HSP Engineering and Environmental Services

2004 ANNUAL MONITORING REPORT
MOUNTAIN LANDFILL
TOWNSHIP OF NORTH DUNDAS

For:	Township of North Dundas P.O. Box 489 Winchester, ON K0C 2K0
By:	HSP Inc. 103 Warner Drive Long Sault, ON K0C 1P0
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EXECUTIVE SUMMARY

The Mountain Landfill Site monitoring network currently exists of 8 overburden/shallow bedrock monitoring wells and five deeper bedrock monitoring wells. Groundwater samples were collected and static groundwater levels were measured during two field programs in June and November 2004. Hydraulic conductivity testing was completed on several of the downgradient wells in November 2004.

Groundwater flow in the shallow bedrock/overburden aquifer near the landfill is generally towards the north/northeast. The local hydraulic gradient in the overburden/shallow bedrock aquifer ranged from 0.007 to 0.01 meters per meter in the fall and spring respectively. The groundwater velocity through this unit was found to exceed 65 meters per year (from hydraulic conductivity testing)

The results of the 2004 groundwater monitoring program continue to indicate that a weak leachate contaminant plume which has been present in the overburden/shallow bedrock groundwater regime is moving vertically to the deeper bedrock groundwater aquifer as it is moving downgradient to the north/northeast. The plume is characterized by elevated concentrations of most leachate indicator parameters including chloride, sodium, sulphate, conductivity, TDS, DOC and COD.

The 2004 results show that concentrations of several non-health related parameters continue to be found at concentrations in excess of the RULs in the monitor located near the northern perimeter of the property currently owned by the Township. As these wells are close to the site boundary, there may be exceedances off-site.

Based on the results of the 2004 landfill monitoring program, it has been recommended that waste should continue to be deposited as far from the downgradient boundary as practicable. The Township should consider acquiring additional downgradient lands or a groundwater easement to the north of the landfill to serve as an extension of the current landfill leachate attenuation zone.

The Operation and Development Plan should be updated to reflect the current waste disposal rates and practices and to include a final waste pile elevation. This will allow the calculation of the volume of additional waste that can be disposed of at the site.

To more accurately determine the quantity of waste currently deposited and the remaining site capacity, a topographical survey of the entire landfill site, which has been in operation now for close to 45 years, should be completed.

The collection of groundwater samples and static water level data should continue twice per year, in the spring and fall, from the existing 13 individual monitoring wells. Groundwater should be analysed for the same parameters as in 2004.

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INDEX

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TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

1.1 Background

This report documents the 2004 groundwater and surface water monitoring results as well as interpretations, conclusions and recommendations for the Township of North Dundas Mountain Landfill facility. This landfill site is located on Lot 11, Concession IV in the Township of North Dundas (formerly Mountain Township), on Cameron Road, approximately four kilometers west of the Hamlet of Inkerman and ten kilometres southwest of the Village of Winchester (Figure 1).

1.2 Previous Studies

Dillon Consulting Engineers & Planners Limited (Dillon) prepared a Site Development and Operations Plan for the Mountain Township Landfill in 1992.

In 1992/1993 a hydrogeological investigation of the site was completed by Golder Associates Limited (GAL) and a report providing the results of the investigation and recommendations for groundwater and surface water monitoring was prepared in 1993.

Oliver, Mangione, McCalla & Associates (OMM), (a division of TROW Associates Inc.) and TROW Associates Inc. (TROW) completed annual groundwater and surface water monitoring at this site from 1998 to 2003. This report is a continuation of the annual summary reports that have been prepared for this site by others since 1993. These previous reports document the site geology and hydrogeology as well as the monitoring well network and installation sequence.

1.3 Description of Work

Two field programs were completed in June and November 2004. During the field programs, groundwater samples were collected for laboratory analyses and static groundwater levels were measured. Field parameters, such as pH, temperature and conductivity were also measured on the groundwater samples.

More specifically the work carried out during 2004 included the following:

- On two occasions, during June and November 2004, static groundwater levels were measured from the 13 available monitoring wells. Groundwater monitoring well locations are shown in Figure 2.

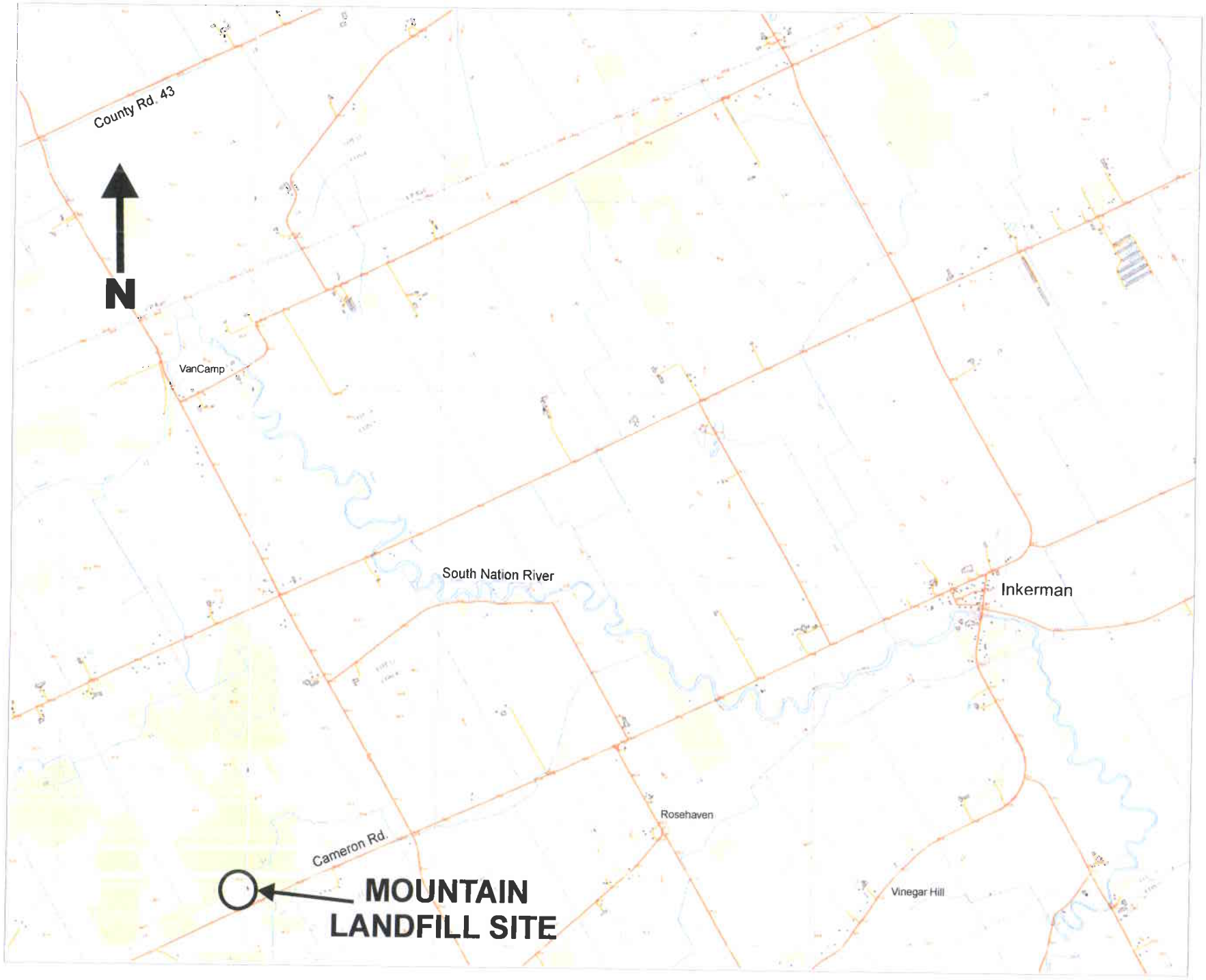
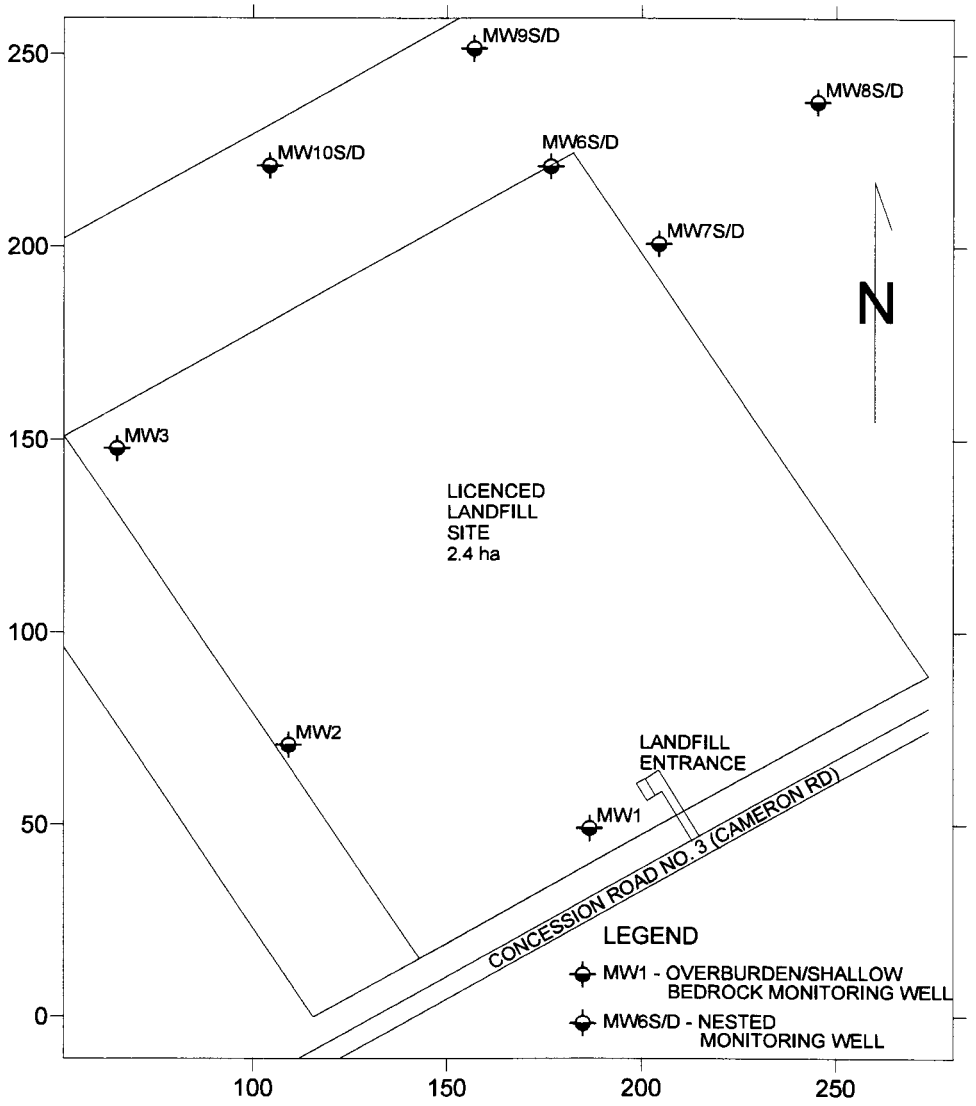


FIGURE 1: MOUNTAIN LANDFILL SITE LOCATION PLAN

Landfill Monitoring Network



Township of North Dundas Mountain Road Landfill

Figure 2

- On two occasions, during June and November 2004, groundwater samples were collected from the 13 available monitoring wells and submitted to a certified environmental laboratory for detailed chemical analyses. The laboratory analyses are attached in Appendix 3.0 and the interpretations of the groundwater quality results are discussed in Section 5.0 of this report.

- Hydraulic conductivity testing was completed on downstream monitoring wells during the November 2004 field program.

- The data collected in 2004 was interpreted to determine the magnitude and extent of impact of the waste deposition on the quality of the groundwater at the site. Compliance of the site with respect to the MOE regulations and policies regarding groundwater is also addressed and recommendations for future monitoring of the site are provided.

- The operation of the site pertaining to waste volumes, site capacity and other operational issues has been evaluated and is discussed in Section 8.0 of this report.

2.0 SITE DESCRIPTION

2.1 Site Location and History

The Mountain Landfill site is located on Lot 11, Concession IV in the Township of North Dundas (formerly Mountain Township). It is located on Cameron Road approximately four kilometers west of the Hamlet of Inkerman and ten kilometres southwest of the Village of Winchester (Figure 1). Several municipalities, including Mountain Township amalgamated in 1998 to form the new Township of North Dundas. The Mountain landfill was the primary waste disposal facility for the Township of Mountain prior to amalgamation. Since amalgamation, most of the Township of North Dundas waste has been directed to the Boyne Road Landfill facility.

The licensed landfill property is 4.6 hectares (11.4 acres) in size with the area licensed for waste disposal being 2.4 hectares (5.9 acres) in size. The landfill site is bound by Township owned land on the north, east and west sides and Cameron Road to the immediate south.

The Mountain Landfill site has been licensed for waste disposal since 1960 under a Provisional Certificate of Approval. In January 1998, a new Provisional Certificate of Approval (A481702) was issued. The Provisional Certificate of Approval permits the transfer and processing of recyclables, which took place at the facility prior to the municipal amalgamation. All recyclable material is currently delivered to the Boyne Road Landfill for processing. Copies of the Certificate of Approval and amendments are attached in Appendix 1.0.

2.2 Site Physiography & Drainage, Geology and Hydrogeology

The most recently submitted annual report for the year 2003, dated March 2004, can be referenced for background information with respect to the site physiography, drainage, geology, and hydrogeology.

3.0 LANDFILL MONITORING NETWORK

3.1 Monitoring Wells

There are currently eight (8) groundwater monitoring well locations at the Mountain landfill site. Some of the locations comprise wells which are grouped as networks (i.e. MW6S/D) indicating that there are two (2) wells in these locations, one shallow and one deep well. The total number of monitoring wells for sampling is thirteen (13). The location of the wells is presented in Figure 2. The monitors are listed below:

Background Well:	MW1
Downgradient Wells:	MW2, MW3, MW6S/6D, MW7S/7D, MW8S/8D, MW9S/9D, MW10S/10D,
Abandoned Wells:	MW4, MW5

The most recently submitted annual report for the year 2003, dated March 2004, can be referenced for background information with respect to the groundwater monitoring well network installation.

Borehole logs for the monitoring wells are attached in Appendix 2.0.

4.0 GROUNDWATER FLOW

4.1 Horizontal Groundwater Flow

The direction and gradient of the groundwater flow at the site is monitored through the measurement of static groundwater elevations at the individual monitoring wells. Static groundwater levels were measured at the thirteen currently existing monitoring wells in June 2004 and November 2004. The calculated groundwater levels for 2004 and previous years are indicated in Table 1.

Table 1: Groundwater Levels

Well No.	Top of Peizo-meter (m)*	Static Water Level Elevations (m)											
		Aug-99	Jan-00	May-00	Nov-00	Jun-01	Nov-01	May-02	Nov-02	Jun-03	Dec-03	Jun-04	Nov-04
MW1	99.04	96.53	Frozen	Flowing	96.59	97.73	97.34	98.74	97.44	98.71	flowing	98.32	97.81
MW2	99.37	95.86	97.70	97.93	96.04	96.94	96.04	97.47	na	97.52	97.50	97.39	97.09
MW3	98.88	95.65	97.15	97.30	95.94	96.65	95.87	97.08	95.67	96.98	97.21	96.98	96.89
MW4	98.48	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
MW5	unknown	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
MW6S	98.54	95.39	96.78	96.59	95.62	96.22	95.67	96.54	95.44	96.54	96.70	96.44	96.55
MW6D	98.57	94.26	95.36	95.60	94.04	94.98	93.51	95.27	93.40	95.07	95.55	94.87	94.95
MW7S	97.5	95.59	96.28	96.33	95.77	96.09	95.75	96.20	95.65	96.21	96.21	96.25	96.23
MW7D	97.51	95.11	96.06	96.08	95.14	95.60	95.21	95.91	95.32	95.91	96.01	95.56	95.93
MW8S	97.15	na	na	na	na	na	na	96.26	96.35	96.26	96.35	96.10	96.2
MW8D	97.15	na	na	na	na	na	na	95.87	95.94	95.87	95.94	95.30	95.8
MW9S	98.62	na	na	na	na	na	na	96.55	96.71	96.55	96.71	96.37	96.48
MW9D	98.62	na	na	na	na	na	na	95.91	96.76	95.91	96.76	95.77	96.98
MW10S	98.28	na	na	na	na	na	na	96.60	96.76	96.60	96.76	96.34	96.58
MW10D	98.28	na	na	na	na	na	na	96.73	96.72	96.73	96.72	96.38	96.58

*Relative Elevation of Top of Peizometer (TROW) (non-geodetic)
na = not applicable
ns = not sampled because well was destroyed

The groundwater static level data indicates that groundwater flows through both the overburden and shallow bedrock deposits in the immediate vicinity of the landfill site. Flow through the overburden deposits is intermittent and dependent upon precipitation.

The 2004 static groundwater level data was used to construct hydraulic equipotential contour plots for the June and November 2004 data (Figures 3 and 4). The data indicates that groundwater flow in the shallow overburden aquifer is generally to the north/northeast. Hydraulic gradients of 0.010 meters/meter and 0.007 meters/meter were calculated using the June and November 2004 data respectively. The average water table was at approximately the same elevation in November 2004 as compared to June 2004.

A previous attempt in 1993 by others to measure hydraulic conductivity through slug tests was unsuccessful due to the extremely rapid recovery in the wells. It had been concluded at that time that the horizontal hydraulic conductivity of the fractured bedrock exceeded 10^{-3} cm/sec and that the groundwater velocities in this unit likely exceed 25 meters per year. To determine a more accurate figure for groundwater velocity, hydraulic conductivity testing was completed in November 2004 on several of the downgradient wells.

Hydraulic conductivity testing on downstream wells MW10S and MW9S provided measurements of 1.47×10^{-3} cm/sec and $> 4.21 \times 10^{-3}$ cm/sec respectively at these two shallow bedrock wells.

An estimate of the linear average groundwater velocity (or contaminant migrational rate, considering only advective transport and neglecting the dispersion factor) in the shallow bedrock unit can be calculated from the following formula:

$$V = \frac{Ki}{n_e}$$

where, V = linear groundwater velocity,
K = hydraulic conductivity,
i = hydraulic gradient, and
n_e = effective porosity

The hydraulic gradient was calculated from the November 2004 groundwater flow data to be 0.007 meters/meter.

Using the above hydraulic conductivity measurements and an effective porosity of 0.05 for limestone, the groundwater linear flow velocity within the shallow bedrock unit was calculated to be 65 m/year and > 186 m/year respectively for MW10S and MW9S.

