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APRIL 2, 2003



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Ms. Lisa Dagdiglan
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Dear Ms. Dagdiglan:

Enclosed for your records, pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments Reauthorization Act of 1986, is the following document:

**2002 Annual Report
Shepley's Hill Landfill
Devens Reserve Forces Training Area
Devens, Massachusetts**

If you have any questions regarding this matter, you may contact me at (978) 796-2205.

Sincerely,

Benjamin F. Goff
Benjamin F. Goff

BRAC Environmental Coordinator

Enclosures

LISA -

FYI -

There has been
lots of press about
Shepley's Hill landfill
because they tried to
reopen a nearby well.
May

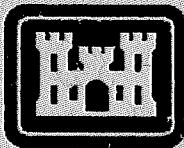
2002 ANNUAL REPORT

SHEPLEY'S HILL LANDFILL LONG TERM MONITORING & MAINTENANCE DEVENS, MASSACHUSETTS

March 2003

PREPARED BY:

DEPARTMENT OF ARMY
NEW ENGLAND DISTRICT, CORPS OF ENGINEERS
CONCORD, MASSACHUSETTS 01742



**US Army Corps
of Engineers**
New England District

**SHEPLEY'S HILL LANDFILL
2002 ANNUAL REPORT**

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DEVENS, MASSACHUSETTS**

March 2003

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EXECUTIVE SUMMARY

This annual report has been prepared to document the monitoring and maintenance activities conducted at the Shepley's Hill Landfill in Devens, Massachusetts as required by the Record of Decision (ROD) for areas of contamination 4, 5, and 18 (ABB-ES, Oct 1995). This report was developed by the U.S. Army Corps of Engineers (USACE), New England District (NAE).

This report documents the results of the seventh year, 2002, of the Long Term Monitoring and Maintenance conducted in accordance with the approved Long Term Monitoring and Maintenance Plan (SWEC, May 1996). Activities conducted as part of this plan include an annual inspection of the landfill cover, annual landfill gas vent monitoring, and semi-annual groundwater monitoring. Post closure monitoring is required for a period of thirty years.

An annual landfill inspection was conducted and observations were made regarding the vegetative cover, vegetation types, erosion, settlement, and general condition of the various features. Presently, the landfill is in fair condition, and appears to be functioning adequately. The cover surface was noted to contain areas of sparse vegetation, intrusive vegetation and settlement. Intermittent standing water, erosion, overgrown areas and wetlands plants were observed in isolated areas within drainage swales. The access roads at the site are in good condition. The security fence was noted to be in need of repair at various locations. No significant difficulties were encountered with the monitoring of gas vents/probes or groundwater wells that are part of the Long Term Monitoring Program. There were no conditions observed which would immediately jeopardize the integrity of the landfill cap.

In 2002, normally scheduled maintenance activities included mowing of the landfill vegetative cover and cutting of vegetative growth in drainage swales. Additionally, a topographic survey of the landfill was conducted and compared to as-built topography to determine settlement patterns and drainage issues. The resulting analysis and conclusions were detailed in a draft feasibility study report submitted to the Army by the USACE under separate cover. Some of the findings of the current inspection will be addressed in that report, including recommendations concerning fencing on the perimeter of the landfill.

As part of the monitoring of the landfill, readings were collected from eighteen gas vents on the landfill, plus four probes just north of the landfill enabling a check for landfill gases migrating through the soil and off of the cap. The gas readings recorded from the vents were within the parameters of a mature landfill. No landfill gas was observed in the probes. The next round of gas monitoring will be conducted in the fall of 2003.

Additionally, groundwater sampling was performed on the fourteen compliance point monitoring wells located adjacent to the landfill on the north and east. Samples were collected in accordance with the *EPA's Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells* (July 1996). Samples were analyzed for volatile organic compounds, inorganics, and general water quality

parameters. Samples were also similarly collected at four off-site groundwater monitoring wells, not part of the Long Term Monitoring Program, for comparison. It should be noted that one of the four off-site wells (SHM-99-32X) could not be sampled in the fall due to extensive damage to the well casing. However, all fourteen compliance point wells were monitored during both the spring and fall.

In accordance with the ROD, only chemicals that present carcinogenic risk are considered trigger chemicals in the Long Term Monitoring Program. The trigger chemicals are arsenic, dichlorobenzenes, and 1,2-dichloroethane. The evaluation of effectiveness of the selected alternative, SHL-2, is based on the reduction of carcinogenic risk, rather than reduction of contamination as a measure of progress toward attainment of cleanup. This approach prevents a situation in which failure to attain a concentration reduction goal for a minor contributor to risk (i.e., 1,2-dichlorobenzene) overshadows the achievement of a 50-percent reduction of concentration of a higher carcinogenic risk (i.e., arsenic). Risk reduction was evaluated during the first five-year review in August 1998. However, for annual reports, contaminant concentrations will be referenced against the cleanup levels as a benchmark. It should be noted that the majority of the risk present at Shepley's Hill Landfill is due to arsenic in the groundwater.

The effectiveness of the selected alternative, SHL-2, is determined by evaluating groundwater sampling results from two groups of monitoring wells, Group 1 and Group 2. Group 1 wells are wells where all chemical of concern concentrations have historically met or been below cleanup levels established in the Record of Decision. Group 2 wells are wells where chemical of concern concentrations have exceeded cleanup levels. In the Long Term Monitoring and Maintenance Plan, all existing wells were designated as Group 2 wells and the three new wells that were installed in 1996 were to be designated after the first round of sampling. During the first five-year site review (August 1998) six monitoring wells (SHL-3, SHL-5, SHL-9, SHM-93-10C, SHL-22, and SHM-93-22C) achieved cleanup levels for all chemicals of concern and were reclassified as Group 1 wells. All other wells, including the three new wells, are currently classified as Group 2 wells. Monitoring will continue in order to examine if cleanup levels are maintained in Group 1 wells. It should be noted that three of the Group 1 wells (SHL-9, SHL-22 and SHM-93-22C) have exceeded a cleanup level for a trigger chemical at least once since the first five-year review – arsenic in all cases. In 2002, two of those wells, SHL-9 and SHL-22, had such exceedances.

Arsenic was the only trigger chemical detected above cleanup levels during the 2002 sampling events. Most wells indicated no definitive change over historic arsenic values, including SHM-96-5B, which continues to record the highest levels of the wells monitored (tending to rise in the spring). Wells SHL-9, SHL-11, SHL-22 and SHM-96-22B all recorded new high arsenic levels in 2002. Of those wells, SHL-11, SHL-22 and SHM-96-22B are showing trends that may be expected to continue rising. However, well SHM-96-22B, which typically shows one of the highest arsenic levels, also recorded a new low arsenic level in the fall. Data collected in the coming years will reveal the significance, or lack thereof, of this anomaly. Similarly, the historical peak value determined for well SHL-9 in the spring was uncharacteristic. Well SHL-20 continues to show a slow decline

in arsenic levels. It should be noted that seven of the fourteen compliance point wells were below the arsenic cleanup level for the latest round of sampling. The next round of groundwater monitoring will be conducted in the spring of 2003.

The first five-year review to assess the protectiveness of the selected remedial action for Shepley's Hill Landfill was completed in 1998, in accordance with the Record of Decision. The review concluded that reductions of contaminant concentrations and corresponding risk satisfied the evaluation criteria at most, but not all, historical groundwater monitoring wells. However, data from monitoring well SHM-96-5B, at the north end of the landfill, showed arsenic concentrations up to two orders of magnitude greater than historical values in other wells. Therefore, supplemental groundwater investigations were performed by the Army to assess whether arsenic contamination exists beyond the Devens Reserve Forces Training Area boundary, and to characterize its nature and location. In accordance with the *Final Work Plan, Supplemental Groundwater Investigation at Shepley's Hill Landfill, Devens Reserve Forces Training Area, Devens, Massachusetts* (HLA, February 1999) the work included: a hydrogeologic assessment of groundwater recharge potential along the western edge of the landfill, characterization of groundwater flow and quality north of Shepley's Hill Landfill to Nonacoicus Brook, updating and refining the groundwater model for Shepley's Hill Landfill, and analyzing rock samples for naturally occurring arsenic.

1.0 INTRODUCTION

This annual report has been prepared to document the monitoring and maintenance procedures conducted at the Shepley's Hill Landfill in Devens, Massachusetts based on the Record of Decision (ROD) (ABB-ES Oct 1995) for Shepley's Hill Landfill Areas of Contamination 4, 5, and 18. This report was developed by the U.S. Army Corps of Engineers (USACE), New England District (NAE).

