Occasional exceedances for aluminum, cadmium, cobalt, lead, manganese and zinc are also noted. No parameters exceeded the Severe Effect Level (SEL) in 2008/2009.

5.6 GAS MONITORING

Field measurements for combustible gas, oxygen content and pressure were taken from all soil air monitors, designated as 1-10 situated along the periphery of the site. Monitors designated 5, 6, 7 were damaged and as a result measurements could not be obtained. Monitoring for combustible gas and pressure measurement in 2008 was conducted on February 13th and August 30th and in 2009 on February 17th and August 31st. The concentrations of combustible gas were below the MOE acceptable level of 5% Methane by volume. The results indicate that methane is not migrating through the perimeter soil at the site.

TABLE 5: GAS MONITORING PROGRAM: PERCENT COMBUSTIBLE GAS & OXYGEN

	COMBUSTIBLE GAS (Percent LEL)														
MONTH/YR → MONITOR ↓	AU 02	FE 03	AU 03	FE 04	AU 04	FE 05	AU 05	FE 06	AU 06	FE 07	AU 07	FE 08	AU 08	FE 09	AU 09
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.05	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.35	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	N/A	N/A	N/A
7	0.0	N/A	N/A	0.0	0.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Combustible Gas Measurements 1-10 represent percent Methane by volume. The lower explosive limit is 5% Methane by volume. MOE standard states that levels below 20% LEL (5% Methane by volume) are not a concern.															
	OXYGEN CONTENT (Percent)														
MONTH/YR → MONITOR ↓	AU 02	FE 03	AU 03	FE 04	AU 04	FE 05	AU 05	FE 06	AU 06	FE 07	AU 07	FE 08	AU 08	FE 09	AU 09
1	19.1	20.1	N/A	21.7	20.8	21.4	21.5	21.3	20.9	18.6	19.0	20.9	18.7	20.7	20.8
2	19.6	20.2	N/A	21.8	20.9	21.6	21.4	20.9	20.8	20.8	19.1	20.9	N/A	20.5	20.5
3	19.5	20.6	N/A	17.4	18.2	20.9	20.9	20.9	20.8	17.2	18.7	16.2	19.3	20.4	20.5
4	17.5	20.1	N/A	21.6	21.2	20.8	20.9	20.7	20.7	20.8	18.3	20.9	18.7	20.7	20.7
5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	20.2	19.8	N/A	21.6	20.7	21.1	21.0	21.6	20.1	20.8	19.5	N/A	N/A	N/A	N/A
7	19.6	N/A	N/A	21.6	22.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	18.2	20.3	N/A	21.6	21.3	21.6	21.4	20.9	20.1	15.8	18.3	20.9	19.5	20.5	20.5
9	20.0	20.5	N/A	21.3	21.1	21.2	21.1	20.8	20.2	19.7	19.7	20.9	19.7	20.5	20.5
10	19.6	20.4	N/A	23.3	22.2	21.4	21.4	20.9	20.3	19.8	19.4	20.9	19.0	20.7	20.5
Pre-2002 results are available at EWSWA											N/A = Not Analyzed				

Testing Dates for 2008 were February 13th & August 30th; for 2009 February 17th and August 31st.

TABLE 6: GAS MONITORING, PRESSURE

MONTH/YR → MONITOR ↓	PRESSURE kPa (kilopascal)										
	AUG 04	FEB 05	AUG 05	FE 06	AU 06	FE 07	AU 07	FE 08	AU 08	FE 09	AU 09
1	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	0.000	0.00	0.00	0.00	0.00	0.00	0.00	N/A	N/A	N/A	N/A
7	0.000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: Pre-2004 results are available at EWSWA; the 2008 monitoring was completed February 13th & August 30th; for 2009 February 17th and August 31st. N/A – indicates measurements were not taken

5.7 VEGETATION AND BIOLOGICAL MONITORING

Routine monitoring of the cap vegetation and plantings carried out as part of the Closure and End Use Plan was carried out by EWSWA staff in 2008 & 2009. Vegetation on the site for the most part was in good health with the exception of the Ash and Elm trees located throughout the Landfill. Many of the Ash trees show signs of infestation with the Emerald Ash Borer and these trees were either dead or will likely die. The remaining Elm trees located on the Landfill site appear to be dieing off as a result of Dutch Elm Disease. In The Biological Inventory report carried out in 2002, and reported in Section 5.7 of the 2002 Annual Report, contained the following recommendation:

> *Increase habitat complexity in the stormwater management pond by introducing brush islands, submersed tree crowns, large island boulders and rock strips.*

In 2005 a number of Elm trees killed by Dutch Elm Disease and Ash trees killed by the Emerald Ash Borer located along the north edge of Area A1 were pulled out, root ball and all, and placed into the stormwater retention pond to create fish habitat and bird roosting sights as recommended in the Biological Inventory report. Brush islands with the branches of the dead trees were also built at various locations around the site to create breeding habitat for the Butler's Garter Snake, a species of Special Concern in Essex County that was identified as breeding on the site during the Biological Inventory, and to provide cover and perch sights for Eastern Bluebird, Horned Lark, Grasshopper Sparrow and other grassland birds that have been recorded as breeding on the site. A breeding bird survey of the landfill in 2005 identified 40 species of birds breeding at Landfill Site No. 3 including an out of range breeding pair of Dickcissels, a species that normally breeds in the prairie grass regions of south-western Manitoba and the first such record for Essex County in over 30 years.

The Biological Inventory also assesses the diversity and abundance of both the fish and benthic invertebrate community including aquatic and terrestrial vegetation of the EWSWA Landfill No. 3 Stormwater Management Facility. The results of the Aquatic Assessment established that general water quality, such as pH, and the daytime dissolved oxygen concentrations in the stormwater pond (SWP) were satisfactory and within safe guideline levels for aquatic life, however, the concentrations of suspended solids (pond turbidity) was considerably elevated. Fauna and flora inventory results revealed relatively little benthic invertebrate diversity and abundance, including a limited population of submergent and emergent aquatic vegetation. This condition was primarily attributed to excessive turbidity; a result of both physical and biological factors affected the pond. It was concluded that the excessive turbidity and limited plant/invertebrate diversity and abundance was a combination of both biological and physical factors, but primarily the result of the foregoing behaviour of Gizzard Shad and Common Carp – both very undesirable species for a stormwater pond.

In order to establish a healthy aquatic community with reduced turbidity and improve water quality, it was recommended that a culling program should be implemented to remove the overly abundant Gizzard Shad and Common Carp from the Stormwater

Pond. In 2006 and 2007, Leadley Environmental Corp. was commissioned to carry out the cull. It is estimated that over one thousand target species were removed from the pond but considering the relatively large size of the stormwater facility, there likely remains a large number of undesirable fish species still occupying the Stormwater Pond. The cull program was not carried out in either 2008 or 2009.

5.8 LEACHATE LEVEL MONITORING

Condition 3 of the Certificate of Approval requires that the leachate collection system be operated in such a manner as to minimize the leachate levels within the landfill. To ensure compliance with this condition leachate level monitoring is undertaken on a monthly basis in all maintenance holes and pump stations on the perimeter leachate collection system. Leachate level monitoring is also performed at a series of monitors installed at four locations around the perimeter of the landfill to assist with an assessment of the effectiveness of the system.

For most of 2008 and 2009 the leachate collection system operated as designed.

In 2008 there were two localized surcharge events noted. Also, two localized surcharge events were noted in 2009. In 2008, the first event was during April at PS6 and the second event was during March when lightning struck PS5. The electrical panel for PS5 was reconstructed by Phasor Industrial and leachate was managed using a 3-inch trash pump on a day-by-day basis. In 2009, the first event was during February at PS6 and the second event was in March at PS6. In all cases the surcharge events were short term in nature 24 hours or less and where required additional pumps were brought in to maintain leachate levels.