Measurements on the deep wells indicated very differing results between wells. The hydraulic conductivity on deeper bedrock well MW10D was found to be similar to the shallow wells measured, at 9.21×10^{-4} cm/sec, indicating a high groundwater velocity in the vicinity of this well; however

Equipotential Contour Plot
June 2004

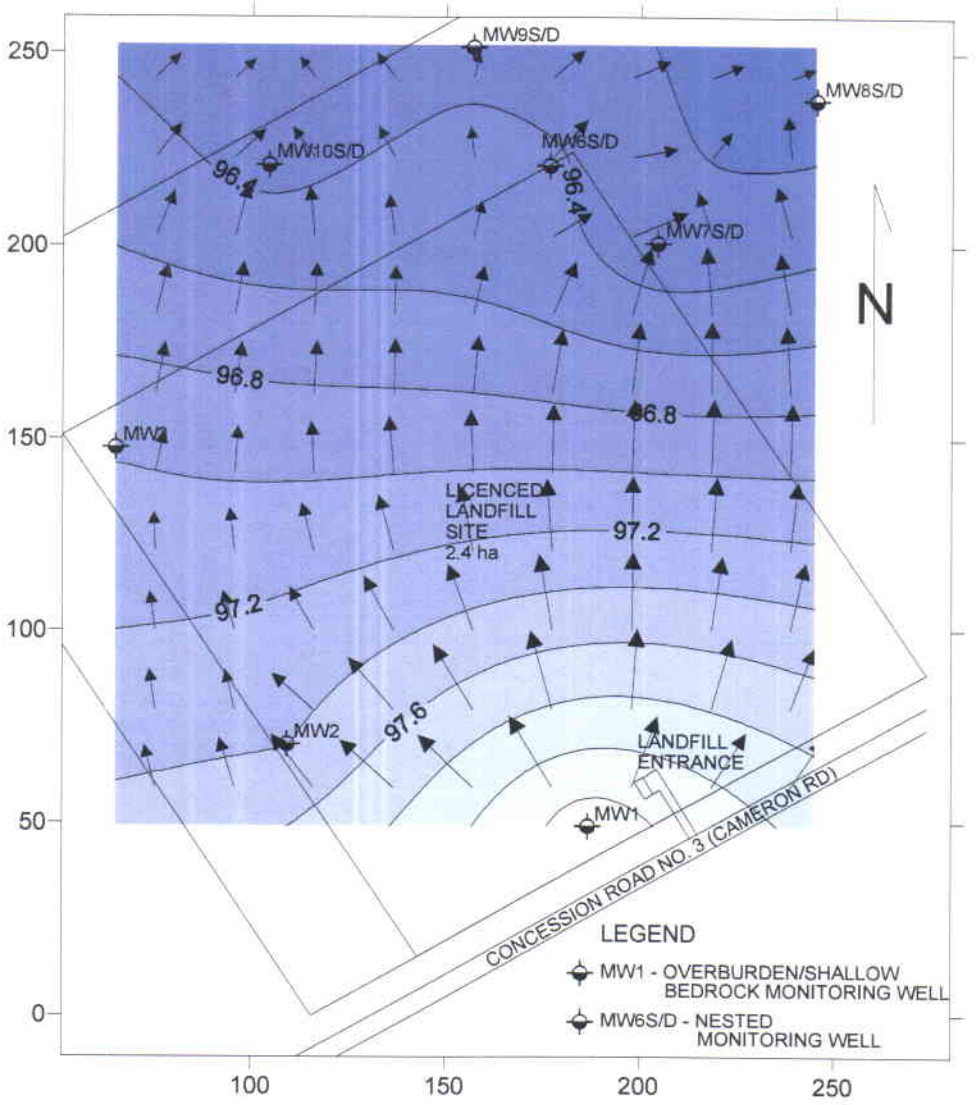


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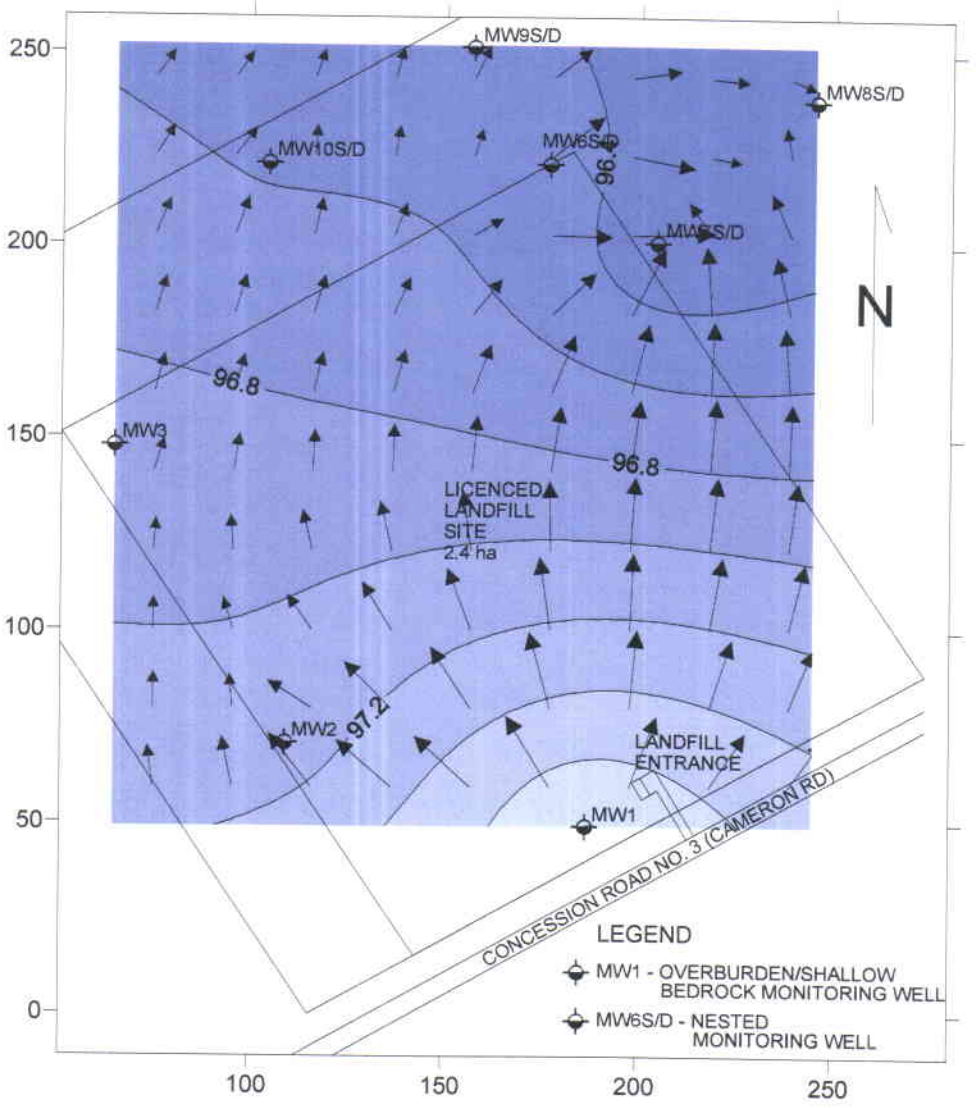
Figure 3

Equipotential Contour Plot
November 2004



Township of North Dundas Mountain Road Landfill

Figure 4

the hydraulic conductivity results at MW9D and MW8D were three orders of magnitude lower at 1.67 x 10^{-6} cm/sec and 7.34 x 10^{-7} cm/sec respectively. Groundwater flow velocity in the deep bedrock in the vicinity of these wells is therefore considerably lower than in the shallow bedrock.

The hydraulic conductivity calculations are provided in Appendix 4.0.

4.2 Vertical Groundwater Flow

The construction of the multilevel bedrock monitoring wells (MW6S/D and MW7S/D in 1999 and MW8S/D, MW9S/D and MW10S/D in 2002) has enabled an evaluation of the vertical gradients between the overburden/shallow bedrock and the deeper bedrock deposits. The table below summarizes the vertical hydraulic gradients measured at each of the five well nest locations in 2004 and previous years. The negative values indicate an upward gradient. The groundwater static level data since 1999 indicates that downward hydraulic gradients exist at most locations with the exception of MW9 S/D where an upward gradient exists in the fall and MW10S/D where an upward gradient exists in the spring.

TABLE 2: Groundwater Vertical Hydraulic Gradients

Well Nest	Vertical Hydraulic Gradient (meters/ meter)											
	Aug -99	Jan -00	May -00	Nov -00	Jun -01	Nov -01	May -02	Nov -02	Jun -03	Dec -03	Jun -04	Nov -04
MW6S/D	0.097	0.122	0.085	0.136	0.107	0.186	0.109	0.176	0.127	0.099	0.135	0.138
MW7S/D	0.070	0.032	0.036	0.091	0.071	0.078	0.042	0.048	0.043	0.029	0.100	0.043
MW8S/D	na	na	na	na	na	na	0.051	0.054	0.051	0.054	0.105	0.053
MW9S/D	na	na	na	na	na	na	0.086	-0.007	0.086	-0.007	0.081	-0.068
MW10S/D	na	na	na	na	na	na	-0.016	0.005	-0.016	0.005	-0.005	0.000

na =not available because well not yet installed

The vertical movement of groundwater depends upon the degree of hydraulic connection between the upper and lower water producing zones as well as the vertical hydraulic gradients present. The chemical analyses completed on the groundwater samples indicate that the deeper bedrock aquifer in the immediate area of the landfill (MW6D and MW7D) has not been significantly impacted as a result of landfill operations. Sodium concentrations in MW6D did increase beginning in November 2002, but have stabilized around 100 mg/L remaining below the Ontario Drinking Water Standard (ODWS) and Reasonable Use Limit (RUL).

Further downgradient to the north, however, the deeper wells MW8D and MW9D have shown a definite increase in leachate indicator parameters. Conductivity, total dissolved solids (TDS) hardness, chloride, sodium, sulphate, DOC and COD are all elevated in these two deeper bedrock wells compared with the shallower bedrock wells in the same locations (MW8S and MW9S) and the background well MW1 (see Figures 5A & 5B, Figures 6A & 6B and Figures 7A & 7B). This indicates that the there is a mixing of contaminants, as they are likely dispersing vertically when moving horizontally through the aquifer system. MW10D which is also downgradient of the waste but more to the west, does not show the elevated concentrations in leachate indicator parameters as seen in MW8D and MW9D.

5.0 GROUNDWATER QUALITY

5.1 Groundwater Monitoring Program 2004

The 2004 groundwater monitoring program consisted of the collection of groundwater samples at all available monitoring wells during June 2004 and November 2004. All samples were submitted to PSC Analytical Services in Mississauga, Ontario for analyses. The groundwater samples were analysed for a specific suite of parameters based both on the chemical characteristics of typical leachate contaminant plumes generated by the landfills and on the composition of the groundwater downgradient of the landfill waste area determined from previous investigations. These parameters included: pH, Conductivity, Alkalinity, Total Dissolved Solids (TDS), Biological Oxygen Demand (BOD_5), Chloride (Cl^-), Sulphate (SO_4^{2-}), Nitrate-Nitrogen (NO_3-N), Ammonia-Nitrogen (NH_3-N), Total Kjeldahl Nitrogen (TKN), Dissolved Organic Carbon (DOC), Chemical Oxygen Demand (COD), Total Phosphorus (Total P), Phenols, Hardness, Aluminum (Al), Arsenic (As), Boron (B), Barium (Ba), Beryllium (Be), Bismuth (Bi), Calcium (Ca), Cadmium (Cd), Cobalt (Co), Chromium (Cr), Copper (Cu), Iron (Fe), Potassium (K), Magnesium (Mg), Manganese (Mn), Molybdenum (Mo), Sodium (Na), Nickel (Ni), Phosphorus (P), Lead (Pb), Antimony (Sb), Selenium (Se), Silicon (Si), Tin (Sn), Strontium (Sr), Titanium (Ti), Thallium (I), Uranium (U), Vanadium (V), and Zinc (Z).

Table 3 provides a summary of the 2004 annual groundwater analytical data for each of the monitoring wells as well as historical analytical data from June 1993 to the present for comparison. The groundwater concentrations have been compared to the Ontario Drinking Water Standards (ODWS) and the shaded values in Table 3 indicate exceedances over the ODWS. The laboratory analytical reports are attached in Appendix 3.0.

Figures 5A & 5B, 6A & 6B and 7A & 7B provide graphical trends for some of the groundwater parameters over time for each well. Figures 8 through 15 provide concentration contour plots for chloride, conductivity, TDS and sulphate for November 2004 individually for both the shallow and the deep wells.

5.2 Sampling Protocols

The procedures for purging and sampling from the monitoring wells were conducted in accordance with the sampling protocols outlined in the Ministry of Environment (MOE) December 1996 document *"Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario".* The static water levels were measured prior to purging. A minimum of three times the volume of water contained in the monitoring wells was evacuated from the wells, or the wells were pumped to dryness, prior to sampling. Electric submersible pumps were used to remove the standing water in the wells and to collect the samples in several of the wells that were not equipped with dedicated Waterra pumps. The pumps were thoroughly cleaned after sampling at each well, prior to being used at the next well. Field parameters, such as pH and conductivity were measured at each monitoring well in the field during each sampling session. All groundwater samples for metals analyses were filtered in the field prior to collection in the sample bottles. All samples were collected in sample bottles supplied by the certified laboratory, containing the correct preservatives, and were capped, labelled, properly packed in coolers, and delivered to PSC Analytical Services for analyses the next day.

5.3 Background Groundwater Quality

Water quality measured at MW1, located southwest of the landfill site is currently used to represent background water quality conditions. The background water quality at MW1 is characterized by relatively lower concentrations of chloride, sodium, sulphate, hardness, total dissolved solids (TDS), Dissolved Organic Carbon (DOC) and conductivity, although there have been periods of elevated chloride, sodium, conductivity, DOC and TDS in this well as indicated particularly by the November 2002 and June 2003 sampling results (see analytical trend graphs in Figures 5A & 5B, Figures 6A & 6B and Figures 7A & 7B). Manganese and iron have also been somewhat variable in the background monitoring well MW1. Analytical results for MW1 in 2004 compared to previous analytical data indicate a slight increase in chloride and sulphate.

The shallow well chemical contour plots indicate that a weak leachate plume extends towards the south in the eastern half of the landfill site and MW1 may be impacted by leachate.

If these trends continue in 2005, the use of MW1 as a background well should be discontinued. The analytical trend graphs for MW2 (Figures, 5A, 6A and 7A) indicate that most parameters at MW2 have remained stable and this well could be used to represent background conditions in the future.

5.4 Downgradient Groundwater Quality

Sampling of groundwater was carried out in 1993 by Golder Associates Limited (GAL), and in 1998 to 2003 by TROW Consulting TROW.

Groundwater sampling at MW1, MW2 and MW3 from 1993 to 2004 has indicated some fluctuations over the years in several parameters; however groundwater chemistry at these three locations has remained essentially similar and unchanged from 1993 to 2004 (see analytical trend graphs in Figures 5A & 5B, Figures 6A & 6B and Figures 7A & 7B). There has been essentially no evidence of leachate contamination present in any of these wells which are located on the south and west sides of the landfill site.

GAL determined in 1993 that leachate had been impacted at MW5, located within the waste pile. The leachate was characterized by elevated concentrations of most inorganic and organic parameters, particularly chloride, total dissolved solids (TDS), hardness, sulphate, alkalinity, total nitrogen and chemical oxygen demand. Impacts to groundwater quality at MW4 were concluded as being not significant. These monitors MW4 and MW5 have since been destroyed.

MW6S/D and MW7S/D are located at the downstream perimeter of the waste pile at the northeast corner. Groundwater sampling at MW6S, and MW7S from 1999 to 2004 has indicated elevated concentrations of most leachate indicator parameters measured (conductivity, total dissolved solids, hardness, chloride, sodium, sulphate, DOC and COD) in comparison to the older wells MW1, MW2, and MW3. From August 1999 when these wells were installed, to 2002, there had been considerable seasonal fluctuation in the parameter concentrations in these two wells (MW6S and MW7S), possibly reflecting seasonal variations in precipitation recharge rate. These fluctuations have not been evident to the same extent in 2003 and 2004 and the trend graphs also indicate a trend to overall lower concentrations of many parameters in these two downgradient wells (see analytical trend graphs in Figures 5A & 5B, Figures 6A & 6B and Figures 7A & 7B). Samples collected from MW6D and MW7D have on the other hand not shown elevated leachate parameter concentrations during these years, with the exception of sodium in MW6D, which increased in November 2002 and has remained elevated since that time. These two deeper bedrock wells have shown similar groundwater chemistry to MW1, MW2 and MW3.

MW8S/D, MW9S/D and MW10S/D, which were installed in November 2002, are located further downgradient form the waste pile in the north direction. Groundwater sampling at these wells has shown that the water quality in the shallow wells at these locations (MW8S, MW9S, and MW10S) does not show any evidence of leachate contamination and is comparable to background conditions. Water quality in two of the deeper wells however (MW8D and MW9D) has displayed elevated concentrations of leachate indicator parameters, including conductivity, total dissolved solids, hardness, chloride, sodium, sulphate, COD and DOC. Sulphate levels in particular have increased significantly in MW9D in December 2003 and continued to increase in June and November 2004. MW10D, which is located downgradient towards the northwest, does not show evidence of leachate contamination. These groundwater monitoring results indicate that there is a significant downward component in the local groundwater flow regime, and that there is hydraulic connection between the deep and shallow groundwater.

A comparison of the 2004 groundwater monitoring data as well as monitoring data from previous years, to the Ontario Drinking Water Standards (ODWSs) for each parameter is provided in Table 3, with the shaded values indicating exceedances of the ODWSs. In 2004 as well as previous years, hardness has exceeded the ODWSs in all wells, including the background well MW1. The ODWSs for TDS, DOC, manganese and alkalinity were exceeded in MW7S and MW8D in one or both sampling events in 2004 and the ODWSs for TDS and manganese were exceeded in MW9D in one or both sampling events in 2004. Not all of these exceedances can be attributed to waste disposal operations since TDS exceedances also occurred in the background well MW1, in the November 2004 and previous years sampling results. No health related parameters have been detected at concentrations exceeding the ODWSs.

5.5 Volatile Organic Compound (VOC) Analyses

Analyses for volatile organic compounds (VOCs) have been most recently conducted in June 2003 on all of the monitoring wells with the exception of MW2. Detectable concentrations of several VOCs were measured in some of the wells (trichloroethylene in MW6D and MW7D, dichlorobenzene in MW8D and MW9D, and acetone in MW9D) at levels only slightly above the detection limits. The concentrations were well below the applicable drinking water standards.

Analyses for volatile organic compounds (VOC's) over previous years have indicated detectable concentrations of several VOC's at levels near the detection limits in some samples. No notable trends have been observed in VOC data that would suggest significant increases or decreases.

For this reason it has been recommended that VOC samples be taken from a leachate characterization monitoring well and two additional monitoring wells likely to be impacted by landfill leachate every five years unless there is a problem. Analyses for VOCs on the three monitoring wells are recommended for completion in the 2008 monitoring year.

5.6 Summary

The results of the 2004 groundwater monitoring program indicate that a leachate contaminant plume which was previously present in the overburden/shallow bedrock aquifer has moved vertically to the deeper bedrock groundwater aquifer as it is moving downgradient to the north/northeast. The plume is characterized by elevated concentrations of most leachate indicator parameters including chloride, sodium, sulphate, conductivity, TDS, DOC and COD.

6.0 GROUNDWATER IMPACT ASSESSMENT

6.1 Background

In order to assess the chemical impact on the groundwater resulting from waste disposal operations, the concentrations of various parameters in the monitoring wells are compared to the quality of the background groundwater. The background groundwater quality is determined through the analysis of groundwater samples collected at a location which is unaffected by the waste disposal operations. MW1 located to the south of the waste disposal site is currently being used to determine background groundwater quality in the overburden aquifer at the Mountain landfill site. The median values of the available parameter concentrations for the groundwater samples collected at MW1 from June 1993 to October 2004 were calculated and used to determine the background water quality (minimum of 5 samples).

6.2 Reasonable Use Limits-Ontario Policy B-7

Ontario Policy B-7 usually referred to as the "Reasonable Use" Policy addresses the potential impact of the landfill leachate on local groundwater resources. This policy establishes maximum allowable concentrations of various parameters at the downgradient site boundary.

These maximum allowable concentrations are based on the background concentration of the specific parameter in the aquifer, the nature of the parameter (i.e. whether it has an applicable health-related criteria or an aesthetic criteria) and the present or future use of the downgradient groundwater resource. The downgradient groundwater resource use is normally assumed to be potable water unless there is specific evidence indicating a different use.

The groundwater quality cannot be degraded by an amount in excess of 50% of the difference between background and the ODWS (for non-health related parameters), and in excess of 25% of the difference between background and the ODWS for (health related parameters).

The Reasonable Use Policy establishes the basis for determining the Reasonable Use of groundwater on property adjacent to sources of contaminants, and can be mathematically presented using the following formula:

$Cm = Cb + x(Cr - Cb)$,

where,

Cm = the maximum acceptable concentration;
Cb = the background concentration;
Cr = the maximum concentration that should, in accordance with the Province's Water Management Policy, be present in the groundwater, and
X = 0.5 for non-health related parameters, and 0.25 for health related parameters;

A summary of the calculated "Reasonable Use" limits (RULs) for those parameters measured at the Mountain landfill site which have either a health related Maximum Acceptable Concentration (MAC), an Interim Maximum Acceptable Concentration (IMAC), an Aesthetic Objective (AO), or an Operational Guideline (OG), in the Ontario Drinking Water Standards (ODWS) are provided in Table 4. The average background concentration for each parameter as calculated from the median of analyses completed on MW1 from June 1993 to October 2004 is also indicated in this Table.

Table 4 provides a comparison of the 2004 groundwater monitoring data to the RULs for each parameter, with the shaded values indicating exceedances of the RULs. The results show that sulphate, hardness, TDS, DOC, manganese and sodium were found at concentrations in excess of the RULs in MW9D in one or both samples, and alkalinity, hardness, TDS, DOC, and manganese were found at concentrations in

excess of the RULs in MW7S and MW8D in both samples collected in 2004. This is of some concern particularly in MW9D, since this well is located near the northern perimeter of the property currently owned by the Township and there may therefore be exceedances off-site.

It should be noted that the exceedances are all with respect to non-health related parameters. Also the RUL for TDS, which is exceeded in a number of the downstream wells, is also exceeded in the background well (MW1) and elevated TDS is therefore characteristic of the groundwater in the landfill vicinity.