The Long Term Monitoring and Maintenance Plan (LTMMP) (SWEC, May 1996) for Shepley's Hill Landfill outlines the landfill closure monitoring and maintenance procedures. These procedures include a semi-annual groundwater sampling program to monitor contaminants, and an annual visual inspection and gas emission monitoring of the landfill cap. This report documents the seventh year of the long term monitoring program. The first two years of monitoring, 1996 and 1997, were conducted by Stone & Webster Environmental Technology & Services (SWEC). From 1998 through 2002, monitoring has been conducted by NAE. Post closure monitoring is required for a period of thirty years.

2.0 LANDFILL CAP MAINTENANCE ACTIVITIES

The Record of Decision for the Shepley's Hill Landfill required monitoring and maintenance of the landfill cap based on observations made during the annual inspections. Based on a recommendation made in the previous annual report, a topographic survey of the landfill was conducted in 2002 and compared to as-built topography to determine settlement patterns and drainage issues. The analysis and conclusions are detailed in a draft feasibility study report submitted to the Army by the USACE under separate cover. This report provides a set of alternatives to reduce the potential for water to pond, migrate and/or infiltrate through the existing cap. Some of the findings of the current inspection (refer to Section 3.0, Landfill Cap Monitoring Activities) will be addressed in that report, including recommendations concerning fencing on the perimeter of the landfill. Normally scheduled maintenance activities performed during 2002 included mowing of the landfill vegetative cover and cutting vegetative growth in drainage swales. The remaining recommended maintenance items listed in the previous annual report did not pose an immediate risk to the integrity of the landfill cap, and are considered non-critical maintenance procedures. Maintenance activities of this non-critical nature will continue to be monitored and evaluated. In the event that repair needs are identified which would prevent immediate damage to the cap, they will be conducted expeditiously.

3.0 LANDFILL CAP MONITORING ACTIVITIES

The Shepley's Hill Landfill at Devens, Massachusetts was inspected on 5 November 2002 by personnel from the U.S. Army Corps of Engineers, New England District (NAE). Features of the landfill inspected included the cap, the drainage system, the gas vent system, access roads, and the security fence. Observations were made regarding the vegetative cover, vegetation types, erosion, settlement, and general condition of the various features. Appendix A of this report contains the Landfill Maintenance Checklist that summarizes the findings of this inspection. All observations are also presented on Figure 3-1. A narrative of the findings of this inspection follows.

- Catch Basin #3 near the Cooke Street entrance to the site is not set at grade. Soil excavation in this area has left the rim of the grate about six to eight inches higher than the surrounding ground. This rim of this catch basin should be lowered to the surrounding grade.
- Catch basin #7 near the southwest corner of the site is substantially overgrown by the adjacent vegetation and will soon be completely overgrown and hidden from view. This catch basin should be cleared of encroaching vegetation.
- The concrete headwall drainage structure at the terminus of the catch basin and underground conduit system on the south side is overgrown with vegetation and is silting in. The grade of the channel bottom is uneven and standing water is present. Wetland species are becoming established as well. The structure and channel immediately downstream should be cleared, accumulated sediment should be removed, and the channel should be regraded as required to properly drain. The channel should then be reseeded or riprap should be placed, depending on water velocities.
- Most of the drainage swale on the south side is being invaded by wetland species. There are also intermittent zones of standing water indicating a lack of proper channel slope and drainage. The south side drainage swale should be cleared of wetland vegetation and regraded as needed to properly drain all areas of standing water. Depending on water velocities, the channel should then be reseeded or riprap should be placed.
- In the east side drainage swale, in the vicinity of gas vent #13 and continuing downstream to the new rock-lined channel, the drainage swale is overgrown with wetland species. It appears to be silted in and has a large area of standing water. This reach of the drainage swale should be cleared of all vegetation and accumulated silt and sand, and regraded to drain properly. Seeding, or riprap placement, should follow, depending on water velocities.
- The northern reaches of the eastern drainage swale have some minor vegetation growth and sand accumulation. The swale should be cleared.

- In the vicinity of gas vents 8, 11 and 12, the perimeter of the cap has some areas of sparse/eroded vegetation. The soil in the bare areas is mostly sand and is eroded in some areas. The area should be graded to fill in the eroded areas and topsoil should be placed to a depth of 6 inches over the sand to allow grass to grow. The grass should extend at least twenty feet past the limits of the cap.
- The access roads on the site are in good condition. There are no problems on access roads that warrant repair at this time.
- Portions of the perimeter chain-link security fence are in poor condition. Fence sections and gates are missing and unrestricted access to the site is available at several locations, most notably at the Cook Street entrance, and continuing over to the dirt road at catch basin number 7. Some evidence of off-road vehicles (ATV's, dirt bikes, etc.) using the cap area was seen. On the east side near monitoring well SHL-11, the fence has been rolled back and is open. A gate and lock should be added here if permanent access is required. The security fence should be repaired, with all missing fence sections, including gates, replaced or repaired. Currently the entire perimeter fencing system is under review, and recommendations are forthcoming.
- The gas monitoring probes installed in 2001 at the northwest edge of the landfill appear to be in excellent condition, with locked, steel caps.
- The gas vents are in good condition. All screens and pipes are in functional condition and no repairs are required at this time.

A summary of Corrective Action measures for the Landfill Cap are included in Section 9.0.

4.0 LANDFILL GAS MONITORING RESULTS

The purpose of the landfill gas monitoring program is to establish long-term trends with regard to gas production and venting. A combustible gas survey was performed to determine whether methane, hydrogen sulfide, or volatile organic compounds have accumulated in the subsurface of the landfill site or are migrating off-site. Four new landfill gas monitoring probes were installed on 7 November 2001. This is the second annual report including data from those probes. The purpose of the probes is to monitor landfill gas migration from Shepley's Hill Landfill towards Sculley Road.

The seventh annual landfill gas sampling was conducted on 5 November 2002. The weather was sunny, with temperatures in the 50's (F), and the barometric pressure was 29.92 inches of mercury and FALLING. Gas samples were field analyzed for the following parameters using the listed equipment:

<u>Parameter</u>	<u>Equipment</u>
Total Volatile Organic Compounds (VOC)	HNu Photoionization Detector (PID) with a 10.6 eV lamp
Percent Oxygen	Industrial Scientific TMX 412 Combustible Gas Indicator (CGI)
Hydrogen Sulfide (ppm)	CGI
Percent Lower Explosive Limit (LEL)	CGI
Carbon Monoxide (ppm)	CGI
Percent Carbon Dioxide	Landtec Gem 500, GA-90 landfill gas monitor
Percent Methane	Landtec Gem 500, GA-90 landfill gas monitor

The CGI and the Landtec GA-90 were both calibrated in the shop by U.S. Environmental. The PID was calibrated in the field to 248 ppm isobutylene and 0 ppm.

Samples were collected by attaching a rubber Quik cap with a hose clamp to the gas vent pipe. A barbed fitting was placed in a drilled hole in the cap. Tubing was run from the barbed fitting to a MSA LC pump. The pump was operated for approximately 7 to 10 minutes to purge 2 vent pipe volumes and to ensure that the gases collected were representative of the gas collection layer. The gas monitoring equipment was then attached

to the MSA pump and turned on. Once stabilization was reached, readings were recorded as displayed in Table 4-1. The locations of the gas vents and probes are shown in Figure 3-1.

The following is a brief summary of the results. The perimeter landfill gas monitoring probes (LGP-01-01X, LPG-01-02X, LPG-01-03X, LPG-01-04X) tested negative (0) for VOC's, hydrogen sulfide, carbon monoxide, and methane. Minimal levels of carbon dioxide were detected, ranging from 0.2 % at LGP-01-01X to 1.4 % at LGP-01-02X. Oxygen levels ranged from 19.3 % at LGP-01-02X to 20.2% at LGP-01-01X.

The following summarizes the gas vent results. VOCs were not detected in any of the gas vent wells. The oxygen levels ranged from 20.7% (Vent # 16) to 2.2% (Vent # 14) using the GA-90. No gas vent wells tested positive for hydrogen sulfide, reading 0 for all wells. LEL readings ranged from 0% in V-1 to over 100% LEL in Vent Nos. 3, 4, 6, 9, 13, 14, 15 and 18. Carbon monoxide registered 0 in all of the gas vent wells and vents. Carbon dioxide ranged from 19 ppm (Vent # 18) to 0 ppm (Vent # 12). Methane ranged from 23.5 ppm (Vent # 18) to 0 ppm in V-1.