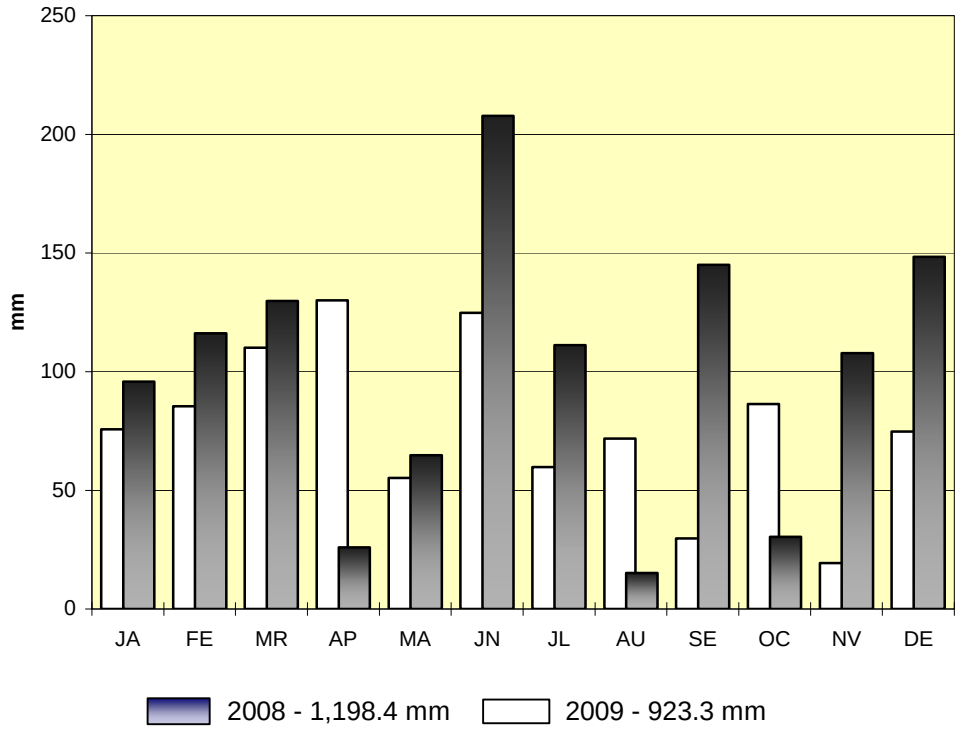
5.9 PRECIPITATION MONITORING

The total precipitation received at the Site in 2008 was 1,198.4 mm and 923.3 mm in 2009. The monthly precipitation rates are shown in Table 7 and Figure 6.

TABLE 7: PRECIPITATION

	2009	2008	2007	2006	2005	2004
JANUARY	75.7	95.8	102.2	69.9	96.8	34.6
FEBRUARY	85.4	116.2	34.4	52.9	68.25	19.2
MARCH	110.1	129.8	82.4	56.7	8.45	79.6
APRIL	130.1	26.0	67.2	36.7	87.0	34.4
MAY	55.2	64.8	68.4	89.6	28.2	179.6
JUNE	124.8	207.8	86.8	110.6	29.8	118.8
JULY	59.8	111.2	30.0	209.1	149.2	123.4
AUGUST	71.8	15.2	154.6	81.5	55.25	127.0
SEPTEMBER	29.8	145.0	41.6	94.0	83.2	17.9
OCTOBER	86.4	30.4	56.8	141.7	22.0	55.8
NOVEMBER	19.4	107.8	69.8	130.9	82.75	93.0
DECEMBER	74.8	148.4	104.0	60.9	62.2	47.0
TOTAL (mm)	**923.3**	**1198.4**	**898.2**	**1134.5**	**773.1**	**930.3**

FIGURE 6: 2008/2009 PRECIPITATION COMPARISON



6 INTERPRETATION AND REPORTING

A summary of the conclusions noted in the Essex County Landfill No. 3 2008/2009 Biennial Monitoring Program Report prepared by Genivar Consultants LP are as follows:

- Leachate elevations within the refuse show stable conditions with minor fluctuations since 2001. Exceptions occurred at Monitors L5, L6, L7, L12, L28-VI, where leachate elevations continue to fluctuate and increase in the long term. The leachate elevations within Areas B1 and B2 continue to show the influences of the refuse underdrains. Although improvements to on-site drainage and the cover material over the perimeter leachate collector system have had a positive effect on controlling leachate generation, leachate generation increased in 2008/2009 compared to 2006/2007.

- The leachate mound within the refuse of Areas A1, A2, A4, and C induces a downward groundwater flow direction and refuse underdrains in Areas B1 and B2 are effective in maintaining low leachate levels, which induce groundwater movement into the two refuse areas.

- During normal operations, the leachate collector system is effective in controlling leachate levels around the perimeter of Areas A1, A2, A4, and C and intercepts leachate moving from the refuse through the soil. Historic, periodic leachate surcharges of the system have affected groundwater quality at some locations. Ongoing operational modifications to the collector system continue to be effective during 2008 and 2009, and should be continued into 2010 and 2011.