6.3 Leachate Plume Configuration

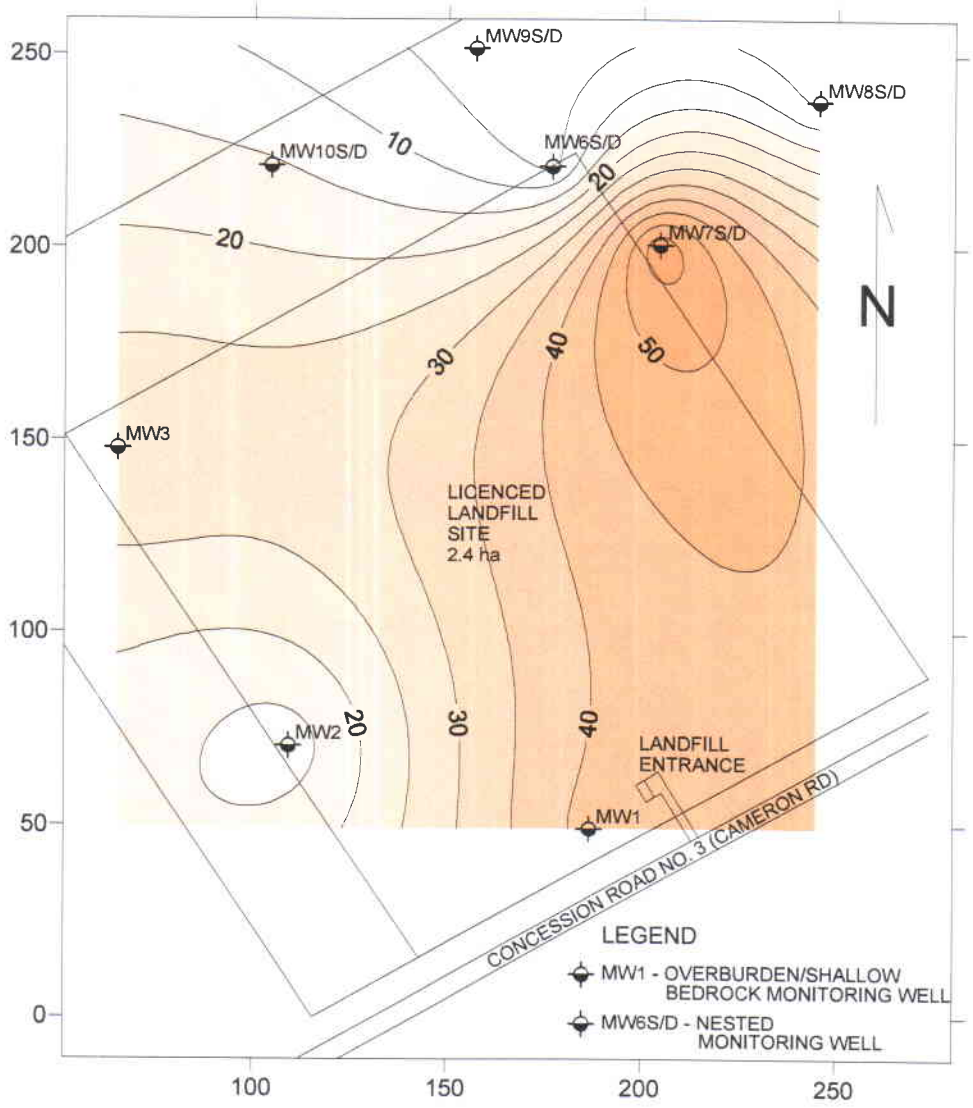
The current geometry of the leachate contaminant plume in the overburden/shallow bedrock, for the parameters chloride, conductivity, TDS and sulphate, can be observed in the concentration plots in Figures 8, 10, 12 and 14 respectively, for November 2004 data. These concentration plots confirm that the highest concentrations in the overburden/shallow bedrock are located at the northeast corner of the waste pile at the location of MW7 and extend north and east towards MW6 and MW8.

The current geometry of the leachate contaminant plume in the deeper bedrock, for the parameters chloride, conductivity, TDS and sulphate, can be observed in the concentration plots in Figures 9, 11, 13 and 15 respectively, which have also been plotted using November 2004 data. These concentration plots confirm that the highest concentrations in the deeper bedrock are located at the most northern well MW9D, for conductivity, TDS and sulphate, and at MW8D, also located north of the site but more towards the east, for chloride. The plots confirm that contaminants have moved offsite in the deeper aquifer, across the northern property boundary (MW9).

The shallow well contour plots show that the leachate plume extends towards the south in the eastern half of the landfill site and MW1 may be slightly impacted by leachate. If this continues to be apparent in 2005, the use of MW1 as a background well should be discontinued. The analytical trend graphs for MW2 (Figures, 5A, 6A and 7A) indicate that most parameters at MW2 have remained stable and this well could be used to represent background conditions in the future.

The specific boundaries of the shallow and deeper bedrock leachate plumes cannot be defined at this time since the plume extends beyond the existing landfill monitoring wells.

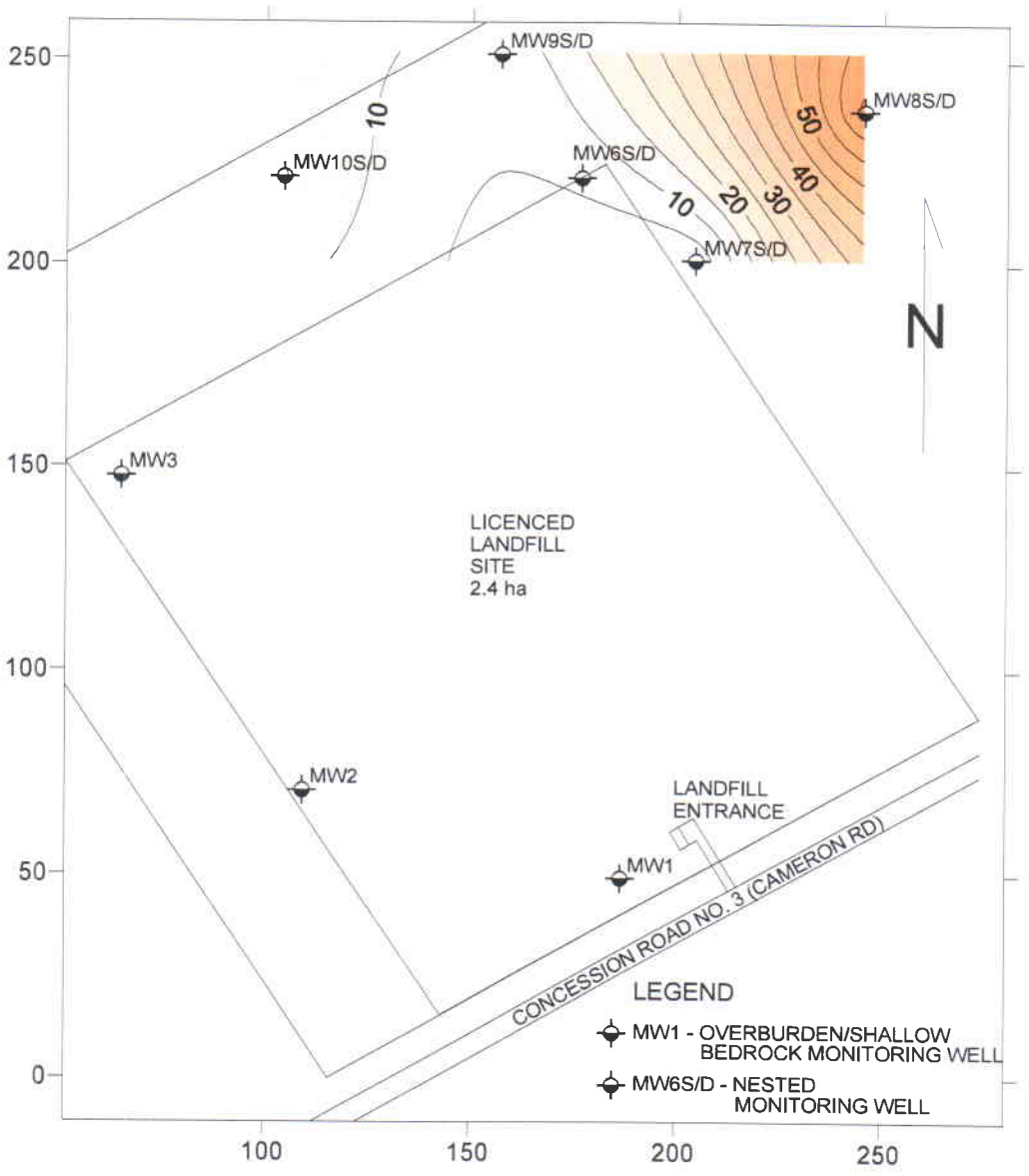
Chloride Iso Concentration Plot
Shallow Wells
November 2004



Township of North Dundas Mountain Road Landfill

Figure 8

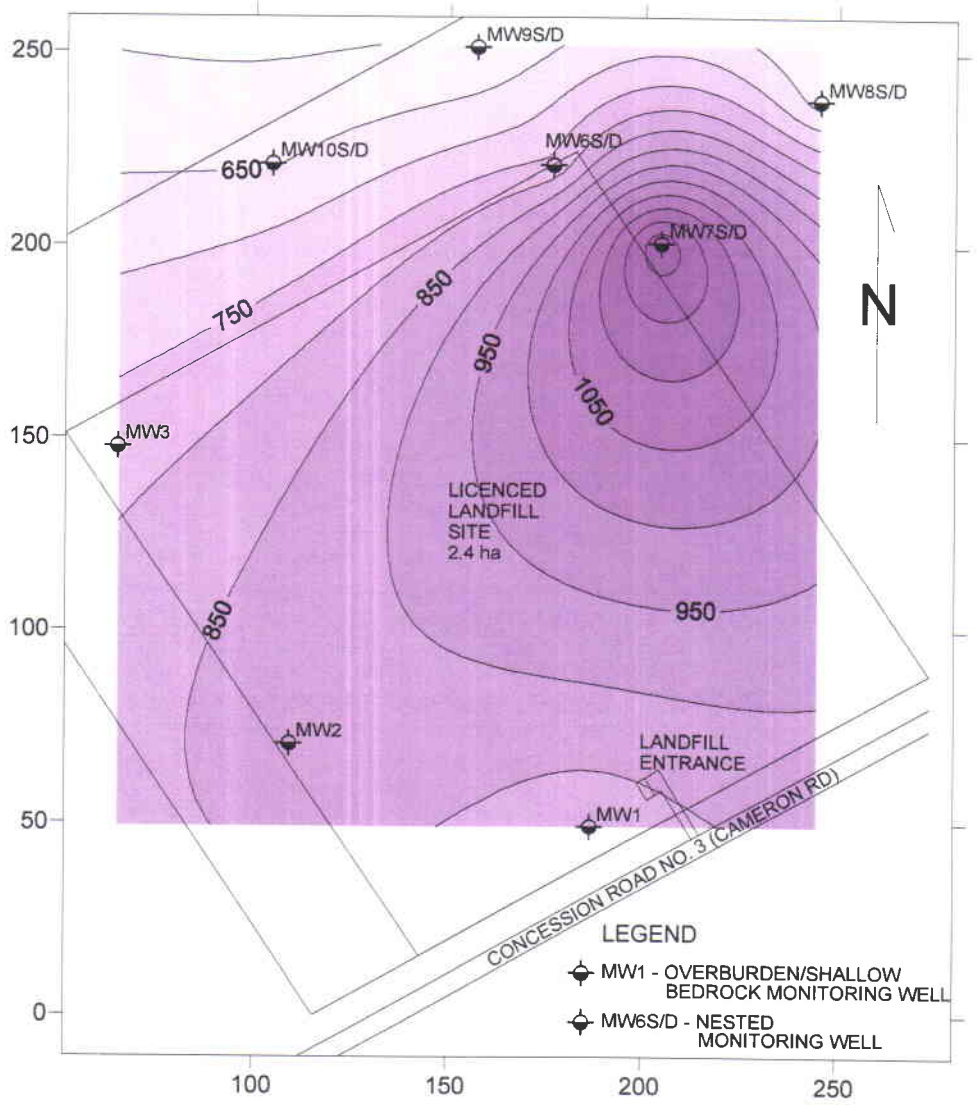
Chloride Iso Concentration Plot
Deep Wells
November 2004



Township of North Dundas Mountain Road Landfill

Figure 9

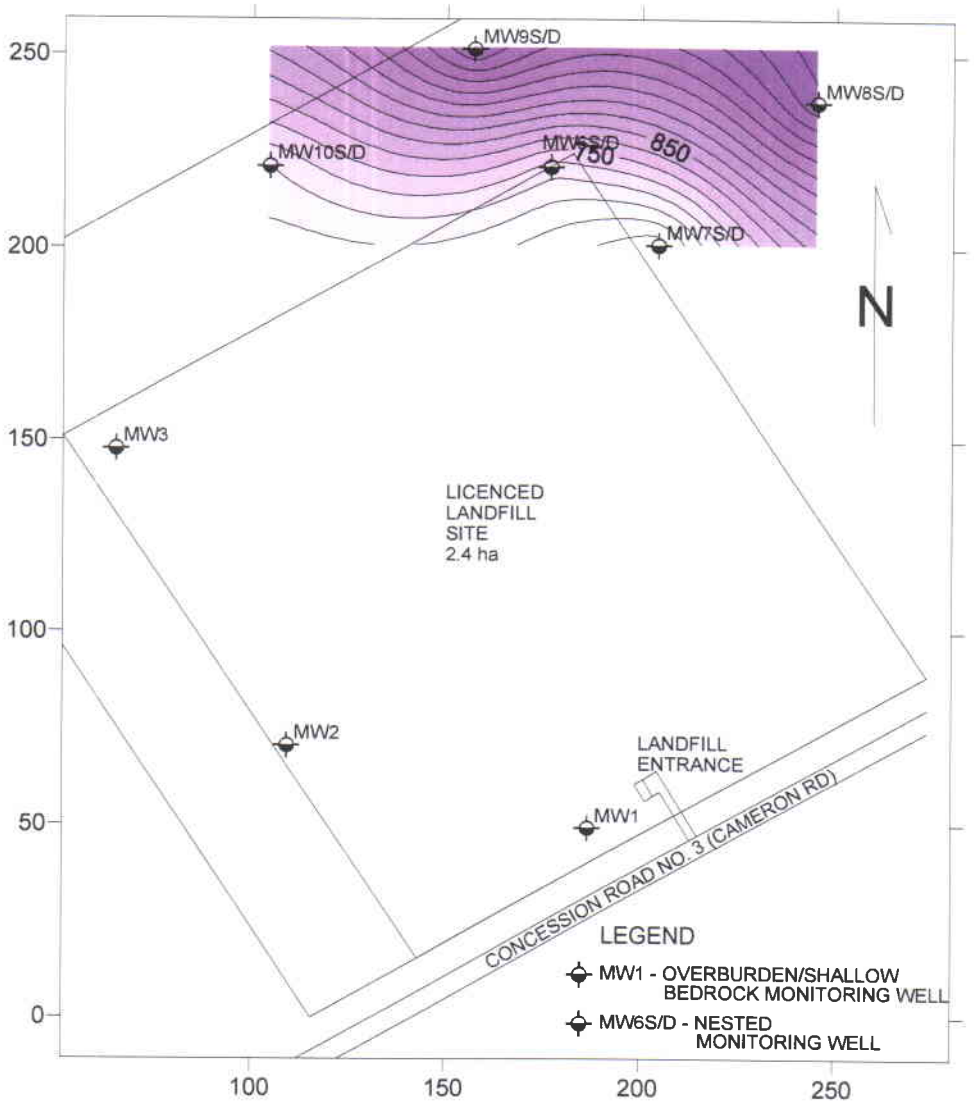
Conductivity Iso Concentration Plot
Shallow Wells
November 2004



Township of North Dundas Mountain Road Landfill

Figure 10

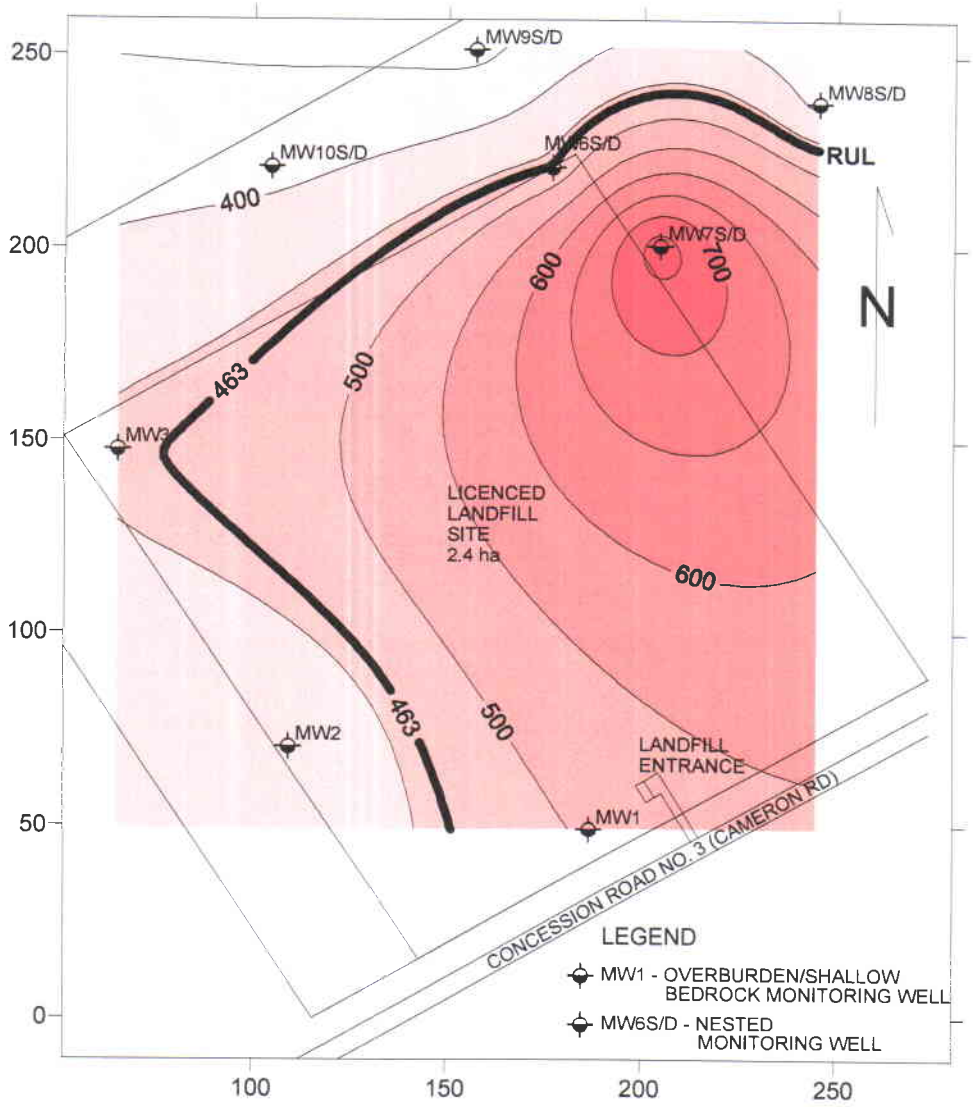
Conductivity Iso Concentration Plot
Deep Wells
November 2004