The gas readings are within the parameters of a mature landfill. The vents are functioning properly. The scenario of high atmospheric pressure to low atmospheric pressure results in a venting of landfill gas into the atmosphere. The scenario of low atmospheric pressure to high atmospheric pressure results in air intrusion into the upper portion of the landfill. The scenario during this inspection was likely somewhere in-between. The major concern with landfill gas is off-site migration. If the gas vents are functioning properly and are adequately spaced there should be no off-site migration of landfill gases; however, due to the high LEL readings and the proximity of residential housing and commercial development, gas monitoring probes should be installed along the property line where the landfill is adjacent to structures (note that this has been done at the northern end near Sculley Road). Gas monitoring probes should also be installed at the southern perimeter of the site along the commercial properties. The LEL readings along the southern perimeter, including gas vents 13, 14, 15, and 18 have consistently registered LEL readings above 100%.

5.0 GROUNDWATER ELEVATIONS

Groundwater elevations were collected from each well during groundwater sampling activities. The depth to groundwater was subtracted from the elevation of the reference point to determine the elevation of the groundwater at each location. Table 5-1 lists the water level elevations for each well for each sampling round. Also included in that table, for reference, are the geological interfaces of the wells, and the elevation of the screened interval for each well. Figure 5-1 shows a cross-section of the wells in the monitored area that has generally shown the highest levels of chemicals of concern, while Figure 5-2 shows the location of that cross-section relative to the landfill. During each sampling event, groundwater elevations were recorded on the first day of sampling for all compliance point wells scheduled to be sampled. Groundwater elevations measured during May 2002 were consistently higher than those measured in October 2002, as is typical for the area. The mean drop in groundwater elevation (from spring to fall reading) was 1.1-feet for the fourteen wells. Groundwater levels in 2002 were typically higher than those in the prior year, with spring levels rising an average 0.4-feet from the previous spring, and fall levels rising 0.6-feet on average. This indicates a partial recovery from low levels caused by low precipitation totals in 2001.

In addition to these semi-annual groundwater measurements, regular groundwater measurements of all Shepley's Hill Landfill wells were conducted by Harding ESE (formerly ABB-ES and HLA) from 1992 until 1999. During the first 5-year review (SWEC, August 1998), groundwater elevations were re-evaluated to identify hydraulic gradients and to confirm changes due to the construction of the landfill cap. Groundwater modeling has suggested that the landfill cap has reduced the volume of water beneath the cap, resulting in a more northerly groundwater flow (SWEC, 1998). Groundwater flow patterns will be re-evaluated during the next 5-year review.

In light of data collected for the first Five-Year Review, performed in accordance with the Record of Decision for the Shepley's Hill Landfill Operable Unit, Harding ESE undertook supplemental groundwater investigations that included, in part, a hydrogeologic assessment to obtain additional data to evaluate the effectiveness of the selected remedial action.

6.0 GROUNDWATER SAMPLING

Groundwater sampling activities at the landfill are conducted semi-annually. Groundwater sampling, for the seventh consecutive year, was conducted in the spring (May 20 and 21, 2002) and in the fall (October 28 through 30, 2002). There were no significant precipitation events during either sampling event. During the week prior to the spring sampling event, approximately three inches of precipitation fell in the area, while approximately one inch fell in the week before the fall event. Wells are designated as either Group 1 or Group 2 wells. Wells which have historically attained cleanup goals are given a Group 1 designation. Wells which have not historically attained cleanup goals are designated as Group 2 wells. Initially, all existing wells were designated as Group 2 wells and the three new wells that were installed in 1996 were to be designated during the first five-year site review (SWEC, August 1998). During the first five-year site review, six wells (SHL-3, SHL-5, SHL-9, SHM-93-10C, SHL-22, and SHM-93-22C) achieved cleanup levels for all chemicals of concern and were reclassified as Group 1 wells. All other wells, including the three new wells, were classified as Group 2 wells. These group designations are presented in Table 6-1, as well as the occurrences of Group 1 wells that have exceeded cleanup levels for trigger chemicals since the first five-year site review. During 2002, two of the Group 1 wells were determined to contain such levels of arsenic (clean-up level = 50 µg/L): SHL-9 was found to contain 144 µg/L in the spring, and SHL-22 was found to contain 55.9 B µg/L and 77.1 µg/L in the spring and fall, respectively.

6.1 Preparation for Sampling

Wells sampled as part of the long term monitoring program included SHL-3, SHL-4, SHL-5, SHM-96-5B, SHM-96-5C, SHL-9, SHL-10, SHM-93-10C, SHL-11, SHL-19, SHL-20, SHL-22, SHM-96-22B, and SHM-93-22C. Locations of the wells are shown on Figure 3-1. Of these fourteen long-term monitoring wells, the seven at the north end of the landfill (SHL-5, SHM-96-5B, SHM-96-5C, SHL-9, SHL-22, SHM-96-22B and SHM-93-22C) are located in the area predicted to experience the greatest intrusion of groundwater flow from the landfill, as suggested by the modeling results depicted in Figure 6-1.

Sampling activities were coordinated with the Devens BRAC Environmental Office and the contract laboratory prior to commencement of sampling. The contract laboratory was contacted approximately three weeks prior to sampling and was requested to prepare and deliver sampling bottles, quality assurance bottles and coolers to New England District approximately one week prior to the sampling event. Bottles were checked to insure that they complied with the requirements of the sampling program. Sampling equipment (including YSI water quality meters, portable generators, Solinst water level indicators, and teflon lined tubing) was reserved for rental/purchase from U.S. Environmental and picked up in the days preceding the sampling event. NAE used their own Grundfos Rediflow II pumps, controllers, Heron water level indicators, and HF Scientific DRT-15CE turbidity meters for the sampling events (NAE's equipment is occasionally supplemented with identical or similar models rented from U.S. Environmental, as required – these instances are noted on the Groundwater Field Analysis Forms where appropriate). All equipment was inventoried and tested to ensure

it was accounted for and functioning. The well logs of each of the wells to be sampled were reviewed by the field team prior to the scheduled event to determine tubing requirements, and brought to the landfill during the sampling event to confirm the screened intervals.

6.2 Sampling

The seventh year of sampling was conducted by NAE on May 20 and 21, 2002 and later on October 28 through 30, 2002. Monitoring wells were purged and sampled in accordance with *EPA's Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells* (July 1996) using an adjustable rate, low flow submersible pump. Teflon lined tubing was used for sample collection and was disposed after each well was sampled.

Before sampling activities commenced, groundwater elevations were measured at each well location to be sampled. YSI water quality meters and turbidity meters were calibrated at the beginning of each day of use. A calibration check was also performed at the end of each day.

During sampling, the generator used to power the pumps was located at a downwind area at least 30 feet away from the well being sampled, to minimize potential contamination from the exhaust. Upon initial opening of each well, initial water level measurements were collected. The pump intake was lowered to approximately the middle of the screen of each well to be sampled when possible. When the water level was below the top of the screen, the pump was positioned at a depth approximately between the top of the water level and the bottom of the screen.

Water quality parameters, including temperature (temp), specific conductance, pH, oxidation reduction potential (ORP), turbidity, and dissolved oxygen (DO) were collected every 3 to 5 minutes to ensure proper purging of the wells before each well was sampled. The results are listed on Groundwater Field Analysis Forms located in Appendix B. All water quality parameters, except turbidity, were monitored using a flow-through cell and a Sonde-YSI water meter (YSI 600XL). Turbidity samples were not collected from the flow through cell due to the silt buildup that can occur in the cell. A T-connector was set up before the flow-through cell to facilitate the collection of samples for turbidity readings. Sampling was conducted when water quality parameters became stabilized for three consecutive readings. The tubing was disconnected from the flow-through cell and samples were collected directly from the discharge tubing. Observations made during the sampling activities include:

- To ensure precision of water level measurements, well casings that had faded marks or no marks were remarked.
- None of the pre-preserved sample bottles required pH adjustments after they were filled with the water samples.
- In cases where the water level was lower than the top of the screen, the pumps were lowered to approximately midpoint between the water level and the

bottom of the screen. This procedure occurred at several wells during each event.