- Within the collector system, the leachate chemical concentrations fluctuate as a result of natural leachate quality variability and the infiltration of precipitation and surface water. Organic chemicals detected within the leachate in 2008 and 2009 were historically detected.

- Leachate is slowly moving downward from the refuse in Area A1 into the underlying upper aquitard. Based on available data, elevated chemical concentrations occur to a depth of about 1m to 2m below the soil/refuse interface. Continued monitoring of groundwater quality below the refuse is recommended to assess predicted solute migration rates. The implementation of remedial measures is not recommended at this time.

- The general groundwater flow direction for the overburden continues to be in a northerly direction. The flow direction of the shallow flow system is influenced locally by the landfill leachate collector system and watercourses such as the Puce River and the Concession 4 drainage ditch.

- Groundwater quality within the shallow flow system and upper aquitard is naturally poor. Groundwater quality within the shallow flow system is typically influenced by the infiltration of precipitation through soil fractures. Where soil fractures are less frequent, such as within the upper aquitard, groundwater quality is naturally more mineralized. The groundwater quality at most monitoring wells is not affected by the landfill leachate and historic leachate effects on groundwater are improving.

- Groundwater quality within the interbedded zone is naturally poor. Elevated concentrations occur upgradient (south), downgradient (north), and laterally removed from the landfill, but no patterns or trends indicative of landfill leachate contamination are apparent

- At select locations at the site, groundwater quality may potentially be affected by the landfill likely as a result of the historic perimeter leachate collector system surcharge events. Select Ministry of the Environment Guideline B-7 (MOE, 1994) criteria for the reasonable use of groundwater were exceeded at Monitor Locations 22A, 25, 28, and 47 during 2008 and/or 2009. Groundwater in the areas of Monitor Locations 25 and 28 is induced to move toward the landfill and leachate collection system in Area

B1. The poor groundwater quality south of Area C is limited to Monitor Location 22A. The groundwater quality at Monitor Location 47 is improving since 2001.

- It is anticipated that the groundwater quality at Monitor Locations 22A, 25, 28, and 47 will improve or continue to improve over time with the inward hydraulic gradients towards the perimeter collector system. The inward hydraulic gradients are expected to persist in the future as a result of the operational modifications completed by the Waste Authority and with continued landfill maintenance activities for the leachate collector system.

- Flow rates within the watercourses and at pond outlets are precipitation dependent. A continual landfill leachate effect on surface water quality within the Standish Drain or Standish Drain Diversion was not detected in 2008 or 2009. Surface water quality changes are related to soil erosion, natural concentrations, and/or runoff from local agricultural land.

- Consistent with historic findings, a continual landfill leachate effect on the sediment quality within the water course ditch base upstream to the Standish Drain Diversion or the Standish Drain was not detected in 2008 or 2009. The 2008/2009 detected concentrations are within their respective historical ranges and indicate a general decrease since the elevated concentrations detected in 2006/2007. Also, the detected metal concentrations within the sediment at stations SW4, SW8, and SW25 are similar to each other and are likely representative of normal sediment quality for the site and do not represent a landfill leachate related impact. Supplemental sediment sampling completed in 2008/2009 confirmed that the sedimentation/retention ponds are effective in reducing sediment related influences to surface water quality that is discharged from the landfill site.

The recommendations noted in the Essex County Landfill No. 3 2008/2009 Biennial Monitoring Program Report prepared by Genivar Consultants LP are as follows:

- The proactive use of a portable large-volume transfer pump should continue to be used during the non-operational periods of pumping stations to limit the occurrence, duration, and extent of surcharge events within the perimeter collector system.
- The improved maintenance and cleaning programs for the waste underdrains in Areas B1 and B2 should be continued on a regular basis.
- Continue with the ongoing refuse cap and surface water drainage improvements to reduce leachate generation.
- Remove the obstructions in Monitors 12-I and 33-II.
- Monitor 25-I is compromised with bentonite and should be decommissioned and reinstalled as Monitor 25A-I.
- Complete the 2010/2011 Monitoring Program with the modifications as outlined in the 2008/2009 Monitoring Program.

_____	_____
MR. RALPH REISER	MR. ELI MAODUS
Waste Disposal Manager	*Acting General Manager*

Report prepared by
MARGARET SHIRES, Administrative Assistant, Essex-Windsor Solid Waste Authority

Appendix A

- Site Map

Appendix B

- Post Closure Maintenance and Inspection Reports