Township of North Dundas Mountain Road Landfill

Figure 11

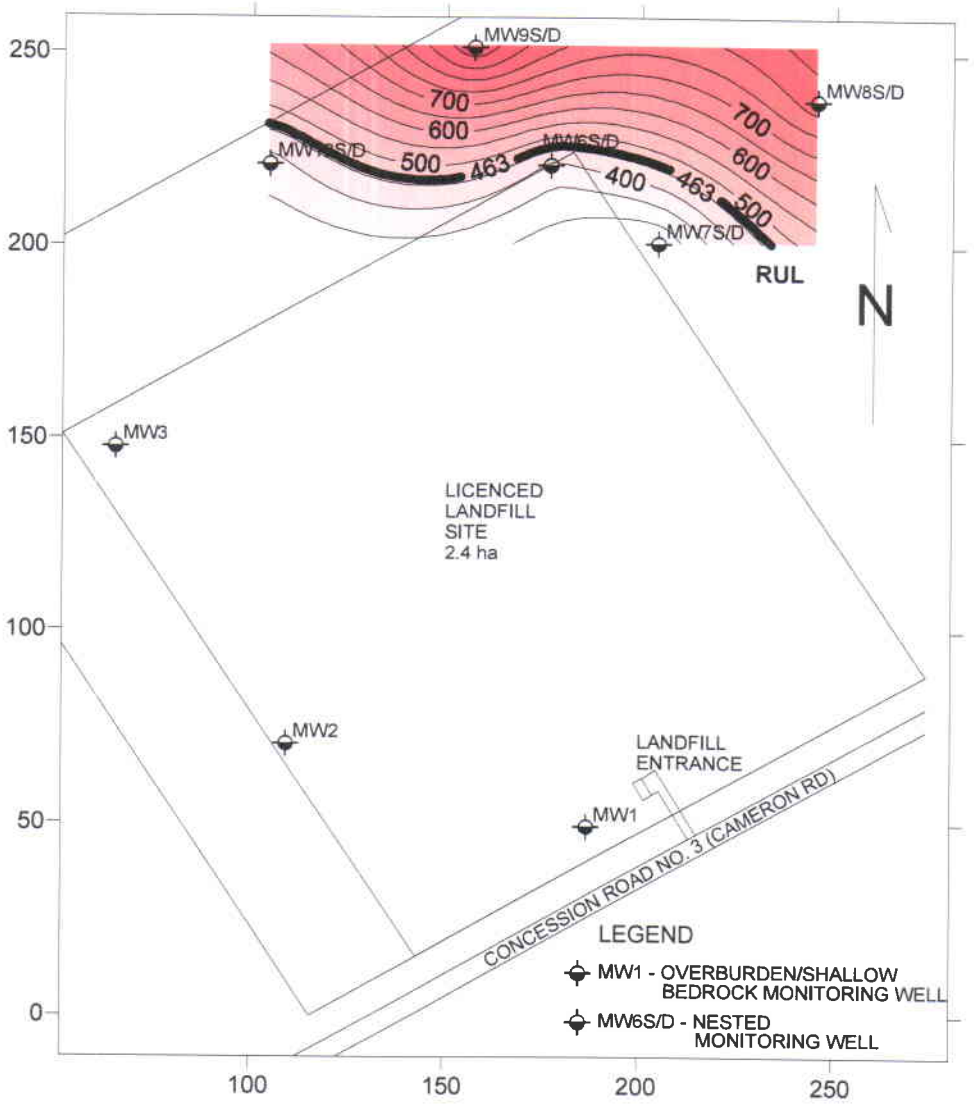
TDS Iso Concentration Plot
Shallow Wells
November 2004



Township of North Dundas Mountain Road Landfill

Figure 12

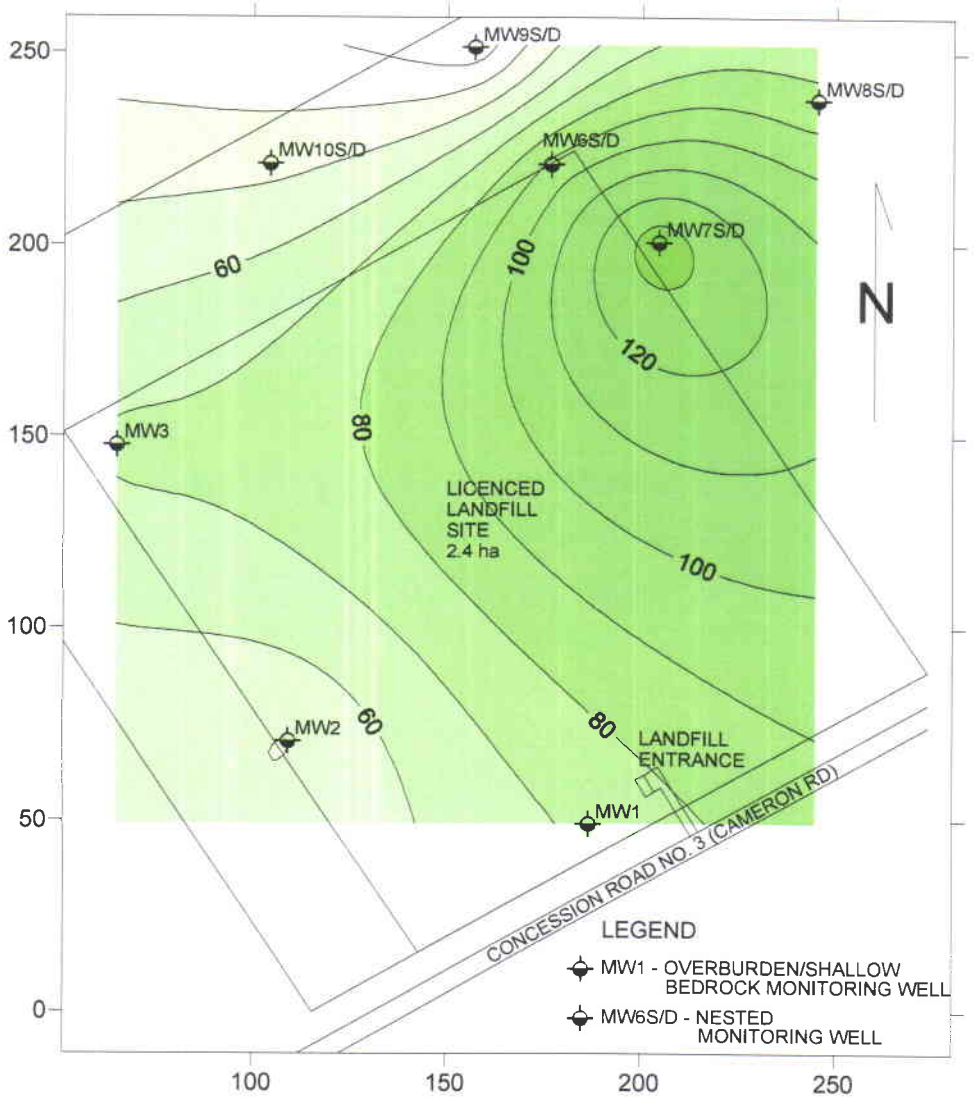
TDS Iso Concentration Plot
Deep Wells
November 2004



Township of North Dundas Mountain Road Landfill

Figure 13

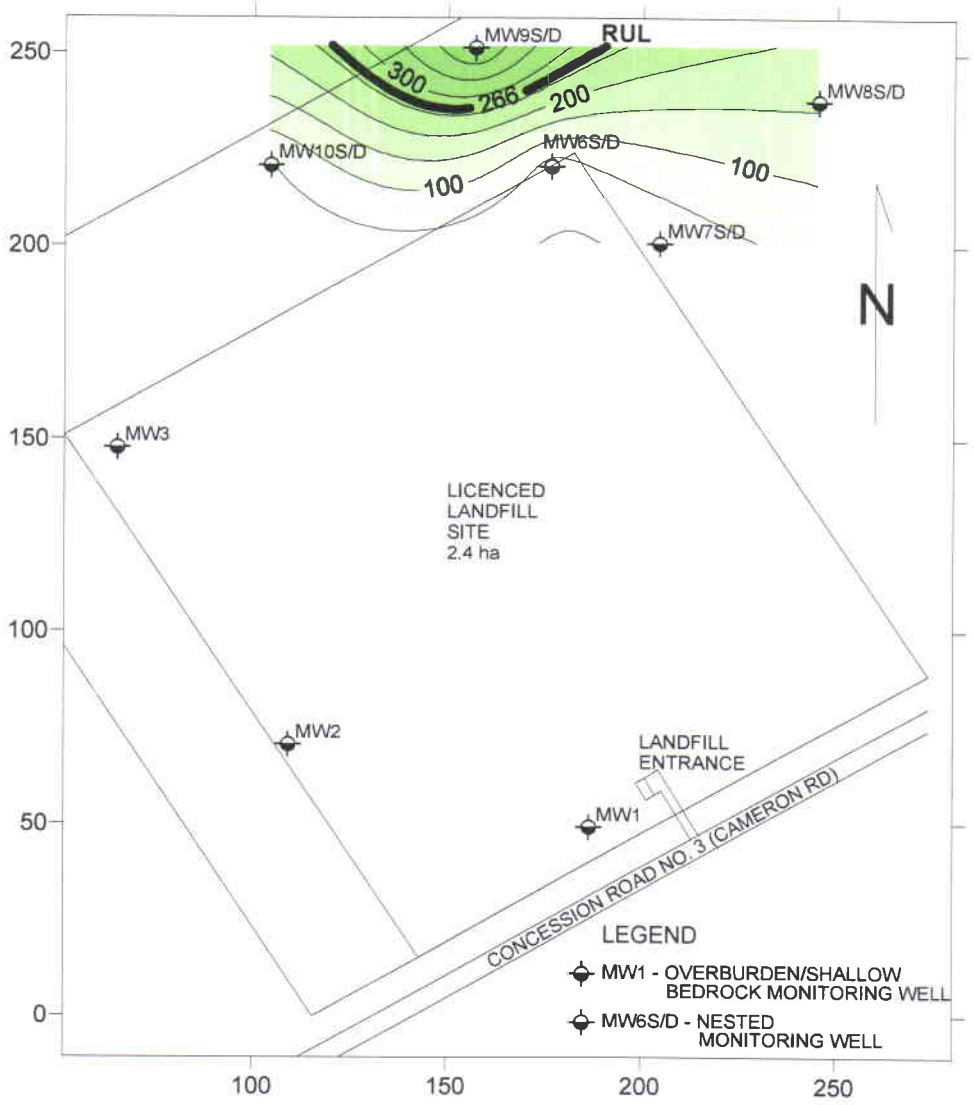
Sulphate Iso Concentration Plot
Shallow Wells
November 2004



Township of North Dundas Mountain Road Landfill

Figure 14

Sulphate Iso Concentration Plot
Deep Wells
November 2004



Township of North Dundas Mountain Road Landfill

Figure 15

6.4 Plume Mitigation Measures

The data indicates that a leachate contaminant plume present in the deeper bedrock aquifer, extends north to northeast of the waste disposal site fill area, and the concentration of several non-health related parameters are currently greater than the calculated reasonable use criteria near the downgradient limit of the property owned by the Township (MW9D). The current nature of the groundwater concentrations indicates that the leachate plume may extend off property.

The contaminant plume in the overburden/shallow bedrock is in general weaker and does not extend off site.

The annual volume of waste currently being deposited at the Mountain landfill site is extremely small and the waste is being deposited in the southwest section of the landfill site, as far upgradient as practicable to minimize downgradient groundwater impacts.

The trend graphs (Figures 5A & 5B, Figures 6A & 6B and Figures 7A & 7B) indicate that most of the contaminant concentrations in the downgradient wells, MW8S/D and MW9S/D, appear to have either stabilized or are on a downward trend, with the exception of sulphate in MW9D, which has increased significantly in December 2003 and June and November 2004. The elevated sulphate concentrations most recently measured in MW9D in 2004 at 465 and 458 mg/L, are considerably higher than all sulphate concentrations previously measured in all of the wells with the exception of the single sulphate measurement on MW5 collected in June 1993, which was 675 mg/L. The sulphate concentrations in MW9D are still however below the ODWS. Chloride concentrations in this well (MW9D) have decreased considerably in 2004 and sodium concentrations have also shown a decrease in the most recent November 2004 sample.

The Township should investigate the potential extension of the current landfill leachate attenuation zone through the purchase of downgradient lands or a groundwater easement or other remedial options.

7.0 SURFACE WATER MONITORING

Surface water sampling was not conducted during the 2004 monitoring program and has not been conducted since May 2000, since the creek has been dry. It has been observed and stated by the previous consultant that the hydrology of the area has changed over the past decade and the land to the north and east of the site which was previously poorly drained and swampy, has transformed to a land which is now generally dry. This was deemed to be most likely the result of drainage improvements undertaken by local farmers.

It was recommended in the 2003 annual monitoring report for the Mountain landfill site that surface water monitoring be discontinued from the landfill site monitoring plan, since water quality data from intermittent limited creek flow events would not accurately reflect surface water conditions and would therefore be of limited use when evaluating waste disposal operations on surface water quality.

8.0 OPERATION AND DEVELOPMENT

8.1 Waste Quantities and Type

The quantity of waste received at the Mountain Landfill is recorded by volume as weigh scales do not exist at the site. The waste volume is calculated from the capacity of the vehicles that haul the waste to the site. During 2004, an estimated 517 cubic meters of waste were received at the landfill site. This waste quantity is similar to 2003 and 2002 when an estimated 578 and 670 cubic meters of waste respectively were received at the site.

The waste delivered to the site is exclusively domestic in origin, comprised of household waste and including minor quantities of building waste such as scrap lumber, etc. from domestic uses. No commercial, industrial or hazardous waste is accepted at the facility.

8.2 Remaining Site Capacity

The Certificate of Approval for the Mountain landfill does not specify an approved site capacity and the existing Operation and Development Plan (Dillon, 1992) does not indicate a final elevation for waste disposal. For this reason the remaining capacity of the landfill site cannot be calculated at this time.

The area of the site licensed for waste disposal is however 2.4 hectares in size. At the current average waste deposition rate of 600 cubic meters per year and without any waste compaction, it would take approximately 40 years for the height of the landfill site to increase by one meter.

TROW has stated in the previous annual monitoring reports for this site, that topographic surveys of the waste area have been conducted for several years to document changes to the site capacity; however, that the volume of waste brought to the site each year is so small that changes to the height of the waste are not sufficient to be reasonably surveyed.

To our knowledge a detailed topographic survey of the entire licensed landfill area has not previously been completed. To more accurately determine the quantity of waste currently deposited at the Mountain site, a topographical contour survey of the entire landfill site, which has been in operation now for close to 45 years, should be completed. The Operation and Development Plan for this site should be updated to include a final waste pile elevation. This will allow the calculation of the volume of additional waste that can be disposed of at the site.

8.3 Operation and Development Plan

The site is currently in compliance with the 1992 Operation and Development Plan; however this plan should be updated to reflect the current operating practices and to determine the landfill site capacity.

8.4 Additional Information

The limited volume of waste that is being deposited at this site is currently being placed in the southwestern section of the landfill site, as far upgradient as practicable.

All Township recyclables are collected at the Recycling Transfer Station at the Boyne Road landfill site where they are transferred by a recycling contractor. No recyclable material was received at the Mountain site in 2004.

No emergency situations were reported at the Mountain site in 2004 and no other operational problems or complaints were recorded in 2004.

9.0 SUMMARY AND RECOMMENDATIONS

9.1 Summary

Two field programs were completed at the Mountain Landfill site in June and November 2004. During the field programs, groundwater samples were collected for laboratory analyses and static groundwater levels were measured. The monitoring network currently exists of eight bedrock monitoring wells, with a total of thirteen individual monitors.

Groundwater flow in the shallow bedrock/overburden aquifer near the landfill is generally towards the north/northeast. The local hydraulic gradient in the overburden/shallow bedrock aquifer ranged from 0.007 to 0.01 meters per meter in the fall and spring respectively. The groundwater velocity through this unit was found to exceed 65 meters per year (from hydraulic conductivity testing)

The results of the 2004 groundwater monitoring program continue to indicate that a weak leachate contaminant plume which has been present in the overburden/shallow bedrock groundwater regime is moving vertically to the deeper bedrock groundwater aquifer as it is moving downgradient to the north/northeast. The plume is characterized by elevated concentrations of most leachate indicator parameters including chloride, sodium, sulphate, conductivity, TDS, DOC and COD.

The 2004 results show that concentrations of several non-health related parameters continue to be found at concentrations in excess of the RULs in the monitor located near the northern perimeter of the property currently owned by the Township. As these wells are close to the site boundary, there may be exceedances off-site.

9.2 Recommendations

Based on the results of the 2004 landfill monitoring program, the following recommendations are presented for consideration by the Township:

Groundwater Compliance

Waste should continue to be deposited as far from the downgradient boundary as practicable.

The Township should consider acquiring additional downgradient lands or a groundwater easement to the north of the landfill to serve as an extension of the current landfill leachate attenuation zone.

Operation and Development Plan

The Operation and Development Plan should be updated to reflect the current waste disposal rates and practices and to include a final waste pile elevation. This will allow the calculation of the volume of additional waste that can be disposed of at the site.

Remaining Site Capacity

To determine the quantity of waste currently deposited and the remaining site capacity, a topographical survey of the entire landfill site, which has been in operation now for close to 45 years, should be completed.

Groundwater Monitoring

The collection of groundwater samples and static water level data should continue twice per year, in the spring and fall, from the existing 13 individual monitoring wells. Groundwater should be analysed for the same parameters as in 2004.

HSP Engineering and Environmental Services

APPENDIX 1.0

CERTIFICATE OF APPROVAL

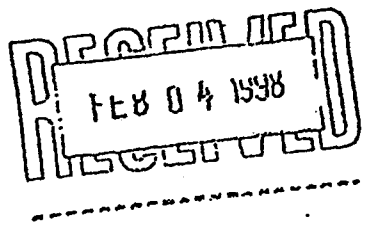
1:45 (cell) 937-6402

Ministry of the Environment
Approvals Branch
250 Davisville Avenue
3rd Floor
Toronto ON M4S 1H2

Ministère de l'Environnement
Direction des autorisations
250, avenue Davisville
3e étage
Toronto ON M4S 1H2

Ontario

14 January 1998



Township of Mountain
P.O. Box 9
2245 Simms Street
MOUNTAIN, Ontario
K0E 1S0

Attention: Doreen DeVries, Clerk-Treasurer

Dear Ms DeVries:

Re: Township of Mountain
Provisional Certificate of Approval for a Waste Disposal Site
Approval No. A481702

Please find enclosed a copy of Provisional Certificate of Approval No. A481702 which is issued to the Township of Mountain by the Ministry for the continued operation of a waste disposal site to landfill domestic waste and non-hazardous solid industrial waste. The site is located at 10891 Cameron Road in the Township of Mountain.

This Provisional Certificate of Approval replaces all previously issued Certificates of Approval and Notices of Amendment issued for the site under the same number. It is recommended that you review this Certificate in detail, so that the terms and conditions by which this site may be operated are fully understood. Failure to operate this site according to the terms and conditions listed on the Certificate will be considered a violation of the *Environmental Protection Act*.

Reasons for the conditions on the Certificate and the procedures to be followed should you wish to appeal any of these conditions are provided as part of the Certificate.

...2/

If you have any questions regarding the Certificate, please contact Kim Lendvay at (416) 326-5620, or questions regarding site operations contact John Firth, Kingston District Office at (613) 549-4000.

Yours truly,

A. Dominski
Director

Attachment

cc: MOE, Kingston District Office, J. Bishop / J. Firth
– United Counties of Stormont, Dundas & Glengarry, 20 Pitt Street, Cornwall, Ontario K6J 3P2, Attention: Clerk
– MOE, Eastern Regional Office, Brian R. Ward, Director
bcc: MOE, Eastern Regional Office, Approvals Main Binder Copy (c/o J. Mulder)
– MOE, Eastern Regional Office, File Room Copy: STAR #321 / CofA No. A481702 / SI DU MT 250, East Part of Lot 11, Conc.4
– MOE, Toronto District Office, K. Lendvay (STAR #13418)
– MOE, Approvals Branch, Waste Unit, File Room Copy (c/o G. Carpentier)

"**Operator**" means Township of Mountain, its officers, employees, agents, contractors or assignees.

"**EPA**" means The Environmental Protection Act, Chapter E.19, R.S.O. 1990.

"**Site**" means the landfill Site located in the Township of Mountain, East Part of Lot 11, Concession 4, 10891 Cameron Road, approved under this Certificate.

GENERAL

1. The requirements specified in this Provisional Certificate of Approval are the requirements under the **Environmental Protection Act**, R.S.O. 1990. The issuance of this Provisional Certificate of Approval in no way abrogates the Operator's legal obligations to take all reasonable steps to avoid violating other applicable provisions of this legislation and other legislation and regulations.

2. The requirements of this Provisional Certificate of Approval are severable. If any requirement of this Provisional Certificate of Approval, or the application of any requirement of this Provisional Certificate of Approval to any circumstance, is held invalid, the application of such requirement to other circumstances and the remainder of this Provisional Certificate of Approval shall not be affected in any way.

3. The Operator shall ensure compliance with all the terms and conditions of this Provisional Certificate of Approval. Any non-compliance constitutes a violation of the **Environmental Protection Act**, R.S.O. 1990 and is grounds for enforcement.

4. The Operator shall allow Ministry personnel, or a Ministry authorized representative(s), upon presentation of credentials, to:

   (a) carry out any and all inspections authorized by Section 156, 157 or 158 of the **Environmental Protection Act**, R.S.O. 1990, Section 15, 16 or 17 of the **Ontario Water Resources Act**, R.S.O. 1990, or Section 19 or 20 of the **Pesticides Act**, R.S.O. 1990, as amended from time to time, of any place to which this Provisional Certificate of Approval relates; and,

   without restricting the generality of the foregoing, to:

   (b) (i) enter upon the premises where the records required by the conditions of this Provisional Certificate of Approval are kept;

   (ii) have access to and copy, at reasonable times, any records required by the conditions of this Provisional Certificate of Approval;

(iii) inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations required by the conditions of this Provisional Certificate of Approval; and

(iv) sample and monitor at reasonable times for the purposes of assuring compliance with the conditions of this Provisional Certificate of Approval.