- Past difficulties with maintaining flowrates and achieving stabilization at wells SHL-3 and SHL-10 showed improvement in 2002, after an attempt to redevelop both wells was made on April 15, 2002 by NAE personnel.
- Instrument calibration checks performed at the end of each day of sampling revealed that the oxidation reduction potential (ORP) readings taken with one of the YSI water quality meters on October 29, 2002 could be questionable. This meter was used to measure ORP at wells SHL-11, SHL-22 and SHM-96-22B on that day (in the order listed). However, only the ORP readings taken at the last well, SHM-96-22B, appear possibly circumspect after reviewing historical ORP data (indicating the readings may be somewhat high biased) and concurrent dissolved oxygen (DO) readings (indicating nothing conclusive). Even so, the readings taken at SHM-96-22B may be valid, as the discrepancy from the limited historical data is not exceedingly large. For the other two wells, the readings are in good agreement with historical data and the relationship between ORP and DO dictates that these values are reasonable.
- During the fall sampling round, ground water sampling well SHM-99-32X, which is located outside the landfill (off of Molumco Road), was found damaged. Apparently, a vehicle collided with the well with a force great enough to destroy the bollards and severely bend the well casing. As such, a sample from this well could not be collected. This well is not among the fourteen compliance point wells at Shepley Hill Landfill, but it is one of four extra wells that have been historically sampled for comparison. Restoration of this well will be addressed in 2003.

6.3 Equipment Decontamination

All non-disposable sampling and testing equipment that came in contact with the sampling medium was decontaminated to prevent cross contamination between sampling points. The submersible pump was decontaminated using the following procedure:

- Upon removal of the pump from the well following sample collection, the pump was submersed in a 4-inch PVC riser containing potable water and detergent (Alconox) solution. At least 1 to 2 gallons of the detergent solution was pumped through (starting the pump at a low flow rate, as in sampling, and increased to a higher speed).
- The pump was removed and sprayed with potable water to minimize the transfer of soap to the rinser.

- The pump was then submersed in a riser filled with potable water and at least 1 to 2 gallons were pumped through.
- The pump was then submersed in a riser filled with deionized water and at least 1 to 2 gallons were pumped through.
- The submersible pump was sprayed with isopropyl alcohol (reagent grade) using a hand held spray bottle, over a tub. The pump was then submersed in a final deionized water rinse and at least 1 to 2 gallons were pumped through.
- The pump was air dried and wrapped in clean aluminum foil.

7.0 LABORATORY TESTING

Groundwater was sampled at monitoring well locations using the low-flow method in accordance with the procedures outlined in the approved Long Term Monitoring and Maintenance Plan, Shepley's Hill Landfill (SWEC, May 1996). Samples were sent to Severn Trent Laboratories in Colchester, Vermont for analysis. For the spring event, the fourteen compliance point samples were collected on May 20 and 21, 2002, with four additional samples collected off-site on May 22, 2002. For the fall event, the fourteen compliance point samples were collected on October 28 through 30, 2002, with three additional samples collected off-site on October 31, 2002. Samples were placed in containers compatible with the intended analysis and properly preserved prior to shipment to the laboratory. Each sealed container was placed in a leakproof plastic bag and placed in a strong thermal ice chest (cooler) filled with bubble wrap packing material, or equivalent, to ensure sample integrity during shipment. Ice was added to cool samples to 4° C or just below. Chains of Custody (COCs) were used to identify and document the samples being shipped (copies are included in Appendix C). Sample custody was initiated by the sampling team upon collection of samples and COC forms were placed in waterproof plastic bags and taped to the inside lid of the cooler. The cooler was sealed with chain-of-custody seals and shipped to the laboratory via overnight delivery.

7.1 Analyses

Water analyses were conducted according to SW846 methods 8260B for volatile organics, 6010B/7470A for TAL metals, and as follows for general chemistry analyses: chemical oxygen demand by EPA method 410.1, biochemical oxygen demand by EPA method 405.1, hardness by Standard Method 2340B, alkalinity by EPA method 310.1, cyanide by EPA method 335.4, anions by EPA method 300.0, total organic carbon by SW846 method 9060, total dissolved solids by EPA method 160.1, and total suspended solids by EPA method 160.2. These analyses were conducted at all fourteen compliance point wells. As reported in the previous annual report, starting with the fall event of 2001, the method used to determine hardness was changed to Standard Method 2340B in order to eliminate the interference to EPA method 130.2 from other heavy metal ions typically present in some of the wells at the site. Table 7-1 indicates the analysis and procedures used for groundwater samples collected at Shepley's Hill Landfill.

7.2 Results

The approach for evaluating the effectiveness of the remedy is presented in the Record of Decision (ABB-ES, 1995). Of the chemicals of concern identified in the Record of Decision, only those chemicals that present carcinogenic risk were considered trigger chemicals in the Long Term Monitoring and Maintenance Plan (SWEC, May 1996). The trigger chemicals are arsenic, dichlorobenzenes, and 1,2-dichloroethane. Therefore, the evaluation of effectiveness of Alternative SHL-2 is based on the reduction of carcinogenic risk, rather than reduction of contamination, as a measure of progress toward attainment of cleanup. This approach prevents a situation in which failure to attain a concentration reduction goal for a minor

contributor to risk (i.e., 1,2-dichloroethane) overshadows the achievement of a 50 percent reduction of concentration of a higher carcinogenic risk (arsenic). Risk reduction was evaluated during the first five-year review in August 1998. However, for the annual reports the contaminant concentrations will be referenced against the cleanup levels as a benchmark. It should be noted that the majority of the risk present at Shepley's Hill Landfill is due to arsenic in the groundwater.

Arsenic was the only trigger chemical detected above cleanup levels at the site during the 2002 sampling events. Analytical results for groundwater analyses of samples collected at the fourteen compliance point wells are presented in Tables 7-2 and 7-4, for the spring and fall rounds, respectively. Tables 7-3 and 7-5 present additional data collected beyond the requirements of the Long Term Monitoring and Maintenance Plan, determined from samples taken at off-site wells near Molumco Road. Historical arsenic data for the fourteen compliance point wells, plus the additional wells, may be found in Table 7-6.

Refer to Appendix D for a graphical comparison of historical arsenic concentrations in compliance point monitoring wells. Most wells indicated no definitive change over previous arsenic values, including SHM-96-5B, which continues to record the highest levels of the wells monitored (tending to be higher in the spring). Wells SHL-9, SHL-11, SHL-22 and SHM-96-22B all recorded new high arsenic levels in 2002. Of those wells, SHL-11, SHL-22 and SHM-96-22B are showing trends that may be expected to continue rising. However, well SHM-96-22B, which typically shows one of the highest arsenic levels, also recorded a new low arsenic level in the fall. Data collected in the coming years will reveal the significance, or lack thereof, of this anomaly. Similarly, the historical peak value determined for well SHL-9 in the spring was uncharacteristic. Well SHL-20 continues to show a slow decline in arsenic levels.

Tables 7-2 through 7-5 present detectable concentrations of chemical contaminants. Where concentrations were not detected the value is recorded as less than the detection limit. These results are compared against the applicable cleanup level. Results of wet chemistry analyses are also included in the table. The results of the spring and fall events are summarized below.

7.2.1 Results for Samples Collected Spring 2002

Volatile Organic Compounds (VOCs), metals and general chemistry parameters were analyzed in eighteen groundwater monitoring wells in the spring of 2002. These wells consisted of the fourteen compliance point wells at the landfill site, plus four additional wells near Molumco Road.

None of the eighteen wells had detectable concentrations of the four VOC trigger chemicals (1,2-dichloroethane, 1,2-dichlorobenzene, 1,3-dichlorobenzene and 1,4-dichlorobenzene). Therefore, none of the established cleanup levels were exceeded for these parameters. Furthermore, none of the other VOCs analyzed were detected above cleanup levels at any of the wells.

Of the identified chemicals of concern for metals, only arsenic was declared a trigger chemical for this site. Arsenic was detected at concentrations greater than the cleanup level of 50 µg/L in the following compliance point monitoring wells: SHM-96-5B (3,800 µg/L), SHM-96-5C (50.4 B µg/L), SHL-9 (144 µg/L), SHL-11 (469 µg/L), SHL-19 (66.9 µg/L), SHL-20 (154 µg/L), SHL-22 (55.9 B µg/L) and SHM-96-22B (2,040 µg/L). The duplicate sample (collected from well SHM-96-5B) had a concentration of 3,830 µg/L.