5. a) Where there is a conflict between a provision of any document referred to in Schedule "A", and the conditions of this Provisional Certificate of Approval, the conditions in this Provisional Certificate of Approval shall take precedence.

b) Where there is a conflict between documents listed in Schedule "A", the document bearing the most recent date shall prevail.

6. The Operator shall ensure that all communications/correspondence made pursuant to this Provisional Certificate of Approval includes reference to the Provisional Certificate of Approval number.

7. The Operator shall notify the Director in writing of any of the following changes within thirty (30) days of the change occurring:

(a) change of owner or Operator of the System or both;

(b) change of address or address of the new Owner;

(c) change of partners where the Owner or operator is or at any time becomes a partnership, and a copy of the most recent declaration filed under the **Business Names Act, 1991** shall be included in the notification to the Director;

(d) any change of name of the corporation where the owner or Operator is or at any time becomes a corporation, and a copy of the most current "Initial Notice or Notice of Change" (form 1 or 2 of O. Reg. 182, Chapter C-39, R.R.O. 1990 as amended from time to time), filed under the **Corporations Information Act** shall be included in the notification to the Director; and

(e) change in directors or officers of the corporation where the owner or Operator is or at any time becomes a corporation, and a copy of the most current "Initial Notice or Notice of Change" as referred to in 8(d), supra.

8. In the event of any change in ownership of the Site, the Operator shall notify in writing the succeeding Operator of the existence of this Provisional Certificate of Approval, and a copy of such notice shall be forwarded to the Director.

9. The Operator shall, forthwith upon request of the Director, District Manager, or Provincial Officer (as defined in the Act), furnish any information requested by such persons with respect to compliance with this Provisional Certificate of Approval, including but not limited to, any records required to be kept under this Provisional Certificate of Approval; and

(a) In the event the Operator provides the Ministry with information, records, documentation or notification in accordance with this Provisional Certificate of Approval (for the purposes of this condition referred to as "Information"),

(i) the receipt of Information by the Ministry;
(ii) the acceptance by the Ministry of the Information's completeness or accuracy; or
(iii) the failure of the Ministry to prosecute the Operator, or to require the Operator to take any action, under this Provisional Certificate of Approval or any statute or regulation in relation to the Information shall not be construed as an approval, excuse or justification by the Ministry of any act or omission of the Operator relating to the Information, amounting to non-compliance with this Provisional Certificate of Approval or any statute or regulation.

10. Any information relating to this Provisional Certificate of Approval and contained in Ministry files may be made available to the public in accordance with the provisions of the **Freedom of Information and Protection of Privacy Act**, R.S.O. 1990, C. F-31.

11. All records and monitoring data required by the conditions of this Provisional Certificate of Approval must be kept on the Operators's premises for a minimum period of at least two (2) years from the date of their creation.

12. This Provisional Certificate of Approval replaces all previous Provisional Certificates of Approval and Notices of Amendment identified by No. A481702 issued under Part V of the EPA.

13. Within sixty (60) days of the issuance of this Certificate, the Operator shall ensure this Certificate and a survey of the lands has been registered on the title to the lands comprising the Site and submit a certified copy to the District Manager.

14. The Operator shall ensure that training is provided on an ongoing basis, as required, to all on-Site personnel relating to the legal, operational and maintenance requirements for the operation of the Site and in emergency response procedures.

SITE OPERATIONS

15. Only domestic waste and non-hazardous solid industrial waste, generated by the Township of Mountain, shall be accepted at the Site.

16. No liquid industrial wastes or hazardous wastes as defined under Regulation 347 shall be disposed, transferred or processed at the Site.

17. a) The Operator shall place a sign at the main entrance to the Site on which is displayed in prominent letters the following information:

- the Operator of the Site
- the hours of operation
- the Certificate of Approval number for the Site
- the hours the Site is open to accept waste from the public
- the wastes acceptable for landfilling
- the telephone number for reporting emergency situations occurring at the Site during non-operating hours
- admission restrictions

b) The Operator shall place signs along on-Site roads giving directions to waste disposal areas and at waste disposal locations indicating the types of waste accepted at each location.

18 (a) The hours of operation at this Site are limited to: Wednesdays between 8:00 a.m. and 6:00 p.m. inclusive; and Saturdays between 8:00 a.m. and 3:30 p.m. inclusive.

(b) During non-operating hours, the entrance gate to the Site shall be locked to prevent access to the Site by unauthorized persons.

19. Should an outbreak of vermin or vector occur at the Site, the Operator shall immediately take all steps necessary to control the outbreak, including if necessary, the services of a licenced exterminator.

20. The Operator shall ensure this Site is operated in a manner which minimizes the impacts of odour, dust, litter, noise and traffic on the natural environment and the public.

21. The Operator shall ensure that waste for processing or transfer is stored in a safe and secure manner and that waste is properly handled and contained so as not to pose any threat to the public, Site personnel or the natural environment.

CONTINGENCY PLAN

29. (a) Within ninety (90) days of issuance of this Certificate, the Operator shall ensure contingency procedures for this Site, as identified in the plans and specifications listed in Schedule "A" which is attached, are available at the Township Office in the case of an emergency situation and for inspection by authorized Ministry personnel. The contingency plan should include, as a minimum, the following:

i) the procedures on how to deal with the receipt of any unauthorized waste;
ii) the procedures on how to deal with illegal dumping; and
iii) the procedures on how to handle an emergency situation, such as a fire or a significant spill, at the Site;

(b) The Operator shall, as a minimum, review the contingency plan on an annual basis; and

(c) The Operator shall ensure staff are trained in the operation and maintenance of this Site and in emergency response procedures.

REPORTING

30. a) The Operator shall maintain a weekly written record of the approximate quantity and types of waste received at the Site for disposal; and

b) The Operator shall maintain a written record of all recyclable material received at, processed and transferred from this Site including waste type, approximate quantity and their destination.

31. The following information shall be recorded on loads refused access to the Site for disposal purposes:

- date
- name of person
- company name on vehicle
- vehicle description and licence number
- quantity and description of waste refused
- reason for the refusal

32. An Annual Report on the development and operation of the Site shall be prepared and retained at the Township of Mountain office, by March 31st of the year following the calendar year covered by the report. The report shall include but is not limited to the following information:

- delineation of the existing limits of the fill area of the disposal Site
- quantity and types of waste received and deposited on-Site
- remaining Site capacity
- conformance with development and operations plan
- operational problems encountered and/or complaints received and the remedial action taken
- groundwater and surface water monitoring program results, trends (past and present), data interpretation, conclusions and recommendations
- waste deposition locations for the next 12 month period
- an annual mass balance of all recyclable material received at and transferred from the Site, including their waste type, quantity and destination
- a descriptive summary of any emergency situation which occurred at the Site

CLOSURE PLAN

33. When the Operator estimates that only twenty-four (24) months remain before waste disposal ceases at the Site, the Operator shall submit to the Director a plan for the closure of the Site, long term maintenance and long term monitoring.

SCHEDULE "A"

This Schedule "A" forms part of this Provisional Certificate of Approval No. A481702.

1. Document dated January 31, 1992, entitled "*Operations Plan, Township of Mountain Sanitary Landfill*" prepared by Dillon Consulting Engineers & Planners on behalf of the Township of Mountain.

2. Application form dated April 2, 1992, for Approval for a Waste Disposal Site (Landfill).

3. Document dated July 1993, entitled "*Hydrogeological Investigation Landfill Site Lot 11, Concession IV Township of Mountain, Ontario*" prepared by Golder Associates for the Township of Mountain.

4. Facsimile dated April 3, 1995, to Brian Kaye, Ministry of Environment and Energy, from K. Marketvette, Golder Associates, Re: "*Site Plan Figure 2*" indicating topography dated June 28, 1993.

5. Application form dated May 2, 1995, for Approval of a Waste Disposal Site.

6. Revised Application form dated July 10, 1995, for Approval of a Waste Disposal Site.

The reasons for the imposition of the above Conditions are as follows:

1. Conditions 1, 2, 3, 5, 6, 7, 8, 9 and 10 is to clarify the legal rights and responsibilities of the Operator.

2. Condition 4 is to ensure that the appropriate Ministry staff have ready access to the operations of the Site which are approved under this Certificate. The Condition is supplementary to the powers of entry afforded a Provincial Officer pursuant to the Environmental Protection Act, the Ontario Water Resources Act, and the Pesticides Act, as amended.

3. Conditions 11, 30 and 32 is to maintain a written record of all waste received at and transferred from the Site which can then be used to prepare the Annual Report.

4. Condition 12 is to make the Operator aware that this Certificate replaces all previous Certificates of Approval and Notices of Amendment issued for the Site.

5. Condition 13 is to ensure that future Operators of the land on which the Site is located are made aware of the fact that the land has been used as a landfill or contaminant attenuation zone and that no use may be made of the land for a period of twenty-five years after such use without the approval of the Minister, (EPA, Section 46).

6. Condition 14 is to ensure that personnel involved in the management and operation of the Site receive instructions about the Conditions on this Certificate and the documents in Schedule "A", as well as, other pertinent information necessary to operate the Site in a legal and environmentally safe manner.

7. Conditions 15, 16, 18, 20, 21, 22, 23, 24, 25, 26, 27 and 29 are to ensure that the Site is operated in a responsible manner in order to minimize any adverse impacts on the natural environment or the public and to ensure it is operated in accordance with the application and documentation submitted in support of the application and not in a manner which the Director has not been asked to consider.

8. Condition 17 is to ensure that the public is aware of the hours of operation of the Site and provides pertinent information regarding the use of the Site.

9. Condition 28 is to ensure the necessary monitoring programs, which are an integral part of the operation and development of the Site, are conducted properly and, should the monitoring show an impact or potential impact on or off Site, corrective measures may be required. The operation of this Site without such a Condition may create a hazard to the health and safety of any person and would not be in the public interest.

10. Condition 31 is to discourage the illegal dumping of loads which have been refused access to the Site for disposal purposes.

11. Condition 33 is to ensure that the Site is closed in accordance with Ministry standards and to protect the health and safety of the public and the environment.

You may, by written notice served upon the Director and the Environmental Appeal Board within fifteen (15) days after receipt of this Certificate, require a hearing by the Board. Section 142 of the Environmental Protection Act, R.S.O. 1990 c. E-19 as amended, provides that the notice requiring the hearing shall state:

1. **The portions of each term or condition in the approval in respect of which the hearing is required, and;**
2. **The grounds on which you intend to rely at the hearing in relation to each portion appealed.**

In addition to these statutory requirements, the notice should include:

3. **The name of the appellant;**
4. **The address of the appellant;**
5. **The Certificate of Approval number;**
6. **The date of the Certificate of Approval;**
7. **The name of the Director;**
8. **The municipality within which the works are located;**

and the notice should be signed and dated by the appellant.

This notice should be served upon:

The Secretary
Environmental Appeal Board
P.O. Box 2382
2300 Yonge Street, 12th Floor
TORONTO, Ontario
M4P 1E4

AND

The Director
Section 39, E.P.A.
Ministry of the Environment
250 Davisville Avenue
3rd Floor
TORONTO, Ontario
M4S 1H2

AND

Environmental Commissioner
1075 Bay Street, Suite 605, 6th Floor
TORONTO, Ontario
M5G 2W5

Dated at Toronto this 14 day of January, 1998.

Director
Section 39, E.P.A.
Ministry of the Environment

HSP Engineering and Environmental Services

APPENDIX 2.0

BOREHOLE LOGS

PROJECT: 921-2778

RECORD OF BOREHOLE: 1

SHEET 1 OF 1

LOCATION: See Plan

BORING DATE: May 6, 1993

DATUM: Local

DIP:

SAMPLER HAMMER: 63.5kg; DROP: 760 mm

METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	RECOVERY %	LAB. TESTING	GAS CONCENTRATION ( ) %LEL	HYDRAULIC CONDUCTIVITY, k, cm/s	WATER CONTENT, PERCENT Wp W Wl (20 40 60 80)	INSTALLATIONS
0	Power Auger, NW Casing	Ground Surface		97.87									
		TOPSOIL		0.00									
				0.12									Native Backfill
1		Dense to very dense brown sandy silt, some gravel, occasional cobbles and boulders (GLACIAL TILL)			1	SO DO	50						Bentonite Seal
2				95.58									
				2.29	2	NQ RC				T.C.R. 100% S.C.R. 99% R.Q.D. 90%			
3	Rotary Drilling, NQ Core	Fresh to faintly weathered light grey to dark grey very fine to fine grained massive vuggy DOLOMITIC LIMESTONE; stylolites common, fractures commonly coincident with stylolites; occasional shaly parting, prominent vuggy zone from 4.3m to 4.6m with some vugs infilled with calcite			3	NQ RC				T.C.R. 75% S.C.R. 60% R.Q.D. 28%			Granular Filter
4					4	NQ RC				T.C.R. 100% S.C.R. 99% R.Q.D. 99%			38mm PVC #10 Slot Screen
5					5	NQ RC				T.C.R. 78% S.C.R. 74% R.Q.D. 69%			
				92.18									
6		End of Hole		5.69									WL. in Screen at Elev. 98.19m Above Ground Surface June 10, 1993
7													
8													
9													
10													

DEPTH SCALE (ALONG HOLE)

LOGGED: K.A.M

CHECKED:

PROJECT: 921-2778
LOCATION: See Plan
DIP:

RECORD OF BOREHOLE 2

BORING DATE: May 6, 1993

SHEET 1 OF 1
DATUM: Local
SAMPLER HAMMER, 63.5kg; DROP, 760 mm

BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	RECOVERY %	LAB. TESTING	GAS CONCENTRATION ( ) ⊕ / %LEL □	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT, PERCENT Wp W Wl (20 40 60 80)	INSTALLATIONS
	Ground Surface		98.53								
	TOPSOIL		98.33 / 0.00								
	Brown SILTY SAND and GRAVEL		97.93 / 0.20								
Power Auger NW Casing	Very dense brown sandy silt, some gravel, occasional cobbles and boulders. Large weathered bedrock fragments from 2.38m to 2.64m (GLACIAL TILL)		95.89 / 0.60	1	SS	50/0.0					Bentonite Seal; Native Backfill; Bentonite Seal
Rotary Drilling NQ Core	Fresh to faintly weathered light grey to dark grey very fine to fine grained massive DOLOMITIC LIMESTONE; stylolites and shale partings common; fractures commonly coincident with stylolites; subvertical fracture at 4.27m depth; some vuggy zones with some vugs infilled with calcite		92.84 / 2.64	2	NQ RC				T.C.R. 89% S.C.R. 78% R.Q.D. 67%		Granular Filter; 38mm PVC #10 Slot Screen
				3	NQ RC				T.C.R. 82% S.C.R. 35% R.Q.D. 12%		
				4	NQ RC				T.C.R. 100% S.C.R. 91% R.Q.D. 76%		
	End of Hole		5.69								WL. in Screen at Elev. 97.75m June 10, 1993

LOGGED: K.A.M

DEPTH SCALE (ALONG HOLE)

PROJECT: 921-2778

RECORD OF BOREHOLE 3

SHEET 1 OF 1

LOCATION: See Plan

BORING DATE: May 7, 1993

DATUM: Local

DIP:

SAMPLER HAMMER: 63.5Kg; DROP: 760 mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	SAMPLES: RECOVERY %	SAMPLES: LAB. TESTING	GAS CONCENTRATION ( ) %LEL	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT, PERCENT Wp W Wl (20 40 60 80)	INSTALLATIONS
0	Power Auger	Ground Surface		97.99								
		TOPSOIL		0.00								
				0.15								Bentonite Seal
1		Brown silty sand, some gravel and cobbles; cobbles and boulders predominant from 1.34m to 1.82m depth (GLACIAL TILL)										
	NW Casing			96.17								Native Backfill
				1.82	1	SS	72					
2		Very dense brown to grey sandy silt, some gravel, cobbles and boulders (GLACIAL TILL)				DO						
					2	NQ RC						Bentonite Seal
				96.36								
				3.63	3	NQ RC				T.C.R. 21% S.C.R. 0% R.Q.D. 0%		
4	Rotary Drilling				4	NQ RC				T.C.R. 30% S.C.R. 0% R.Q.D. 0%		Granular Filter
	NQ Core	Fresh to faintly weathered light grey to dark grey very fine grained to fine grained massive DOLOMITIC LIMESTONE, occasional stylolite and shale parting with fractures commonly coincident with stylolite zones; vuggy zones present with some vugs infilled with calcite			5	NQ RC				T.C.R. 61% S.C.R. 27% R.Q.D. 0%		
5					6	NQ RC				T.C.R. 99% S.C.R. 78% R.Q.D. 77%		38mm PVC #10 Slot Screen
6					7	NQ RC				T.C.R. 100% S.C.R. 96% R.Q.D. 56%		
				91.69								
		End of Hole		6.30								
7												
8												
9												
10												

WL. in Screen at Elev. 97.09m June 10, 1993

DEPTH SCALE (ALONG HOLE)

1 to 50

Golder Associates

LOGGED: K.A.M

CHECKED: K.A.M

PROJECT: 921-2778

LOCATION: See Plan

DIP:

RECORD OF BOREHOLE 4

BORING DATE: May 7, 1993

SHEET 1 OF 1

DATUM: Local

SAMPLER HAMMER, 63.5 kg; DROP, 760 mm

BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	RECOVERY %	LAB. TESTING	GAS CONCENTRATION (%LEL)	HYDRAULIC CONDUCTIVITY, k, cm/s	WATER CONTENT, PERCENT (Wp, W, Wl; 20 40 60 80)	INSTALLATIONS
	Ground Surface		97.56 / 0.00									
Power Auger, NW Casing	Brown SILTY SAND and GRAVEL		95.85 / 1.71	1	SS	50 DO 96						Bentonite Seal; Native Backfill
	Very dense brown to grey sandy silt, some gravel, cobbles (GLACIAL TILL)		95.43 / 2.13	2	NQ RC			T.C.R. 100% S.C.R. 66% R.Q.D. 66%				Bentonite Seal
Rotary Drilling, NQ Core	Fresh to faintly weathered light grey to dark grey very fine grained to fine grained massive DOLOMITIC LIMESTONE, occasional shale interbed and stylolite.			3	NQ RC			T.C.R. 75% S.C.R. 42% R.Q.D. 0%				
				4	NQ RC			T.C.R. 86% S.C.R. 79% R.Q.D. 68%				Granular Filter
				5	NQ RC			T.C.R. 100% S.C.R. 100% R.Q.D. 93%				38mm PVC #10 Slot Screen
				6	NQ RC			T.C.R. 93% S.C.R. 78% R.Q.D. 61%				
	End of Hole		92.47 / 5.09									WL, In Screen at Elev. 96.70m June 10, 1993

DEPTH SCALE (ALONG HOLE)

LOGGED: K.A.M

RECORD OF BOREHOLE 5

PROJECT: 921-2778
LOCATION: See Plan
DIP:

BORING DATE: May 10, 1993

SHEET 1 OF 1
DATUM: Local
SAMPLER HAMMER, 63.5kg; DROP, 760 mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	RECOVERY %	LAB. TESTING	GAS CONCENTRATION (%LEL)	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT, PERCENT (Wp, W, Wl; 20 40 60 80)	INSTALLATIONS
0	Power Auger 200mm Diam (Hollow Stem)	Ground Surface		98.48 / 0.00								Bentonite Seal
1		Very loose fine to medium SAND, some gravel, wire, plastic (WASTE FILL)			1	50 DO	2					Native Backfill
2					2	50 DO	21					Bentonite Seal ▽
3		Compact brown SILTY SAND and GRAVEL		95.63 / 2.83								Granular Filter
		Dense brown sandy silt, some gravel, occasional cobbles (GLACIAL TILL)		95.26 / 3.20	3	50 DO	48					38mm PVC #10 Slot Screen
4		Very dense brown to grey sandy silt to silt, trace fine to coarse gravel (GLACIAL TILL)		94.65 / 3.81	4	50 DO	73					
5		End of Hole Sampler Refusal		93.74 / 4.72	5	50 DO	>100					WL. in Screen at Elev. 96.51m June 10, 1993
6												
7												
8												
9												
10												

DEPTH SCALE (ALONG HOLE)

LOGGED: K.A.M
CHECKED: K.A.M

Golder Associates

The Ontario Water Resources Act
WATER WELL RECORD

County or District	Township/Borough/City/Town/Village	Con. block, tract, survey, etc.	Lot
North Dundas	Mountain	Con. 4	11
Municipality: Mountain Dundas	Address: 5410 St. Lawrence Street	Date completed: 5 08 [illegible]	

LOG OF OVERBURDEN AND BEDROCK MATERIALS (see instructions)

General colour	Most common material	Other materials	General description	Depth – feet From	To
Grey	Limestone	Fracture		0	5
Grey	Limestone	Soft		5	8
	Limestone	Med		[illegible]	[illegible]

MW6

WATER RECORD

Water found at – feet	Kind of water
	☐ Fresh ☐ Salty ☐ Sulphur ☐ Minerals ☐ Gas
	☐ Fresh ☐ Salty ☐ Sulphur ☐ Minerals ☐ Gas
	☐ Fresh ☐ Salty ☐ Sulphur ☐ Minerals ☐ Gas
	☐ Fresh ☐ Salty ☐ Sulphur ☐ Minerals ☐ Gas
	☐ Fresh ☐ Salty ☐ Sulphur ☐ Minerals ☐ Gas

CASING & OPEN HOLE RECORD

Inside diam. inches	Material	Wall thickness inches	Depth – feet From	To
6	☒ Open hole		0	50
2	☐ Steel ☐ Galvanized ☐ Concrete ☐ Open hole ☐ Plastic	Sch. 40	+3	15
2	☐ Open hole ☐ Plastic	Sch. 40	+3	50
6	☒ Steel ☐ Galvanized ☐ Concrete ☐ Open hole ☐ Plastic	.188	+4	1

SCREEN

Slot of opening (slot no.)	Diameter	Length
10	2 inches	10 feet
Material and type: Plastic	Depth at top of screen: 1 – 40 / 2 – 5 feet	

PLUGGING & SEALING RECORD

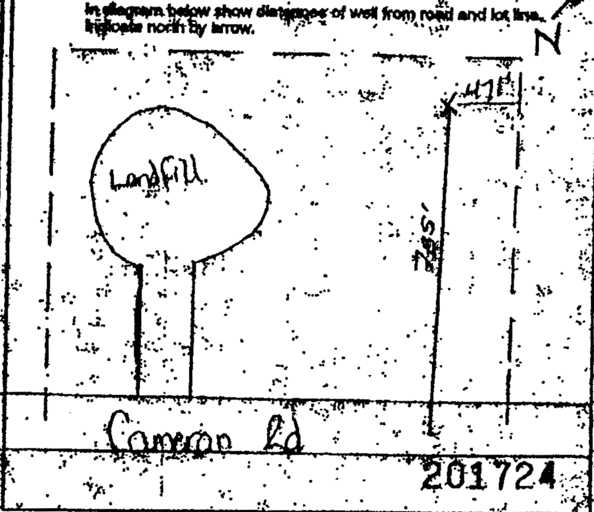
☐ Annular space ☐ Abandonment

Depth set at – feet From	To	Material and type (Cement grout, bentonite, etc.)
50	39	#Filtersand
39	34	[illegible]
34	14	Back of [illegible]
14	4	[illegible]
4	0	Hole plug

Pumping test method	Pumping rate	Duration of pumping
☐ Pump ☐ Bailer	GPM	Hours Mins
Static level	Water level end of pumping	Water levels during ☐ Pumping ☐ Recovery
		15 minutes / 30 minutes / 45 minutes / 60 minutes — feet
If flowing give rate: GPM	Pump intake set at: feet	Water at end of test: ☐ Clear ☐ Cloudy
Recommended pump type: ☐ Shallow ☐ Deep	Recommended pump setting: feet	Recommended pump rate: GPM

LOCATION OF WELL

In diagram below show distances of well from road and lot line. Indicate north by arrow.



201724

FINAL STATUS OF WELL

☐ Water supply ☐ Abandoned, insufficient supply ☐ Unfinished
☒ Observation well ☐ Abandoned, poor quality ☐ Replacement well
☐ Test hole ☒ Abandoned (Other)
☐ Recharge well ☐ Dewatering

WATER USE

☐ Domestic ☐ Commercial ☐ Not used
☐ Stock ☐ Municipal ☐ Other
☐ Irrigation ☐ Public supply
☐ Industrial ☐ Cooling & air conditioning

METHOD OF CONSTRUCTION

☐ Cable tool ☐ Air percussion ☐ Boring
☐ Rotary (conventional) ☐ Jetting ☐ Digging
☐ Rotary (reverse) ☐ Driving ☐ Other
☒ Rotary (air) ☐ Jetting

Name of Well Contractor	Well Contractor's Licence No.
Olympic Drilling Co. Ltd.	4006
Address: 2320 Sedwan Dr. Metcalfe	
Name of Well Technician: Wayne Renaud	Well Technician's Licence No.: T0-327
Signature of Technician/Contractor: [signature]	Submission date: day mo. yr.

MINISTRY USE ONLY

1 – CONTRACTOR'S COPY

0506 (07/94) Front Form 9

Ministry of the Environment and Energy

The Ontario Water Resources Act
WATER WELL RECORD

County or District	Township/Borough/City/Town/Village	Con. block tract survey, etc.	Lot
North Dundas	Mountain North Dundas	Con 4	11
Owner	Address	Date completed	
Township of North Dundas	547 St Lawrence Street	01 08 99	

LOG OF OVERBURDEN AND BEDROCK MATERIALS

General colour	Most common material	Other materials	General description	Depth – feet From	To
Grey	Limestone	Fracture		0	7
Grey	Limestone	Soft		7	18
Grey	Limestone	Med		18	50

MW 7

CASING & OPEN HOLE RECORD

Inside diam inches	Material	Wall thickness inches	Depth – feet From	To
6	Open hole		0	50
2	Plastic	Sch 40	+3	15
2	Plastic	Sch 40	+3	50
6	Steel	.188	+4	1

SCREEN

Slot No.	Diameter	Length
10	2 inches	10 feet

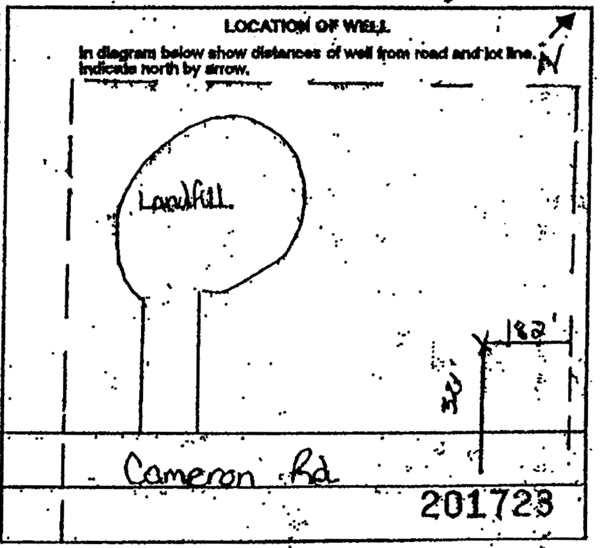
Material and type: Plastic. Depth at top of screen: 42.5 feet

PLUGGING & SEALING RECORD

Depth set at – feet From	To	Material and type
50	37	#3 Filterstone
37	34	Bentonite
34	16	Rock Cutting
16	4	Filterstone
4	0	Hole plug

LOCATION OF WELL

In diagram below show distances of well from road and lot line. Indicate north by arrow.



201723

Name of Well Contractor: Olympic Drilling Co. Ltd. Well Contractor's Licence No.: 4006

Address: 2320 Sciences Dr, Hetalfe

Name of Well Technician: Wayne Rearwell. Well Technician's Licence No.: 10327

1 - CONTRACTOR'S COPY

Project No: MC12684A

Log of MW 8

Project: North Dundas Landfill

Client: County of North Dundas

Location: Mountain Township

Logged by: Matt Prince

Trow

SUBSURFACE PROFILE				SAMPLE					
Depth (ft / m)	Symbol	Description	Elev.	Number	Type	Recovery	Volatile Organic Compounds (ppmv: 25, 75, 125, 175)	Well Data	Well Data
0 / 0		Ground Surface	0						
0–9 / 0–2.7		***TILL*** Medium brown, dry, silty sandy till with some boulders.	-2.7	-					
9–30 / 2.7–9		***BERDOCK*** Limestone bedrock.							

Drill Method: Air Rotary

Drill Date: November 6, 2002

Hole Size: 0.15 metres

Trow Consulting Engineers Ltd.
154 Colonnade Road South
Nepean, Ontario K2E 7J5

Datum:

Checked by: Blaine Coons

Project No: MC12684A

Log of MW 8

Project: North Dundas Landfill

Client: County of North Dundas

Location: Mountain Township

Logged by: Matt Prince

Trow

SUBSURFACE PROFILE				SAMPLE			Volatile Organic Compounds ppmv 25 75 125 175	Well Data	Well Data
Depth	Symbol	Description	Elev.	Number	Type	Recovery			
31 32 33 10 34 35 36 11 37 38 39 12 40 41 42 43 13 44 45			-14	-					
46 14 47 48 49 15 50 51 52 16 53 54 55 56 17 57 58 59 18 60		End of Borehole							

Drill Method: Air Rotary

Drill Date: November 6, 2002

Hole Size: 0.15 metres

Trow Consulting Engineers Ltd.
154 Colonnade Road South
Nepean, Ontario K2E 7J5

Datum:

Checked by: Blaine Coons

Sheet: 2 of 2

Project No: MC12684A

Log of MW 9

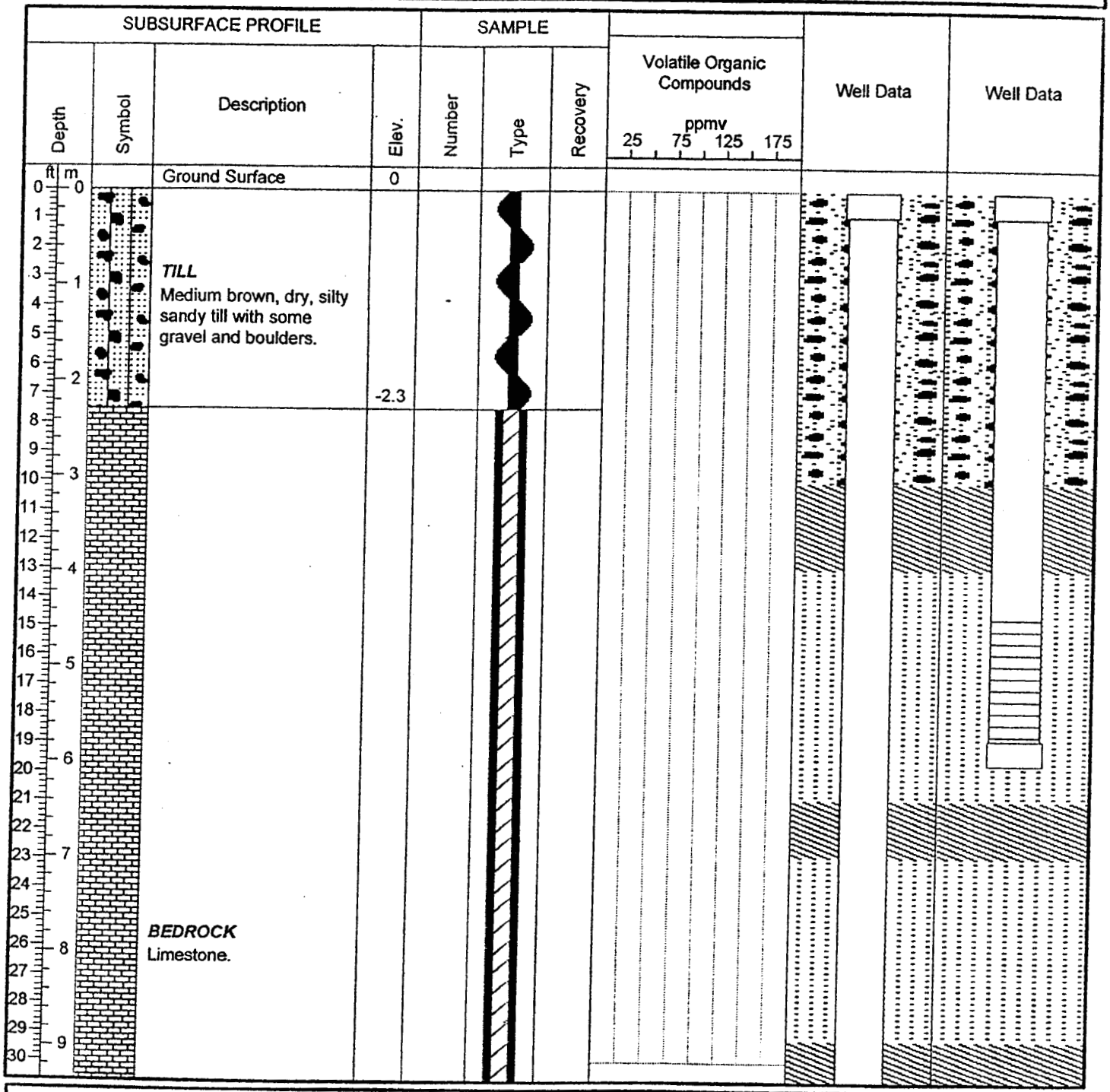
Project: North Dundas Landfill

Client: County of North Dundas

Location: Mountain Township

Logged by: Matt Prince

Trow



Drill Method: Air Rotary

Drill Date: November 7, 2002

Hole Size: 0.15 metres

Trow Consulting Engineers Ltd.
154 Colonnade Road South
Nepean, Ontario K2E 7J5

Datum:

Checked by: Blaine Coons

Project No: MC12684A

Log of MW 9

Project: North Dundas Landfill

Client: County of North Dundas

Location: Mountain Township

Logged by: Matt Prince

Trow

SUBSURFACE PROFILE				SAMPLE			Volatile Organic Compounds ppmv 25 75 125 175	Well Data	Well Data
Depth	Symbol	Description	Elev.	Number	Type	Recovery			
10									
11				-					
12									
13			-13						
		End of Borehole							
14									
15									
16									
17									
18									

Drill Method: Air Rotary

Drill Date: November 7, 2002

Hole Size: 0.15 metres

Trow Consulting Engineers Ltd.
154 Colonnade Road South
Nepean, Ontario K2E 7J5

Datum:

Checked by: Blaine Coons

Sheet: 2 of 2

Project No: MC12684A

Project: North Dundas Landfill

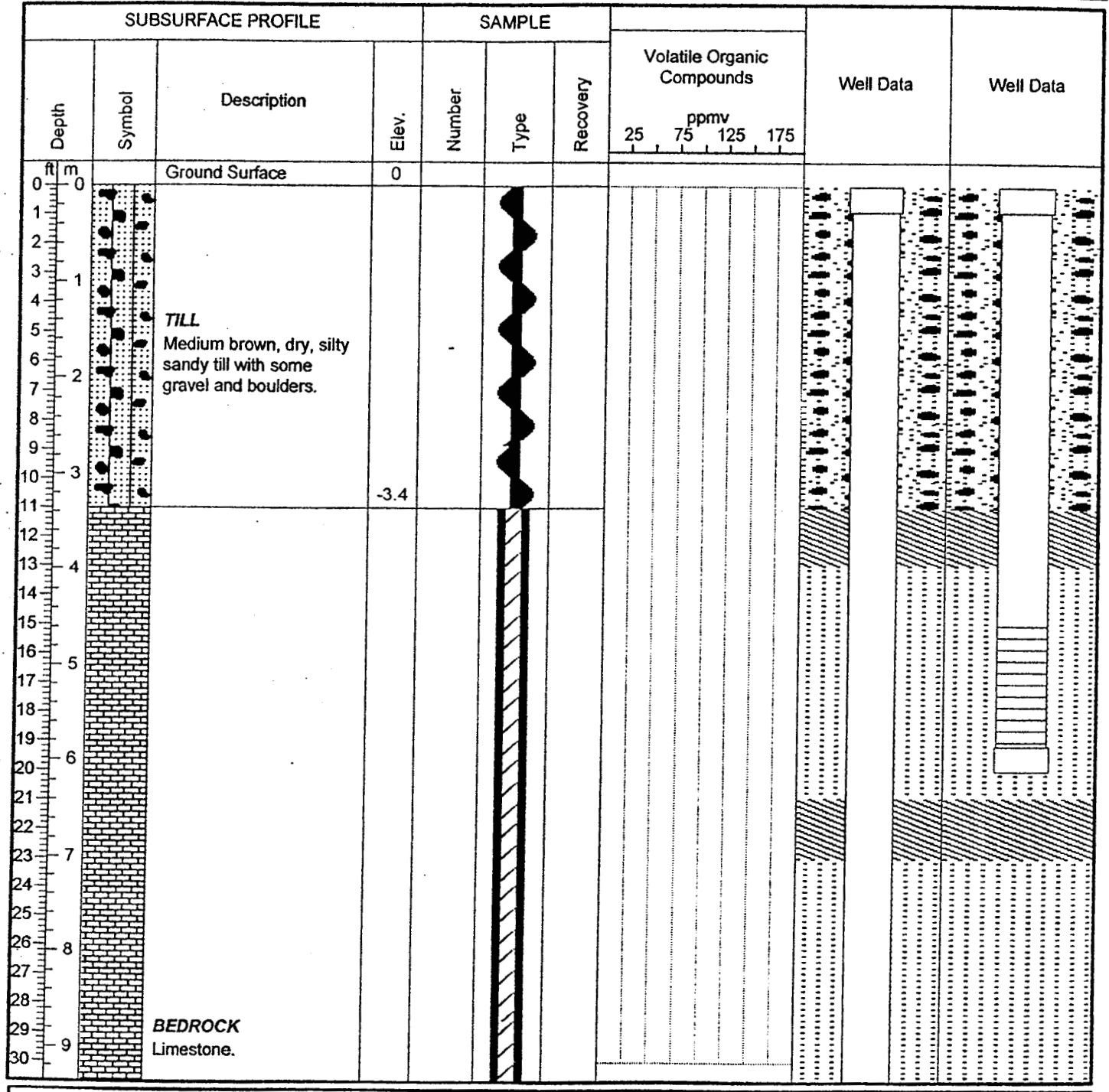
Client: County of North Dundas

Location: Mountain Township

Log of MW 10

Logged by: Matt Prince

Trow



Drill Method: Air Rotary

Drill Date: November 8, 2002

Hole Size: 0.15 metres

Trow Consulting Engineers Ltd.