The other chemicals of concern (those not designated as trigger chemicals) detected at concentrations above cleanup levels were also metals (iron, manganese, and sodium). Metal chemicals of concern that were not found to exceed cleanup levels at any of the wells include aluminum, chromium, lead and nickel. Iron was detected at levels above its cleanup level of 9,100 µg/L at compliance point wells SHM-95-5B, SHM-96-5C, SHL-9, SHL-11, SHL-19, and SHM-96-22B, with the maximum detected (92,000 µg/L) at well SHM-96-22B. Compliance point wells SHM-96-5B, SHM-96-5C, SHL-11, SHL-19, and SHL-20 had concentrations of manganese above the cleanup level of 1,715 µg/L. The maximum value detected for manganese was 11,000 µg/L at SHM-96-5B. Sodium was detected at levels above its cleanup level of 20,000 µg/L at compliance point wells SHM-96-5B, SHM-96-5C, SHL-11, SHL-20, SHL-22 and SHM-96-22B with the maximum detected (43,700 µg/L) at well SHL-22.

The same four chemicals of concern were those found to be above the landfill's cleanup levels at some of the four off-site monitoring wells near Molumco Road. Of these four wells, SHM-99-31C was indicated as having the highest levels of each of these parameters (345 µg/L arsenic, 54,100 µg/L iron, 7,720 µg/L manganese and 47,600 µg/L sodium). The sodium concentration determined here is higher than at any of the fourteen compliance point monitoring wells.

7.2.2 Results for Samples Collected Fall 2002

Volatile Organic Compounds (VOCs), metals and general chemistry parameters were analyzed in seventeen groundwater monitoring wells in the fall of 2002 (the fourteen compliance point wells at the landfill site, plus three additional wells near Molumco Road), with the following exceptions noted. Due to laboratory error, VOCs, mercury and total organic carbon samples collected at one of the Molumco Road wells, SHM-99-31C, were not analyzed. An eighteenth well, which is normally monitored during these events, could not be accessed for sample collection due to recent severe damage to the well casing (apparently caused by a vehicular collision). This well, SHM-99-32X, is also located near Molumco Road. All fourteen compliance point wells were sampled and analyzed for all required parameters.

None of the sixteen wells analyzed for VOCs were determined to have concentrations of the four VOC trigger chemicals (1,2-dichloroethane, 1,2-dichlorobenzene, 1,3-dichlorobenzene and 1,4-dichlorobenzene) above the established cleanup levels. The only well found to have a detectable concentration of any these four VOCs was SHL-11 (2.0 J µg/L 1,4-

dichlorobenzene). Furthermore, none of the other VOCs analyzed were detected above cleanup levels at any of the wells.

Of the identified chemicals of concern for metals, only arsenic was declared a trigger chemical for this site. Arsenic was detected at concentrations greater than the cleanup level of 50 µg/L in the following compliance point monitoring wells: SHL-4 (56.1 µg/L), SHM-96-5B (1,970 µg/L), SHL-11 (648 µg/L), SHL-19 (164 µg/L), SHL-20 (175 µg/L), SHL-22 (77.1 µg/L) and SHM-96-22B (159 µg/L). The duplicate sample (collected from well SHM-96-5B) had a concentration of 1,960 µg/L.

The other chemicals of concern (those not designated as trigger chemicals) detected at concentrations above cleanup levels were also metals (iron, manganese, and sodium). Metal chemicals of concern that were not found to exceed cleanup levels at any of the wells include aluminum, chromium, lead and nickel. Iron was detected at levels above its cleanup level of 9,100 µg/L at compliance point wells SHM-95-5B, SHM-96-5C, SHL-11, SHL-19, and SHL-20, with the maximum detected (64,500 µg/L) at well SHL-11. Compliance point wells SHM-96-5B, SHM-96-5C, SHL-11, SHL-19, SHL-20 and SHL-22 had concentrations of manganese above the cleanup level of 1,715 µg/L. The maximum value detected for manganese was 13,000 µg/L at SHM-96-5B. Sodium was detected at levels above its cleanup level of 20,000 µg/L at compliance point wells SHM-96-5B, SHM-96-5C, SHL-11, SHL-20, SHL-22 and SHM-96-22B with the maximum detected (114,000 µg/L) at well SHM-96-22B.

The same four chemicals of concern were those found to be above the landfill's cleanup levels at some of the three off-site monitoring wells near Molumco Road. Of these three wells, SHM-99-31C was indicated as having the highest levels of each of these parameters (332 µg/L arsenic, 45,500 µg/L iron, 6,740 µg/L manganese and 47,200 µg/L sodium).

8.0 QUALITY CONTROL

Quality assurance/quality control (QA/QC) samples were collected to monitor the sample collection, transportation, and analysis procedures.

8.1 Field Quality Control

One set of equipment (rinsate) blank samples was collected from the pump after decontamination had been conducted for each sampling event (spring and fall) and analyzed for the full suite of analytical parameters. Results of equipment blank samples are discussed in Section 8.3, Data Evaluation. One field duplicate groundwater sample was collected during each sampling round at well SHM-96-5B and analyzed for the full suite of analytical parameters. Results of duplicate samples are shown on Tables 7-2 and 7-4 and are also discussed in Section 8.3. One trip blank sample was collected per shipped cooler, and submitted for VOC analysis only to evaluate potential cross-contamination of samples during transport. No chemicals of concern were detected in the trip blanks.

8.2 Laboratory Quality Control

One set of QA samples were also collected by the sampling team and sent to the designated QA laboratory (an independent testing laboratory) in the form of duplicates for each sampling round. A QA sample was collected during each event at well SHM-96-5B and analyzed for the full suite of analytical parameters. QA samples were collected, packaged and shipped in the same manner as the other groundwater samples. Appendix E presents the Chemical Quality Assurance Report (CQAR) for both sampling rounds, providing a statistical comparison of the primary and QA laboratory results.

8.3 Data Evaluation

8.3.1 Data Evaluation for Samples Collected Spring 2002

Eighteen groundwater samples were collected at or near Shepley's Hill Landfill, Fort Devens, MA. Fourteen of these samples were collected at the landfill, and the remaining four samples were collected near Molumco Road. The samples were analyzed at Severn Trent Laboratories (in Colchester VT) for Volatile Organic Compounds (VOCs), Target Analyte List (TAL) Metals, Alkalinity, Anions (Nitrate, Phosphate, Sulfate, and Chloride), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Hardness, Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Cyanide and Total Organic Carbon (TOC). The samples were collected on May 20, 21, and 22, 2002 (see Tables 7-2 and 3).

The results were evaluated for acceptability in accordance with the laboratory's defined acceptance limits, standard EPA SW846 guidance and/or guidelines provided in the EPA Contract Laboratory Program (CLP) Data Validation Functional Guidelines.

8.3.1.1 Sample Shipment and Receipt, Spring Event

All sample coolers were packed with ice in the field. Sample shipments were received at the laboratory on 21, 22, and 23 May 2002. All samples were appropriately preserved by the procedures shown in Table 8-1. There are no sample shipment or receipt anomalies associated with these samples.

8.3.1.2 Holding Times, Spring Event

Samples were extracted and analyzed in accordance with the methods and holding time requirements cited in Table 8-1, except for BOD in which the 48-hour holding time was exceeded by between one to seven hours for samples SHL-3, SHL-4, SHL-10, SHM-93-10C, SHL-11, SHL-19, SHL-20, SHM-99-31A, SHM-99-31B, and SHM-99-32X. All such results are consequently qualified.

8.3.1.3 Volatile Organic Compound (VOC) Analysis, Spring Event

In addition to the regular sample complement, the laboratory analyzed one field duplicate (SHM-DUP, a duplicate of sample SHM-96-5B); three trip blanks (dated 5/20/02, 5/21/02, and 5/22/02); one equipment blank (EB-5B, taken 5/21/02), and one MS/MSD (SHL-19 MS and SHL-19 MSD).

Laboratory Method Blank, Trip Blank and Equipment Blanks: Although there were some analytes detected at levels above the reporting limits, none were for the site-specific contaminants of concern. All results are consequently without qualifications.

Laboratory Control Sample (LCS) : Although there were some analytes with recoveries outside limits for all three of the LCS results, none of these exceedances were for the site-specific contaminants of concern, with the sole exception of 4-methyl-2-pentanone (for one LCS). Nevertheless, although positive bias for this analyte would normally be anticipated, since 4-methyl-2-pentanone was not detected in any potentially affected samples, all results are consequently without qualification.

Field Duplicate Sample: Sample results for SHM-96-5B, and its duplicate, sample SHM-DUP-02A, are within limits and no qualifications have been applied.