154 Colonnade Road South
Nepean, Ontario K2E 7J5

Datum:

Checked by: Blaine Coons

Project No: MC12684A

Log of MW 10

Project: North Dundas Landfill

Client: County of North Dundas

Location: Mountain Township

Logged by: Matt Prince

Trow

SUBSURFACE PROFILE				SAMPLE			Volatile Organic Compounds ppmv 25 75 125 175	Well Data	Well Data
Depth	Symbol	Description	Elev.	Number	Type	Recovery			
31									
32									
33 – 10									
34									
35									
36 – 11									
37									
38									
39 – 12									
40									
41									
42									
43 – 13									
44									
45									
46 – 14			-14						
47		End of Borehole							
48									
49 – 15									
50									
51									
52 – 16									
53									
54									
55									
56 – 17									
57									
58									
59 – 18									
60									

Drill Method: Air Rotary

Drill Date: November 8, 2002

Hole Size: 0.15 metres

Trow Consulting Engineers Ltd.
154 Colonnade Road South
Nepean, Ontario K2E 7J5

Datum:

Checked by: Blaine Coons

Sheet: 2 of 2

HSP Engineering and Environmental Services

APPENDIX 3.0

GROUNDWATER LABORATORY ANALYSES

ANALYTICAL SERVICES

24-Nov-2004

HSP ENGINEERING & ENV. SERVICES
103 Warner Drive
Long Sault, ON
K0C 1P0

Attn: Lena Perry
Project: 5447

Received: 9-Nov-2004 08:37
PO #:

Job: 2461858

Status: Final

Ground Water Samples

Sample Id	Ni ICP/MS mg/L	P ICP/MS mg/L	Pb ICP/MS mg/L	Sb ICP/MS mg/L	Se ICP/MS mg/L	Si ICP/MS mg/L	Sn ICP/MS mg/L	Sr ICP/MS mg/L
MOUNTAIN MW1	0.003	<0.05	<0.0005	0.0041	<0.002	2.32	<0.001	0.106
MOUNTAIN MW2	<0.001	<0.05	<0.0005	<0.0005	<0.002	2.76	<0.001	0.147
MOUNTAIN MW3	0.001	<0.05	<0.0005	<0.0005	<0.002	3.92	<0.001	0.149
MOUNTAIN MW6S	0.004	<0.05	<0.0005	<0.0005	<0.002	4.48	<0.001	0.116
MOUNTAIN MW6D	<0.001	<0.05	<0.0005	<0.0005	<0.002	2.64	<0.001	1.32
MOUNTAIN MW7S	0.013	<0.05	<0.0005	<0.0005	<0.002	3.68	<0.001	0.251
MOUNTAIN MW7D	<0.001	<0.05	<0.0005	<0.0005	<0.002	3.44	<0.001	0.818
MOUNTAIN MW8S	<0.001	<0.05	<0.0005	<0.0005	<0.002	3.79	<0.001	0.398
MOUNTAIN MW8D	0.013	0.21	0.0006	<0.0005	<0.002	3.85	<0.001	1.09
MOUNTAIN MW9S	<0.001	<0.05	<0.0005	<0.0005	<0.002	3.00	<0.001	0.080
MOUNTAIN MW9D	0.006	<0.05	<0.0005	0.0006	<0.002	2.80	<0.001	2.14
MOUNTAIN MW10S	<0.001	<0.05	<0.0005	<0.0005	<0.002	4.10	<0.001	0.835
MOUNTAIN MW10D	<0.001	<0.05	<0.0005	<0.0005	<0.002	3.96	<0.001	0.793
Sample+Spike (found)	0.515	---	0.538	0.536	0.518	---	---	---
Sample+Spike (expected)	0.503	---	0.500	0.504	0.500	---	---	---
Blank	<0.001	<0.05	<0.0005	<0.0005	<0.002	<0.05	<0.001	<0.001
QC Standard (found)	0.047	0.10	0.0511	0.0504	0.049	0.10	0.052	0.049
QC Standard (expected)	0.050	0.10	0.0500	0.0500	0.050	0.10	0.050	0.050
Repeat MOUNTAIN MW1	0.003	<0.05	<0.0005	0.0040	<0.002	2.30	<0.001	0.106

PSC
ANALYTICAL SERVICES

24-Nov-2004

HSP ENGINEERING & ENV. SERVICES
103 Warner Drive
Long Sault, ON
K0C 1P0

Page: 6
Copy: 1 of 2

Attn: Lena Perry
Project: 5447

Received: 9-Nov-2004 08:37
PO #:

Job: 2461858

Status: Final

Ground Water Samples

Sample Id	Ti ICP/MS mg/L	Tl ICP/MS mg/L	U ICP/MS mg/L	V ICP/MS mg/L	Zn ICP/MS mg/L
MOUNTAIN MW1	<0.005	0.00006	0.0095	<0.0005	<0.005
MOUNTAIN MW2	<0.005	0.00011	0.0033	<0.0005	<0.005
MOUNTAIN MW3	<0.005	<0.00005	0.0016	<0.0005	<0.005
MOUNTAIN MW6S	<0.005	0.00008	0.0022	<0.0005	0.022
MOUNTAIN MW6D	<0.005	0.00008	0.0027	0.0030	<0.005
MOUNTAIN MW7S	<0.005	0.00062	0.0024	<0.0005	<0.005
MOUNTAIN MW7D	<0.005	<0.00005	0.0010	<0.0005	0.008
MOUNTAIN MW8S	<0.005	<0.00005	0.0002	<0.0005	0.008
MOUNTAIN MW8D	<0.005	0.00023	0.0069	<0.0005	0.007
MOUNTAIN MW9S	<0.005	<0.00005	0.0010	<0.0005	<0.005
MOUNTAIN MW9D	<0.005	0.00006	0.0082	<0.0005	0.009
MOUNTAIN MW10S	<0.005	<0.00005	0.0007	<0.0005	<0.005
MOUNTAIN MW10D	<0.005	<0.00005	0.0007	<0.0005	<0.005
Sample+Spike (found)	0.523	0.529	0.533	0.532	0.532
Sample+Spike (expected)	0.500	0.500	0.509	0.500	0.500
Blank	<0.005	<0.00005	<0.0001	<0.0005	<0.005
QC Standard (found)	0.049	0.0996	0.0520	0.0496	0.050
QC Standard (expected)	0.050	0.100	0.0500	0.0500	0.050
Repeat MOUNTAIN MW1	<0.005	0.00006	0.0094	<0.0005	<0.005

PSC
ANALYTICAL SERVICES

24-Nov-2004

HSP ENGINEERING & ENV. SERVICES
103 Warner Drive
Long Sault, ON
K0C 1P0

Attn: Lena Perry
Project: 5447

Received: 9-Nov-2004 08:37
PO #:

Job: 2461858

Status: Final

Ground Water Samples

Sample Id	As ICP/MS mg/L	B ICP/MS mg/L	Ba ICP/MS mg/L	Be ICP/MS mg/L	Bi ICP/MS mg/L	Ca ICP/MS mg/L	Cd ICP/MS mg/L	Co ICP/MS mg/L
MOUNTAIN MW1	0.012	0.011	0.145	<0.0005	<0.001	101.	<0.0001	<0.0001
MOUNTAIN MW2	<0.002	0.015	0.158	<0.0005	<0.001	80.5	<0.0001	<0.0001
MOUNTAIN MW3	<0.002	0.021	0.107	<0.0005	<0.001	89.6	<0.0001	0.0003
MOUNTAIN MW6S	<0.002	0.016	0.063	<0.0005	<0.001	87.8	<0.0001	0.0003
MOUNTAIN MW6D	<0.002	0.781	0.309	<0.0005	<0.001	23.5	<0.0001	<0.0001
MOUNTAIN MW7S	<0.002	0.298	0.166	<0.0005	<0.001	127.	<0.0001	0.0009
MOUNTAIN MW7D	<0.002	0.271	0.122	<0.0005	<0.001	49.3	<0.0001	<0.0001
MOUNTAIN MW8S	<0.002	0.071	0.118	<0.0005	<0.001	70.3	<0.0001	<0.0001
MOUNTAIN MW8D	<0.002	0.375	0.143	<0.0005	<0.001	131.	<0.0001	0.0020
MOUNTAIN MW9S	<0.002	0.010	0.050	<0.0005	<0.001	78.0	<0.0001	<0.0001
MOUNTAIN MW9D	<0.002	0.184	0.053	<0.0005	<0.001	127.	<0.0001	0.0005
MOUNTAIN MW10S	<0.002	0.171	0.100	<0.0005	<0.001	69.9	<0.0001	<0.0001
MOUNTAIN MW10D	<0.002	0.160	0.097	<0.0005	<0.001	68.8	<0.0001	<0.0001
Sample+Spike (found)	0.563	---	0.697	0.538	---	---	0.528	0.526
Sample+Spike (expected)	0.512	---	0.645	0.500	---	---	0.500	0.500
Blank	<0.002	<0.005	<0.005	<0.0005	<0.001	<0.5	<0.0001	<0.0001
QC Standard (found)	0.052	0.050	0.053	0.0506	0.050	4.9	0.0501	0.0481
QC Standard (expected)	0.050	0.050	0.050	0.0500	0.050	5.0	0.0500	0.0500
Repeat MOUNTAIN MW1	0.012	0.013	0.146	<0.0005	<0.001	99.8	<0.0001	<0.0001

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ANALYTICAL SERVICES

24-Nov-2004

HSP ENGINEERING & ENV. SERVICES
103 Warner Drive
Long Sault, ON
K0C 1P0

Attn: Lena Perry
Project: 5447

PO #:

Received: 9-Nov-2004 08:37

Job: 2461858

Status: Final

Ground Water Samples

Sample Id	Cr ICP/MS mg/L	Cu ICP/MS mg/L	Fe ICP/MS mg/L	K ICP/MS mg/L	Mg ICP/MS mg/L	Mn ICP/MS mg/L	Mo ICP/MS mg/L	Na ICP/MS mg/L
MOUNTAIN MW1	<0.005	<0.0005	<0.03	1.3	47.0	0.006	0.095	2.2
MOUNTAIN MW2	<0.005	<0.0005	<0.03	1.8	38.2	<0.005	0.010	1.9
MOUNTAIN MW3	<0.005	<0.0005	<0.03	1.0	43.3	0.008	0.004	7.2
MOUNTAIN MW6S	<0.005	0.0007	<0.03	1.0	41.6	0.015	0.018	14.7
MOUNTAIN MW6D	<0.005	<0.0005	<0.03	4.9	13.0	<0.005	0.012	101.
MOUNTAIN MW7S	<0.005	0.0012	<0.03	18.1	63.6	1.13	0.005	37.8
MOUNTAIN MW7D	<0.005	<0.0005	<0.03	3.1	25.3	<0.005	0.004	7.6
MOUNTAIN MW8S	<0.005	<0.0005	<0.03	2.0	36.3	<0.005	0.031	3.5
MOUNTAIN MW8D	<0.005	0.0071	<0.03	21.0	66.3	0.167	0.018	51.0
MOUNTAIN MW9S	<0.005	0.0010	<0.03	0.8	29.1	<0.005	0.002	5.3
MOUNTAIN MW9D	<0.005	0.0044	<0.03	5.8	58.7	0.017	0.118	64.4
MOUNTAIN MW10S	<0.005	<0.0005	<0.03	4.4	37.7	0.006	0.004	4.2
MOUNTAIN MW10D	<0.005	<0.0005	<0.03	4.2	36.6	0.006	0.004	3.9
Sample+Spike (found)	0.526	0.515	0.56	---	---	0.542	0.648	---
Sample+Spike (expected)	0.500	0.500	0.50	---	---	0.506	0.595	---
Blank	<0.005	<0.0005	<0.03	<0.1	<0.05	<0.005	<0.001	<0.1
QC Standard (found)	0.049	0.0490	0.05	0.9	1.02	0.049	0.057	4.5
QC Standard (expected)	0.050	0.0500	0.05	1.0	1.00	0.050	0.055	5.0
Repeat MOUNTAIN MW1	<0.005	<0.0005	<0.03	1.3	47.3	0.006	0.094	2.1

PSC
ANALYTICAL SERVICES

HSP ENGINEERING & ENV. SERVICES
103 Warner Drive
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K0C 1P0

24-Nov-2004

Page: 1
Copy: 1 of 2

Attn: Lena Perry
Project: 5447

PO #:

Received: 9-Nov-2004 08:37

Job: 2461858

Status: Final

Ground Water Samples

Sample Id	pH SM 4500B pH Units	Sp. Cond. SM 2510B umhos/cm	Alk 4.5 SM 2320B mg CaCO3/L	TDS SM 2540C mg/L	BOD (5) SM 5210B mg/L	Cl- SM 4110B mg/L	SO4= SM 4110B mg/L
MOUNTAIN MW1	7.79	816	344	506	<0.5	41.9	72.0
MOUNTAIN MW2	7.68	877	323	400	<0.5	12.0	49.7
MOUNTAIN MW3	7.80	777	334	462	<0.5	29.8	72.0
MOUNTAIN MW6S	7.92	763	350	466	<0.5	3.6	93.0
MOUNTAIN MW6D	8.27	675	329	386	0.6	6.2	23.4
MOUNTAIN MW7S	7.60	1241	532	778	<0.5	58.6	136.
MOUNTAIN MW7D	7.96	468	243	250	<0.5	0.8	17.1
MOUNTAIN MW8S	7.87	629	273	388	<0.5	3.7	82.4
MOUNTAIN MW8D	8.00	1291	536	832	2.2	66.1	157.
MOUNTAIN MW9S	7.64	606	318	336	<0.5	3.2	22.4
MOUNTAIN MW9D	8.00	1255	283	948	<0.5	6.1	458.
MOUNTAIN MW10S	7.81	646	298	386	<0.5	15.6	47.0
MOUNTAIN MW10D	7.91	648	297	374	<0.5	15.3	46.3
Sample+Spike (found)	---	---	---	---	---	---	---
Sample+Spike (expected)	---	---	---	---	---	---	---
Blank	---	2	<1	<2	<0.5	<0.5	<0.5
QC Standard (found)	7.04	722	250	250	5.4	2.0	4.8
QC Standard (expected)	7.00	718	250	250	6.0	2.0	5.0
Repeat MOUNTAIN MW1	7.75	815	347	514	1.0	42.4	71.6

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ANALYTICAL SERVICES

24-Nov-2004

HSP ENGINEERING & ENV. SERVICES
103 Warner Drive
Long Sault, ON
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Page: 2
Copy: 1 of 2

Attn: Lena Perry
Project: 5447

PO #:

Received: 9-Nov-2004 08:37

Job: 2461858

Status: Final

Ground Water Samples

Sample Id	NO3-N SM 4110B mg/L	NH3-N SM 4500H mg/L	TKN SM 4500B mg/L	DOC SM 5310C mg/L	COD SM 5220D mg/L	C-Hard. SM 2340B mg CaCO3/L	Ag ICP/MS mg/L	Al ICP/MS mg/L
MOUNTAIN MW1	<0.2	<0.03	0.13	1.6	6	447.7	0.0001	<0.005
MOUNTAIN MW2	0.3	<0.03	0.13	1.2	<5	358.5	<0.0001	0.012
MOUNTAIN MW3	<0.2	<0.03	0.10	1.5	<5	402.3	<0.0001	0.006
MOUNTAIN MW6S	<0.2	<0.03	0.09	1.2	<5	390.6	<0.0001	0.012
MOUNTAIN MW6D	<0.2	0.04	0.06	0.6	<5	112.6	<0.0001	0.015
MOUNTAIN MW7S	0.8	3.64	4.60	5	16	579.8	<0.0001	<0.005
MOUNTAIN MW7D	<0.2	0.08	0.11	0.4	<5	227.6	<0.0001	0.012
MOUNTAIN MW8S	<0.2	<0.03	0.07	1	<5	325.3	<0.0001	<0.005
MOUNTAIN MW8D	2.1	1.06	1.69	6.7	20	600.4	<0.0001	0.013
MOUNTAIN MW9S	0.5	<0.03	0.12	1.9	5	314.8	<0.0001	<0.005
MOUNTAIN MW9D	0.5	<0.03	0.21	2	5	560.9	<0.0001	0.011
MOUNTAIN MW10S	<0.2	0.06	0.14	1	<5	330.0	<0.0001	<0.005
MOUNTAIN MW10D	<0.2	0.05	0.16	1.1	<5	322.6	<0.0001	<0.005
Sample+Spike (found)	---	0.55	---	14.8	---	nan	---	0.544
Sample+Spike (expected)	---	0.59	---	15	---	nan	---	0.500
Blank	<0.2	<0.03	<0.03	<0.2	<5	1.5	<0.0001	<0.005
QC Standard (found)	1.0	1.51	1.36	9.9	41	16.5	0.0028	0.989
QC Standard (expected)	1.0	1.50	1.40	10	40	16.6	0.0030	1.00
Repeat MOUNTAIN MW1	<0.2	<0.03	0.13	1.6	5	444.1	0.0001	<0.005

PSC ANALYTICAL SERVICES
5735 McAdam Road
Mississauga
Ontario L4Z 1N9
Tel: (905) 890-8566
Fax: (905) 890-8575
Toll Free: 1-800-263-9040

LABORATORY USE ONLY
Work Order: 2455766
Comments:

CHAIN OF CUSTODY RECORD

Mountain Groundwater

Client: HSP Inc.
103 Warner Dr.
Long Sault, ON K0C 1P0
Contact: Lenard Perry
Phone: 613-932-3289 Fax: 613-937-0125

PASC Quote #: 279-2004-BC
Client P.O. #:
Client Project #: 5447
Sampled by: Joshua Teixeira
Please specify Guideline (if applicable) Table A- MOE "Guidelines for Use at Cont. Sites"

Page 2 of 2

Invoice to (if other than above):

TAT (Turnaround Time)

PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Some exceptions apply. Please contact Lab

STD 5-7 Business Days ☒
RUSH Specify Date:
Time:

Sample #	Client Sample I.D.	Date Sampled	Time Sampled	BOD5	Nutrients (COD, DOC, TKN, NH3-N)	General (pH, Alk, Conductivity, Cl, NO3, SO4, Hardness)	TDS	Metals-ICPMS	Sample Matrix	No. of Containers	Comments/Contamination/ Site History
13	Mountain 10D	June 18/04		✓	✓	✓	✓	✓	water	5	Metals samples field filtered 0.45 µm
~~2~~	~~Mountain~~										
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											

Samples Relinquished to PASC by: (Client Signature) — Date: June 18/04 Time: 4:00 pm — Method of Shipment:
Samples Received in lab by: — Date: 04/06/19 Time: 9:32 — Condition of samples upon receipt at lab: 18, 16, 17°C

White: PSC *Yellow:* Mail *Pink:* Receiver *Goldenrod:* Client

Rev.PSC-COC.5.26.02

050847

ANALYTICAL SERVICES

8-Jul-2004

HSP ENGINEERING & ENV. SERVICES
103 Warner Drive
Long Sault, ON
K0C 1P0

Page: 7
Copy: 1 of 2

Attn: Lena Perry
Project: 5447

Received: 19-Jun-2004 09:32
PO #:

Job: 2455766

Status: Final

All work recorded herein has been done in accordance with normal professional standards using accepted testing methodologies and QA/QC procedures. Philip Analytical is limited in liability to the actual cost of the pertinent analyses done unless otherwise agreed upon by contractual arrangement. Your samples will be retained by PASC for a period of 30 days following reporting or as per specific contractual arrangements.

Job approved by:

Signed: .....

Malgorzata Dancziger
Project Manager

PSC ANALYTICAL SERVICES

5735 McAdam Road
Mississauga
Ontario L4Z 1N9

Tel: (905) 890-8566
Fax: (905) 890-8575
Toll Free: 1-800-263-9040

LABORATORY USE ONLY
Work Order: 2455766
Comments:

CHAIN OF CUSTODY RECORD

Mountain Groundwater

Client: HSP Inc.
103 Warner Drive
Long Sault, ON K0C 1P0
Contact: Leith Perry
Phone: 613-932-3289 Fax: 613-937-0125

PASC Quote #: 279-2004-BC
Client P.O. #:
Client Project #: 5447
Sampled by: Joshua Teixeira
Please specify Guideline (if applicable) Table A MOE "Guidelines for Use at Cont. Sites"

Invoice to (if other than above):

TAT (Turnaround Time)

PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Some exceptions apply. Please contact Lab

STD 5-7 Business Days ☒
RUSH Specify Date:
Time:

Sample #	Client Sample I.D.	Date Sampled	Time Sampled	BOD5	Nutrients (COD, DOC, TKN, NH3-N)	General - pH, Alk., Cond., Cl, NO3, SO4, Hardness	TDS	Metals - ICPMS, [redacted]	Sample Matrix	No. of Containers	Comments/Contamination/ Site History
1	Mountain MW1	June 18/04		✓	✓	✓	✓	✓	water	5	Metal Samples Field Filtered 0.45 um
2	Mountain MW2	"		✓	✓	✓	✓	✓	"	"	
3	Mountain MW3	"		✓	✓	✓	✓	✓	"	"	
4	Mountain MW6S	"		✓	✓	✓	✓	✓	"	"	
5	Mountain MW6D	"		✓	✓	✓	✓	✓	"	"	
6	Mountain MW7S	"		✓	✓	✓	✓	✓	"	"	
7	Mountain MW7D	"		✓	✓	✓	✓	✓	"	"	
8	Mountain MW8S	"		✓	✓	✓	✓	✓	"	"	
9	Mountain MW8D	"		✓	✓	✓	✓	✓	"	"	
10	Mountain MW9S	"		✓	✓	✓	✓	✓	"	"	
11	Mountain MW9D	"		✓	✓	✓	✓	✓	"	"	
12	Mountain MW10S	"		✓	✓	✓	✓	✓	"	"	

Samples Relinquished to PASC by: (Client Signature) Lynda Perry
Date: June 18/04 Time: 4:00 pm
Method of Shipment: Purolator

Samples Received in lab by: Jan.
Date: 04/06/19 Time: 9:32
Condition of samples upon receipt at lab: 18, 16, 17°C.