Surrogates: All recoveries are within acceptance limits and no qualifications have been applied.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) : One MS/MSD pair was analyzed for this project. Although there were four analytes whose recoveries were outside limits, none of these exceedances were for the site-specific contaminants of concern and no qualifications have been applied.

8.3.1.4 Target Analyte List (TAL) Metals Analysis, Spring Event

In addition to the regular sample complement, the laboratory analyzed one field duplicate (SHM-DUP, a duplicate of sample SHM-96-5B) along with one equipment blank (EB-5B, taken 5/21/02), and one MS/MSD (SHL-19 MS and SHL-19 MSD).

Laboratory Preparation Blank and Equipment Blank: Relative to the site-specific contaminants of concern, Pb, Se, and Zn were detected at levels less than the Contract Required Detection Limit (CRDL) but greater than the reporting limit (RL) for the preparation blank. In addition, Cd, Cr, Cu, Pb, Na, Se, and Zn were also detected in the equipment blank sample at levels less than the CRDLs but greater than the RLs. Finally, As and Mn were also detected in the equipment blank but at levels above both the CRDLs and the RLs. All results for these metals are qualified for those sample data concentrations within five times that of the greater of the preparation blank or the equipment blank value.

Laboratory Control Sample (LCS): Since all analyte recoveries were within limits, no qualifications have been applied.

Field Duplicate Sample: For reported concentrations within five times the reporting limit, then the comparison was judged to be acceptable if the values were within two times the RL. As such, the precision is acceptable and no qualifications have been applied.

Matrix Spike (MS) and Duplicate (MSD): One set of (MS/ MSD) was analyzed for this project. All precision and accuracy calculations are within the acceptance limits for project analytes and no qualifications have been applied.

8.3.1.5 General Inorganic Analyses, Spring Event

In addition to the regular sample complement, the laboratory analyzed one field duplicate (SHM-DUP, a duplicate of sample SHM-96-5B) along with one equipment blank (EB-5B, taken 5/21/02), and one MS (SHL-19 MS). In addition, a laboratory repeat of sample SHL-19 was also performed.

Laboratory Preparation Blank and Equipment Blank: No target analytes were detected for preparation blanks. The equipment blank showed detectable levels of Alkalinity (4.0 mg/L) and COD (26 mg/L), but since no corresponding concentrations for sample results are within five times that of these equipment blank values, no qualifications have been applied.

Field Duplicate Sample: Of all matrix duplicate results, only COD exceeded precision limits. Consequently, COD results for samples SHM-96-5B and SHM-96-5B-DUP are qualified.

Matrix Spike (MS) and Duplicate: Of all MS/MSD results, there were no exceedances of precision or accuracy and no qualifications have been applied.

8.3.1.6 Conclusion, Spring Event

Laboratory reports were reviewed for adherence to acceptable laboratory practices. Based on the data evaluation elements reviewed (including holding times, blank sample results, field duplicate results, surrogate recoveries, and MS/MSD recoveries), all necessary analytical data qualifications have been applied as summarized in Table 7-2, Table 7-3, and as enumerated above.

8.3.2 Data Evaluation for Samples Collected Fall 2002

Seventeen total groundwater samples were collected. Fourteen were collected from Shepley's Hill Landfill at the former Fort Devens and three from the Molumco Road wells (off-site), Ayer, Massachusetts. The samples were analyzed at Severn Trent Laboratories (in Colchester VT) for Volatile Organic Compounds (VOCs), Target Analyte List (TAL) Metals, Alkalinity, Anions (Nitrate, Phosphate, Sulfate, and Chloride), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Hardness, Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Cyanide and Total Organic Carbon (TOC). The samples were collected on October 28, 29, 30 and 31, 2002 (see Tables 7-4 and 5).

The results were evaluated for acceptability in accordance with the laboratory's defined acceptance limits, with standard EPA SW846 guidance, with guidelines provided in the "Interim Chemical Data Quality Management (CDQM) Policy for USACE Hazardous, Toxic and Radioactive Waste (HTRW) Projects", dated 23 November 1998, and/or EM 200-1-10 (DRAFT/Final), "Guidance for Evaluating Performance Based Chemical Data Packages".

8.3.2.1 Sample Shipment and Receipt, Fall Event

All sample coolers were packed with ice in the field. Sample shipments were received at the laboratory on October 29, 30, 31 and November 1, 2002. All samples were appropriately preserved by the procedures shown in Table 8-1. There are no sample shipment or receipt anomalies associated with these samples.

8.3.2.2 Holding Times, Fall Event

Samples were prepared and analyzed in accordance with the methods and holding time requirements cited in Table 8-1, except for TDS in which the 48-hour holding time was exceeded by as much as three days in some cases. All samples for TDS are affected. TDS results for all samples are qualified as "H" for holding time exceedance.

8.3.2.3 Volatile Organic Compound (VOC) Analysis, Fall Event

Sixteen groundwater samples were analyzed for VOCs using SW846 method 8260B. As a result of an error at the laboratory, sample SHM-99-31C was not analyzed for volatiles. In

addition to the sixteen groundwater samples, the laboratory analyzed: one field duplicate (SHM-DUP), a duplicate of sample SHM-96-5B); four trip blanks (dated 10/28/02, 10/29/02, 10/30/02 and 10/31/02); and one equipment blank (SHL-EB, dated 10/30/02).

Laboratory Method Blank, Trip Blank and Equipment Blank Results: Target analytes were undetected at levels above the laboratory's practical quantitation limit (PQL) for method blank, trip blank. The equipment blank sample exhibited acetone contamination at 5.7 ug/L. Since no acetone was detected in any of the samples, data is reported unqualified. All results are acceptable.

Field Duplicate Sample Results: VOC results for sample SHM-96-5B, and its duplicate, sample SHM-DUP, show less than 20 % relative percent difference for all detected target analytes. The field duplicate sample shows acceptable comparative results.

Surrogate Results: All VOC sample surrogate recoveries are within the laboratory's stated acceptance limits. All results are acceptable.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) Results: One set of matrix spike/matrix spike duplicate (MS/MSD) samples was submitted to the laboratory for analysis. As a result of an error at the laboratory, the MS/MSD samples for volatile analysis were not analyzed. In the absence of this information, the LCS/LCSD was reviewed and found to be in control for all project specific target analytes. Since the LCS/LCSD was in control, and surrogate spike recoveries were all acceptable and the fact that historically spike recovery for the project target analytes has not typically been a problem, all data is acceptable and usable.

8.3.2.4 Target Analyte List (TAL) Metals Analysis, Fall Event

Seventeen groundwater samples were analyzed for TAL metals using SW846 method 6010B or 7000 series methods. Through an error at the laboratory, sample SHM-99-31C was not analyzed for mercury. In addition to the seventeen groundwater samples, the laboratory analyzed one field duplicate (SHM-DUP, a duplicate of sample SHM-96-5B), and one equipment blank (SHL-EB, dated 10/30/02).

Laboratory Preparation Blank and Equipment Blank Results: Target analytes were undetected at levels above the Contract Required Detection Limit (CRDL) for preparation blank and equipment blank samples. All results are acceptable.

Field Duplicate Sample Results: The results of the metals for sample SHM-96-5B, and its duplicate, sample SHM-DUP, show less than 20 % relative percent difference for all analytes detected above the CRDL. All results are acceptable.

Matrix Spike (MS) and Duplicate Results: One set of matrix spike (MS) and duplicate samples were analyzed for this project. All MS recoveries are within the 75-125 % recovery acceptance limits. For analytes, which showed concentrations above the CRDL, the duplicate RPDs are within the 20% acceptance limit. All results are acceptable.

8.3.2.5 General Inorganic Analyses, Fall Event

Seventeen groundwater samples were analyzed for general inorganic analyses, including Alkalinity by EPA method 310.1, Anions (Nitrate, Sulfate, and Chloride) by EPA method 300.0, Biochemical Oxygen Demand (BOD) by EPA method 405.1, Chemical Oxygen Demand (COD) by EPA method 410.1, Total Hardness by Standard Method 2340B, Total Dissolved Solids (TDS) by EPA method 160.1, Total Suspended Solids (TSS) by EPA method 160.2, Cyanide by EPA method 335.4, and Total Organic Carbon (TOC) by SW846 method 9060 with the following exception: due to an error at the laboratory, analysis of TOC was not performed for sample SHM-99-31C. In addition to the seventeen groundwater samples, the laboratory analyzed one field duplicate (SHM-DUP, a duplicate of sample SHM-96-5B) and one equipment blank (SHL-EB, dated 10/30/02).