Rev. [redacted] 5.26.02

White: PSC *Yellow:* Mail *Pink:* Receiver *Goldenrod:* Client

050846

PSC
ANALYTICAL SERVICES

8-Jul-2004

HSP ENGINEERING & ENV. SERVICES
103 Warner Drive
Long Sault, ON
K0C 1P0

Page: 5
Copy: 1 of 2

Attn: Lena Perry
Project: 5447

PO #:

Received: 19-Jun-2004 09:32

Job: 2455766

Status: Final

Ground Water Samples

Sample Id	Ni ICP/MS mg/L	P ICP/MS mg/L	Pb ICP/MS mg/L	Sb ICP/MS mg/L	Se ICP/MS mg/L	Si ICP/MS mg/L	Sn ICP/MS mg/L	Sr ICP/MS mg/L
MOUNTAIN MW1	<0.001	<0.05	0.0034	<0.0005	<0.002	1.95	<0.001	0.092
MOUNTAIN MW2	<0.001	<0.05	<0.0005	<0.0005	<0.002	2.32	<0.001	0.136
MOUNTAIN MW3	0.001	<0.05	<0.0005	<0.0005	<0.002	3.24	<0.001	0.125
MOUNTAIN MW6S	0.005	<0.05	<0.0005	<0.0005	<0.002	4.00	<0.001	0.136
MOUNTAIN MW6D	<0.001	<0.05	<0.0005	<0.0005	<0.002	2.96	0.001	1.54
MOUNTAIN MW7S	0.009	<0.05	<0.0005	<0.0005	<0.002	3.14	<0.001	0.216
MOUNTAIN MW7D	<0.001	<0.05	<0.0005	<0.0005	<0.002	3.39	<0.001	0.853
MOUNTAIN MW8S	<0.001	<0.05	<0.0005	<0.0005	<0.002	3.76	<0.001	0.438
MOUNTAIN MW8D	0.011	<0.05	<0.0005	<0.0005	<0.002	3.51	<0.001	0.537
MOUNTAIN MW9S	<0.001	<0.05	<0.0005	<0.0005	<0.002	3.12	<0.001	0.086
MOUNTAIN MW9D	0.007	<0.05	0.0010	0.0016	<0.002	4.93	<0.001	3.77
MOUNTAIN MW10S	<0.001	<0.05	<0.0005	<0.0005	<0.002	5.08	<0.001	0.933
MOUNTAIN MW10D	<0.001	<0.05	<0.0005	<0.0005	<0.002	4.09	<0.001	0.936
Sample+Spike (found)	0.515	---	0.539	0.532	0.529	---	---	---
Sample+Spike (expected)	0.500	---	0.503	0.500	0.500	---	---	---
Blank	<0.001	<0.05	<0.0005	<0.0005	<0.002	<0.05	<0.001	<0.001
QC Standard (found)	0.048	0.10	0.0505	0.0487	0.051	0.09	0.053	0.053
QC Standard (expected)	0.050	0.10	0.0500	0.0500	0.050	0.10	0.050	0.050
Repeat MOUNTAIN MW1	<0.001	<0.05	0.0034	<0.0005	<0.002	1.97	<0.001	0.093

PSC
ANALYTICAL SERVICES

8-Jul-2004

HSP ENGINEERING & ENV. SERVICES
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Page: 6
Copy: 1 of 2

Attn: Lena Perry
Project: 5447
PO #:

Received: 19-Jun-2004 09:32

Job: 2455766

Status: Final

Ground Water Samples

Sample Id	Ti ICP/MS mg/L	Tl ICP/MS mg/L	U ICP/MS mg/L	V ICP/MS mg/L	Zn ICP/MS mg/L
MOUNTAIN MW1	<0.005	<0.00005	0.0009	<0.0005	0.018
MOUNTAIN MW2	<0.005	<0.00005	0.0031	<0.0005	0.045
MOUNTAIN MW3	<0.005	<0.00005	0.0014	<0.0005	0.089
MOUNTAIN MW6S	<0.005	0.00007	0.0023	<0.0005	<0.005
MOUNTAIN MW6D	0.005	0.00006	0.0025	0.0019	0.019
MOUNTAIN MW7S	<0.005	0.00037	0.0019	0.0005	0.044
MOUNTAIN MW7D	<0.005	<0.00005	0.0010	0.0006	0.029
MOUNTAIN MW8S	<0.005	<0.00005	0.0003	<0.0005	0.110
MOUNTAIN MW8D	<0.005	0.00029	0.0035	0.0006	0.021
MOUNTAIN MW9S	<0.005	<0.00005	0.0009	0.0005	0.009
MOUNTAIN MW9D	<0.005	0.00014	0.0114	0.0020	0.044
MOUNTAIN MW10S	<0.005	<0.00005	0.0005	<0.0005	0.094
MOUNTAIN MW10D	<0.005	<0.00005	0.0006	<0.0005	0.120
Sample+Spike (found)	0.511	0.515	0.534	0.540	0.542
Sample+Spike (expected)	0.500	0.500	0.500	0.500	0.518
Blank	<0.005	<0.00005	<0.0001	<0.0005	<0.005
QC Standard (found)	0.049	0.0972	0.0509	0.0508	0.050
QC Standard (expected)	0.050	0.100	0.0500	0.0500	0.050
Repeat MOUNTAIN MW1	<0.005	<0.00005	0.0009	<0.0005	0.018

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8-Jul-2004

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Page: 3
Copy: 1 of 2

Attn: Lena Perry
Project: 5447

Received: 19-Jun-2004 09:32
PO #:

Job: 2455766

Status: Final

Ground Water Samples

Sample Id	As ICP/MS mg/L	B ICP/MS mg/L	Ba ICP/MS mg/L	Be ICP/MS mg/L	Bi ICP/MS mg/L	Ca ICP/MS mg/L	Cd ICP/MS mg/L	Co ICP/MS mg/L
MOUNTAIN MW1	<0.002	0.006	0.086	<0.001	<0.001	75.7	<0.0001	<0.0001
MOUNTAIN MW2	<0.002	0.012	0.130	<0.001	<0.001	72.8	<0.0001	0.0004
MOUNTAIN MW3	<0.002	0.016	0.087	<0.001	<0.001	79.8	<0.0001	0.0003
MOUNTAIN MW6S	<0.002	0.026	0.062	<0.001	<0.001	90.1	<0.0001	0.0001
MOUNTAIN MW6D	<0.002	0.741	0.213	<0.001	<0.001	30.4	<0.0001	<0.0001
MOUNTAIN MW7S	<0.002	0.247	0.112	<0.001	<0.001	115.	<0.0001	0.0006
MOUNTAIN MW7D	<0.002	0.280	0.128	<0.001	<0.001	51.7	<0.0001	<0.0001
MOUNTAIN MW8S	<0.002	0.064	0.122	<0.001	<0.001	81.5	<0.0001	<0.0001
MOUNTAIN MW8D	<0.002	0.354	0.130	<0.001	<0.001	119.	<0.0001	0.0038
MOUNTAIN MW9S	<0.002	0.011	0.052	<0.001	<0.001	78.1	<0.0001	<0.0001
MOUNTAIN MW9D	0.003	0.427	0.075	<0.001	<0.001	127.	0.0002	0.0015
MOUNTAIN MW10S	<0.002	0.164	0.092	<0.001	<0.001	68.5	<0.0001	<0.0001
MOUNTAIN MW10D	<0.002	0.181	0.098	<0.001	<0.001	75.7	<0.0001	<0.0001
Sample+Spike (found)	0.550	---	0.606	0.517	---	---	0.552	0.536
Sample+Spike (expected)	0.500	---	0.586	0.500	---	---	0.500	0.500
Blank	<0.002	<0.005	<0.005	<0.001	<0.001	<0.5	<0.0001	<0.0001
QC Standard (found)	0.053	0.049	0.051	0.051	0.049	4.9	0.0520	0.0510
QC Standard (expected)	0.050	0.050	0.050	0.050	0.050	5.0	0.0500	0.0500
Repeat MOUNTAIN MW1	<0.002	0.007	0.086	<0.001	<0.001	75.7	<0.0001	<0.0001

PSC
ANALYTICAL SERVICES

8-Jul-2004

HSP ENGINEERING & ENV. SERVICES
103 Warner Drive
Long Sault, ON
K0C 1P0

Page: 4
Copy: 1 of 2

Attn: Lena Perry
Project: 5447

Received: 19-Jun-2004 09:32
PO #:

Job: 2455766

Status: Final

Ground Water Samples

Sample Id	Cr ICP/MS mg/L	Cu ICP/MS mg/L	Fe ICP/MS mg/L	K ICP/MS mg/L	Mg ICP/MS mg/L	Mn ICP/MS mg/L	Mo ICP/MS mg/L	Na ICP/MS mg/L
MOUNTAIN MW1	<0.005	<0.0005	<0.03	1.0	36.4	0.006	0.012	2.1
MOUNTAIN MW2	<0.005	<0.0005	<0.03	1.5	36.0	0.018	0.010	1.9
MOUNTAIN MW3	<0.005	<0.0005	0.04	0.9	36.5	0.012	0.004	4.4
MOUNTAIN MW6S	<0.005	<0.0005	0.03	1.1	43.0	<0.005	0.018	9.8
MOUNTAIN MW6D	<0.005	0.0008	<0.03	5.5	16.4	<0.005	0.014	95.4
MOUNTAIN MW7S	<0.005	0.0006	<0.03	12.8	53.7	0.661	0.005	28.6
MOUNTAIN MW7D	<0.005	<0.0005	<0.03	3.3	26.9	<0.005	0.005	8.7
MOUNTAIN MW8S	<0.005	<0.0005	0.06	2.0	40.5	0.012	0.030	3.3
MOUNTAIN MW8D	<0.005	0.0033	<0.03	19.5	57.1	0.363	0.010	36.0
MOUNTAIN MW9S	<0.005	0.0008	<0.03	0.9	29.6	<0.005	0.002	4.5
MOUNTAIN MW9D	<0.005	0.0017	<0.03	9.6	69.0	0.101	0.094	130.
MOUNTAIN MW10S	<0.005	<0.0005	<0.03	4.5	41.1	0.007	0.005	5.9
MOUNTAIN MW10D	<0.005	<0.0005	<0.03	4.6	40.0	0.012	0.005	5.4
Sample+Spike (found)	0.531	0.523	0.55	---	---	0.535	0.571	---
Sample+Spike (expected)	0.500	0.500	0.50	---	---	0.506	0.512	---
Blank	<0.005	<0.0005	<0.03	<0.1	<0.05	<0.005	<0.001	<0.1
QC Standard (found)	0.050	0.0516	0.05	1.0	1.04	0.050	0.059	4.7
QC Standard (expected)	0.050	0.0500	0.05	1.0	1.00	0.050	0.055	5.0
Repeat MOUNTAIN MW1	<0.005	<0.0005	<0.03	1.0	36.2	0.006	0.012	2.2

PSL
ANALYTICAL SERVICES

8-Jul-2004

HSP ENGINEERING & ENV. SERVICES
103 Warner Drive
Long Sault, ON
K0C 1P0

Attn: Lena Perry
Project: 5447

Received: 19-Jun-2004 09:32
PO #:

Job: 2455766

Status: Final

Ground Water Samples

Sample Id	pH SM 4500B pH Units	Sp. Cond. SM 2510B umhos/cm	Alk 4.5 SM 2320B mg CaCO3/L	Cl- SM 4110B mg/L	NO3-N SM 4110B mg/L	SO4= SM 4110B mg/L	C-Hard. SM 2340B mg CaCO3/L
MOUNTAIN MW1	7.71	604	305	19.0	<0.2	28.0	339.1
MOUNTAIN MW2	7.67	598	308	7.1	<0.2	34.0	330.3
MOUNTAIN MW3	7.70	662	324	21.2	<0.2	40.8	349.8
MOUNTAIN MW6S	7.63	711	345	4.7	<0.2	83.8	402.1
MOUNTAIN MW6D	8.03	606	298	4.4	0.2	31.8	143.7
MOUNTAIN MW7S	7.39	997	416	46.8	2.4	115.	509.5
MOUNTAIN MW7D	7.88	454	241	2.4	0.5	16.2	239.8
MOUNTAIN MW8S	7.78	612	277	3.4	<0.2	80.2	370.5
MOUNTAIN MW8D	7.79	1069	448	47.5	2.3	136.	533.0
MOUNTAIN MW9S	7.73	543	298	2.4	<0.2	21.8	316.8
MOUNTAIN MW9D	7.84	1432	401	28.7	0.2	465.	601.5
MOUNTAIN MW10S	7.96	607	289	14.6	<0.2	47.5	340.5
MOUNTAIN MW10D	7.88	608	294	16.7	<0.2	44.4	353.7
Sample+Spike (found)	---	---	---	---	---	---	nan
Sample+Spike (expected)	---	---	---	---	---	---	nan
Blank	---	1	<1	<0.5	<0.2	<0.5	1.5
QC Standard (found)	7.02	704	252	1.9	1.0	4.7	16.4
QC Standard (expected)	7.00	718	250	2.0	1.0	5.0	16.6
Repeat MOUNTAIN MW1	7.68	605	303	17.1	<0.2	27.7	338.4

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ANALYTICAL SERVICES

8-Jul-2004

HSP ENGINEERING & ENV. SERVICES
103 Warner Drive
Long Sault, ON
K0C 1P0

Attn: Lena Perry
Project: 5447

Received: 19-Jun-2004 09:32
PO #:

Job: 2455766

Status: Final

Ground Water Samples

Sample Id	BOD (5) SM 5210B mg/L	TDS SM 2540C mg/L	COD SM 5220D mg/L	DOC SM 5310C mg/L	TKN SM 4500B mg/L	NH3-N SM 4500H mg/L	Ag ICP/MS mg/L	Al ICP/MS mg/L
MOUNTAIN MW1	<0.5	346	6	2.1	0.15	<0.03	<0.0001	<0.005
MOUNTAIN MW2	<0.5	350	8	1.7	0.16	<0.03	<0.0001	0.025
MOUNTAIN MW3	<0.5	360	6	1.6	0.19	<0.03	<0.0001	0.055
MOUNTAIN MW6S	<0.5	446	10	2.2	0.23	<0.03	<0.0001	0.045
MOUNTAIN MW6D	<0.5	374	6	1.8	0.25	0.03	<0.0001	0.099
MOUNTAIN MW7S	<0.5	640	15	5.1	1.28	0.89	<0.0001	0.021
MOUNTAIN MW7D	<0.5	260	6	1.1	0.09	<0.03	<0.0001	0.020
MOUNTAIN MW8S	<0.5	388	<5	1.1	0.18	0.05	<0.0001	0.040
MOUNTAIN MW8D	<0.5	730	17	5.3	1.65	1.38	<0.0001	0.019
MOUNTAIN MW9S	<0.5	328	7	2.7	0.21	<0.03	<0.0001	0.009
MOUNTAIN MW9D	<0.5	1112	13	4.1	0.68	0.38	<0.0001	0.024
MOUNTAIN MW10S	<0.5	370	6	1.8	0.18	0.04	<0.0001	0.008
MOUNTAIN MW10D	2.0	378	6	1.7	0.23	0.04	<0.0001	0.050
Sample+Spike (found)	---	---	27	15.1	---	0.56	---	0.553
Sample+Spike (expected)	---	---	26	15.5	---	0.60	---	0.500
Blank	<0.5	<2	<5	<0.2	<0.03	<0.03	<0.0001	<0.005
QC Standard (found)	5.5	250	40	10.6	1.28	1.64	0.0032	0.982
QC Standard (expected)	6.0	250	40	10	1.40	1.50	0.0030	1.00
Repeat MOUNTAIN MW1	<0.5	354	6	2.3	0.18	<0.03	<0.0001	<0.005

PSC
ANALYTICAL SERVICES

24-Nov-2004

HSP ENGINEERING & ENV. SERVICES
103 Warner Drive
Long Sault, ON
K0C 1P0

Page: 7
Copy: 1 of 2

Attn: Lena Perry
Project: 5447

Received: 9-Nov-2004 08:37
PO #:

Job: 2461858

Status: Final

All work recorded herein has been done in accordance with normal professional standards using accepted testing methodologies and QA/QC procedures. PSC Analytical is limited in liability to the actual cost of the pertinent analyses done unless otherwise agreed upon by contractual arrangement. Your samples will be retained by PSC Analytical for a period of 30 days following reporting or as per specific contractual arrangements.

Job approved by:

Signed: .....

Ralph Siebert, B.Sc.
Section Supervisor, Metals

PSC ANALYTICAL SERVICES

5735 McAdam Road
Mississauga
Ontario L4Z 1N9

Tel: (905) 890-8566
Fax: (905) 890-8575
Toll Free: 1-800-263-9040

Mountain Groundwater

LABORATORY USE ONLY

Work Order: NOV 9'04 AM 8:57

Comments: 2116358

CHAIN OF CUSTODY RECORD

Client: HSP Inc.
103 Warner Dr.
Long Sault, ON K0C 1P0
Contact: Lena Perry
Phone: (613) 932-3289 Fax: (613) 937-0125

PASC Quote #: 279-2004-BC

Page 1 of 2

Client P.O. #:

Client Project #: 5447

Sampled by: Joshua Teixeira Bottle Order # B24-05616

Please specify Guideline (if applicable) Table A MOE Guidelines for Use at Cont Sites MOE

Invoice to (if other than above):

Analysis Required

Drinking Water Sample - Y/N

TAT (Turnaround Time)

PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS

Some exceptions apply. Please contact Lab

STD 5-7 Business Days ☒

RUSH Specify Date:

Time:

Sample #	Client Sample I.D.	Date Sampled	Time Sampled	BOD5	Nutrients (COD, DOC, TKN, NH_3-N)	General - Ell, Alk, Cond, Cl, NO_3, SO_4, Hardness	TDS	Metals - ICPMS	Sample Matrix	No. of Containers	Comments/Contamination/ Site History
1	Mountain MW1	Nov 7/04	2am	✓	✓	✓	✓	✓	water	5	Metal Samples Field Filtered 0.45 um
2	Mountain MW2	"	"	✓	✓	✓	✓	✓	"	5	
3	Mountain MW3	"	"	✓	✓	✓	✓	✓	"	5	
4	Mountain MW6S	"	"	✓	✓	✓	✓	✓	"	5	
5	Mountain MW6D	"	"	✓	✓	✓	✓	✓	"	5	
6	Mountain MW7S	"	"	✓	✓	✓	✓	✓	"	5	
7	Mountain MW7D	"	"	✓	✓	✓	✓	✓	"	5	
8	Mountain MW8S	"	"	✓	✓	✓	✓	✓	"	5	
9	Mountain MW8D	"	"	✓	✓	✓	✓	✓	"	5	
10	Mountain MW9S	"	"	✓	✓	✓	✓	✓	"	5	
11	Mountain MW9D	"	"	✓	✓	✓	✓	✓	"	5	
12	Mountain MW10S	"	"	✓	✓	✓	✓	✓	"	5	

Samples Relinquished to PASC by: (Client Signature) Lena Perry Date: Nov 8/04 Time: 11:00 2m Method of Shipment: Purolator

Samples Received in lab by: Date: Nov 9/04 Time: 8:40 am Condition of samples upon receipt at lab: 7, 7, 5

White: PSC *Yellow:* Mail *Pink:* Receiver *Goldenrod:* Client

Rev.PSC-COC (8/11/04)

№ 83383

PSC ANALYTICAL SERVICES
5735 McAdam Road
Mississauga
Ontario L4Z 1N9
Tel: (905) 890-8566
Fax: (905) 890-8575
Toll Free: 1-800-263-9040

LABORATORY USE ONLY
Work Order:
Comments:

CHAIN OF CUSTODY RECORD

Mountain Groundwater

Client: HSP Inc.
103 Warner Dr
Long Sault ON K0C 1P0
Contact: Lena Perry
Phone: (613) 932-3289 Fax: (613) 937-0125

PASC Quote #: 279-2004-BC
Client P.O. #:
Client Project #: 5447
Sampled by: Joshua Teixeira Bottle Order # B24-05616
Please specify Guideline (if applicable) Table A Met Guidelines for Use at Cont Sites

Invoice to (if other than above):

TAT (Turnaround Time)
PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Some exceptions apply. Please contact Lab
STD 5-7 Business Days ☒
RUSH Specify Date:
Time:

Sample #	Client Sample I.D.	Date Sampled	Time Sampled	Analysis Required: BODs	Nutrients (COD, DOC, TKN, NH3-N)	General - pH, Alk, Cond, Cl, NO3, SO4, Hardness	TDS	Metals ICP MS	Drinking Water Sample - Y/N	Sample Matrix	No. of Containers	Comments/Contamination/ Site History
13	Mountain MW10D	Nov 7/04	am	✓	✓	✓	✓	✓		water	5	Metals samples - Field Filtered 0.45 µm
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												

Samples Relinquished to PASC by: (Client Signature)	Lena Perry	Date: Nov 8/04	Time: 11:00 am	Method of Shipment: Purolator
Samples Received in lab by:		Date: Nov 9/04	Time: 8:40 am	Condition of samples upon receipt at lab: 7, 7.5

White: PSC Yellow: Mail Pink: Receiver Goldenrod: Client

Rev.PSC-COC (8/11/04)

NO 22204

HSP Engineering and Environmental Services

APPENDIX 4.0

HYDRAULIC CONDUCTIVITY AND GROUNDWATER FLOW VELOCITY CALCULATIONS

Hydraulic Conductivity and Groundwater Flow Velocity Calculations

Hydraulic Conductivity (K)
$K=r^2 \ln(L_e/R)/2L_eT_o$

Groundwater Flow Velocity (V)
$V=Ki/n_e$

Calculated hydraulic gradient (i) = 0.007 meters/meter (November 2004 data for shallow wells)

For limestone, effective porosity (n_e) = 0.05

Well	r (m)	Le (m)	R (m)	To * (seconds)	K cm/sec	V cm/sec	V m/year
10S	0.0508	6.1	0.1524	53	1.47E-03	2.06E-04	65.01
10D	0.0508	14.3	0.1524	44.5	9.21E-04		
9S	0.0508	5.9	0.1524	<19	>4.21E-03	>5.89E-04	>185.80
9D	0.0508	13	0.1524	26446	1.67E-06		
8D	0.0508	13.2	0.1524	59436	7.34E-07		

*time calculated from pumping test