Laboratory Preparation Blank and Equipment Blank Results: All target analytes were undetected at levels above the laboratory's practical quantitation limit (PQL) for preparation blank samples.

Field Duplicate Sample Results: The results of the general inorganic analyses for sample SHM-96-5B, and its duplicate, sample SHM-DUP, showed less than 20 % relative percent difference for all detected analytes, except COD and TOC. As a result of the exceedance of RPD criteria for COD and TOC, sample SHM-96-5B, and its duplicate are qualified with a "*", indicating that the duplicate sample RPD values are outside the acceptance limits. Other field duplicate results show acceptable comparative results.

Matrix Spike (MS) and Duplicate Results: One set of matrix spike and duplicate samples was analyzed for Anions, TOC, COD, Total Hardness and Alkalinity. All MS recoveries are within the laboratory's acceptance limits.

8.3.2.6 Conclusion, Fall Event

Laboratory reports were reviewed for adherence to acceptable laboratory practices. Based on the data evaluation elements reviewed (including holding times, blank sample results, surrogate recoveries, field duplicates, and MS/MSD recoveries), all data may be reported without qualification, except as summarized below:

- Total Dissolved Solids (TDS) Analysis: Holding times for TDS were exceeded in some cases by as much as several days. All samples for TDS analysis are affected. All results are qualified as estimated "H" as a result of holding time exceedance.
- Chemical Oxygen Demand (COD) Analysis and Total Organic Carbon (TOC) Analysis : The results of sample SHM-96-5B and it's duplicate for both of these parameters exhibited greater than 20% RPD. Therefore, results for the sample and duplicate are qualified, "*", indicating that duplicate sample RPD values are outside of the acceptance limits.

9.0 CORRECTIVE ACTION

Options for corrective action have been detailed in a draft report titled "Draft Cap Drainage Report, Shepleys Hill Landfill, Devens RFTA, Ayer, MA" and dated January 2003, which was submitted to the Army by the USACE. Implementation of the selected options should improve the drainage and function of the landfill cap. The following items should be addressed before the next inspection or as provided for in the final recommendations in the report cited above: (1) Repair and replace the security fence and gates as required to control access to the site; (2) Place topsoil and seed over the sandy area lacking vegetation on the east side along the perimeter of the cap. Along with the corrective actions listed above, it is recommended to: (1) Install additional landfill gas monitoring probes along the commercial property at the south side of the landfill; (2) Repair and regrade around the catch basins on the south side of the landfill.

With the exception of the repairs mentioned above, and the other repairs recommended in the report, the landfill is in fair condition and appears to be functioning adequately.

TABLES

TABLE 4-1
Landfill Gas Monitoring

INSPECTOR: Kullberg/Michalak TITLE: Civil Engineer DATE: 11/05/02

ORGANIZATION: CENAE-EP WEATHER: Sunny, 50 d F,

BAROMETER: 29.92 in Hg TIME: 1050 BAROMETER: 29.86 in Hg TIME: 1330

Vent No.	VOC ppm PID	O ₂ % GA-90	H ₂ S ppm CGI	LEL % CGI	CO ppm CGI	CO ₂ % GA-90	CH ₄ % GA-90	Remarks
V-1	0.0	18.3	0	0	0	1.2	0	CGI O2 – 18.9
V-2	0.0	18.1	0	75	0	1.3	1.4	CGI O2 – 18.1
V-3	0.0	10.7	0	>100	0	5.7	3.4	CGI O2 – 10.7
V-4	0.0	14.1	0	>100	0	4	0.9	CGI O2 – 14.0
V-5	0.0	18.8	0	0	0	0.8	0	CGI O2 – 19.0
V-6	0.0	15.4	0	>100	0	3.4	2.8	CGI O2 – 15.9
V-7	0.0	18.0	0	16	0	0.8	0.2	CGI O2 – 18.3
V-8	0.0	16.1	0	40	0	2.4	0.6	CGI O2 – 16.3
V-9	0.0	7.2	0	>100	0	14.7	19.8	CGI O2 – 9.3
V-10	0.0	17.8	0	9	0	0.6	0	CGI O2 – 17.7
V-11	0.0	16.3	0	62	0	1.5	1	CGI O2 – 16.5
V-12	0.0	20.5	0	0	0	0	0	CGI O2 – 20.7
V-13	0.0	9.3	0	>100	0	6.3	4.9	CGI O2 – 9.0
V-14	0.0	2.2	0	>100	0	15.7	18.6	CGI O2 – 2.0
V-15	0.0	4.2	0	>100	0	12.2	10.6	CGI O2 – 4.4
V-16	0.0	20.7	0	0	0	0	0	CGI O2 – 20.9
V-17	0.0	14.9	0	17	0	3	0.5	CGI O2 – 19.2
V-18	0.0	3.2	0	>100	0	19	23.5	CGI O2 – 3.4
PGV-1	0.0	20.2	0	0	0	0.2	0	CGI O2 – 21.7
PGV-2	0.0	19.3	0	0	0	1.4	0	CGI O2 – 19.5
PGV-3	0.0	20.2	0	0	0	0.6	0	CGI O2 – 20.3
PGV-4	0.0	20.2	0	0	0	0.2	0	CGI O2 – 21.7

CALIBRATION INFORMATION:

Instrument: PID, 10.6 eV lamp

Results: 0.0/248 ppm isobutylene

Calibrated by: Michalak

Instrument: Industrial Scientific TMX 412 CGI

Results: 53% LEL Methane/Pentane, 14%, 20.9% O₂, 26 ppm H₂S, 54 ppm CO Calibrated by: US Environmental Co

Instrument: Landtech Gem 500 GA-90

Results: 20.9% O₂, 15% CO₂, 15% CH₄

Calibrated by: US Environmental Co

TABLE 5-1
Monitoring Well Specifications and Groundwater Elevations

Well Identification	Description	Screened Interval (feet NGVD)	Groundwater Elevations (feet NGVD)	
			May 20, 2002	October 28, 2002
SHL-3	Water Table	213.4-223.4	218.27	217.61
SHL-4	Water Table	213.0-223.0	218.48	217.89
SHL-5	Water Table	203.4-213.4	216.19	215.60
SHM-96-5B	Base of Sand/Till	128.5-138.5	214.94	213.47
SHM-96-5C	Water Table	158.5-168.5	214.91	213.44
SHL-9	Water Table	197.8-207.8	215.10	213.23
SHL-10	Water Table	210.1*-231.0	218.18	217.26
SHM-93-10C	Bedrock	192.7-202.7	218.79	218.09
SHL-11	Water Table	206.5-221.5	217.64	217.22
SHL-19	Water Table	209.3-224.3	219.14	217.98
SHL-20	Base of Till	185.8-195.8	217.74	217.24
SHL-22	Base of Till	104.5-114.5	214.74	213.19
SHM-96-22B	Sand/Till Interface	127.6-157.6	214.70	213.18
SHM-93-22C	Bedrock	87.3-97.3	214.75	213.20

* Records show well SHL-10 having an as-built bottom elevation of 207.0 NGVD. Recent field observations have revealed that fine material has collected in the bottom of the well, causing refusal to be met at 211.2 NGVD prior to this year. On 15 April 2002, an attempt was made to redevelop the well, with over a foot of the material being removed. At that point, the amount of material continuing to resuspend, allowing removal, was minimal.

TABLE 6-1
Monitoring Well Designations

Monitoring Well Identification	Well Designation (Based on First Five-Year Review, SWEC, Aug 1998)	Exceedances of Cleanup Levels for Trigger Chemicals, Since Achieving Group 1 Status
SHL-3	Group 1	None
SHL-4	Group 2	Not Applicable
SHL-5	Group 1	None
SHM-96-5B	Group 2	Not Applicable
SHM-96-5C	Group 2	Not Applicable
SHL-9	Group 1	71.3 µg/L As (Spring 1999) 144 µg/L As (Spring 2002)
SHL-10	Group 2	Not Applicable
SHM-93-10C	Group 1	None
SHL-11	Group 2	Not Applicable
SHL-19	Group 2	Not Applicable
SHL-20	Group 2	Not Applicable
SHL-22	Group 1	55.9 B µg/L As (Spring 2002) 77.1 µg/L As (Fall 2002)
SHM-96-22B	Group 2	Not Applicable
SHM-93-22C	Group 1	51.1 µg/L As (Fall 1998)

As - Arsenic

B - Value was within 5 times of the greater amount detected in the equipment or preparation blank samples.

TABLE 7-1
Groundwater Sample Analysis and Procedures

PARAMETERS	METHOD
Volatile Organic Compounds Xylenes Acetone 2-Butanone 2-Methyl-2-Pentanone Benzene Methyl-t-Butyl Ether 1,1-Dichloroethane 1,2-Dichloroethene (total) 1,2-Dichloroethane 1,2-Dichlorobenzene 1,3-Dichlorobenzene 1,4-Dichlorobenzene	SW846 8260B
Inorganics Aluminum Arsenic Barium Cadmium Chromium Copper Cyanide (wet chemistry) Iron Lead Manganese Mercury Nickel Selenium Sodium Silver Zinc	SW846 6010B except Cyanide by EPA 335.4 and Mercury by SW846 7470A
General Parameters (laboratory determination) Hardness Total Dissolved Solids Total Suspended Solids Chloride Nitrate as N Sulfate Alkalinity Biochemical Oxygen Demand – 5 day Chemical Oxygen Demand Total Organic Carbon	SM 2340B EPA 160.1 EPA 160.2 EPA 300.0 EPA 300.0 EPA 300.0 EPA 310.1 EPA 405.1 EPA 410.1 SW846 9060
General Parameters (field determination) pH Temperature Specific Conductance Dissolved Oxygen Oxygen Reduction Potential Turbidity	

Table 7-2
Groundwater Analytical Results - May 20 & 21, 2002 Sampling Event
Shepley's Hill Landfill Compliance Point Wells
Devens, Massachusetts
(Sheet 1 of 1)

PARAMETERS	Well No. CLEANUP LEVEL (1) µg/L	SHL-3 µg/L	SHL-4 µg/L	SHL-5 µg/L	SHM-96-5B µg/L	SHM-96-5B DUP µg/L	SHM-96-5C µg/L	SHL-9 µg/L	SHL-10 µg/L	SHM-93-10C µg/L	SHL-11 µg/L	SHL-19 µg/L	SHL-20 µg/L	SHL-22 µg/L	SHM-96-22B µg/L	SHM-93-22C µg/L
VOLATILES (8260B)																
Xylenes	10,000 (2)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Acetone	3,000 (4)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2-Butanone	-	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
4-Methyl-2-Pentanone	-	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Benzene	5 (2)	<5.0	<5.0	<5.0	1.0 J	1.1 J	1.4 J	<5.0	<5.0	<5.0	2.1 J	<5.0	1.4 J	<5.0	1.6 J	<5.0
Methyl-t-Butyl Ether	70 (4)	<5.0	<5.0	<5.0	1.0 J	1.1 J	1.6 J	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	1.5 J	1.1 J	1.2 J
1,1-Dichloroethane	70 (4)	<5.0	<5.0	<5.0	1.8 J	1.8 J	1.8 J	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	2.2 J	2.3 J	1.6 J
1,2-Dichloroethene (total)	70 (2)	<5.0	<5.0	<5.0	2.7 J	2.7 J	2.8 J	<5.0	<5.0	<5.0	<5.0	<5.0	1.0 J	2.7 J	3.2 J	1.2 J
1,2-Dichloroethane	5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,3-Dichlorobenzene	600 (2)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,4-Dichlorobenzene	5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,2-Dichlorobenzene	600	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
METALS (6010B or as noted)																
Aluminum	6,870	<19.8	<19.8	248	<19.8	<19.8	<19.8	229	<19.8	21.2	<19.8	<19.8	<19.8	<19.8	<19.8	<19.8
Arsenic	50	2.8 B	47.8 B	11.9 B	3,800	3,830	50.4 B	144	4.0 B	11.0 B	469	66.9	154	55.9 B	2,040	30.5 B
Barium	2,000 (2)	8.6	23.2	10.0	60.1	60.9	55.9	17.5	<6.3	8.1	101	15.6	94.7	15.8	100	68.8
Cadmium	5 (2)	1.2 B	1.1 B	1.3 B	1.1 B	0.94 B	1.3 B	1.4 B	1.4 B	1.4 B	1.4 B	1.3 B	1.4 B	1.6 B	1.3 B	1.2 B
Chromium	100	5.1 B	3.1 B	2.9 B	3.2 B	2.7 B	2.9 B	2.5 B	3.1 B	2.9 B	2.3 B	2.1 B	3.0 B	4.0 B	1.8 B	4.7 B
Copper	1,300 (3)	4.2 B	2.4 B	3.8 B	2.9 B	4.2 B	4.3 B	2.5 B	2.7 B	2.4 B	2.0 B	1.9 B	3.4 B	4.0 B	3.0 B	2.3 B
Iron	9,100	30.4	1,520	1,110	40,100	38,000	49,200	19,300	<17.0	71.1	55,400	13,000	7,010	605	92,000	916
Lead	15	1.8 B	2.2 B	2.0 B	<0.80	1.8 B	2.0 B	4.2 B	2.8 B	1.8 B	1.1 B	1.1 B	1.6 B	1.1 B	<0.80	1.2 B
Manganese	1,715	14.3 B	573	289	11,000	10,900	4,110	446	1.3 B	45.4 B	2,010	2,280	5,950	1,370	1,680	425
Mercury (7470A)	2 (2)	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Nickel	100	5.5	4.3	3.3	15.2	14.9	6.2	<2.8	<2.8	3.7	4.9	8.8	11.7	12.6	9.1	3.5
Selenium	50 (2)	<2.0	4.5 B	3.5 B	4.4 B	2.4 B	3.3 B	3.8 B	5.2 B	<2.0	4.2 B	3.2 B	6.3 B	2.8 B	8.7 B	4.5 B
Silver	40 (4)	3.0	1.6	2.4	2.1	3.1	3.0	<1.2	<1.2	1.3	<1.2	1.8	2.1	2.4	<1.2	1.5
Sodium	20,000	1,340 B	6,370	2,340 B	36,800	37,000	34,000	2,380 B	1,380 B	8,620	27,600	2,570 B	34,000	43,700	35,900	18,800
Zinc	2,000 (4)	5.1 B	4.3 B	5.1 B	8.9 B	8.8 B	29.3	6.2 B	2.8 B	3.6 B	8.9 B	5.8 B	5.4 B	21.3 B	12.0 B	4.4 B
GENERAL CHEMISTRY																
Alkalinity as CaCO ₃	-	5,000	39,000	33,000	348,000	336,000	320,000	68,000	4,000	188,000	228,000	38,000	280,000	440,000	312,000	232,000
Biochemical Oxygen Demand ₅	-	<1,300 H	<1,300 H	<1,300	<1,300	<1,300	<1,300	<1,300	<1,300 H	<1,300 H	1,200 H	<1,300 H	<1,300 H	<1,300	<1,300	2,200
Chloride	-	720	4,700	1,100	41,200	39,600	49,000	1,500	800	32,800	31,000	1,300	42,000	52,600	45,700	36,800
Chemical Oxygen Demand	-	<5,000	<5,000	37,500	43,500 *	148,000 *	53,400	53,400	<5,000	8,100	14,100	<5,000	16,100	67,200	53,400	33,600
Cyanide (Total)	200 (2)	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0
Hardness as CaCO ₃	-	9,500	31,000	28,200	304,000	301,000	258,000	68,400	18,400	237,000	162,000	37,400	250,000	433,000	249,000	238,000
Nitrate as Nitrogen	10,000 (2)	400	220	<200	<200	<200	<200	<200	1,900	<200	210	220	380	<200	220	<200
Sulfate	500,000 (2)	2,700	8,700	2,900	5,400	5,400	3,700	9,700	2,100	19,800	530	12,800	8,800	4,900	1,800	12,400
Total Dissolved Solids	-	23,000	65,000	61,000	438,000	452,000	398,000	91,000	43,000	326,000	314,000	76,000	371,000	547,000	412,000	320,000
Total Suspended Solids	-	2,300	11,100	1,200	59,500	61,700	53,400	35,500	<500	1,700	37,400	7,200	9,000	1,900	104,000	2,400
Total Organic Carbon	-	<1,000	2,300	8,500	5,100	5,600	6,300	6,700	<1,000	<1,000	4,200	<1,000	3,500	4,300	6,800	3,400

FIELD READINGS (units as noted below)

Dissolved Oxygen (mg/L)	-	11.0	0.3	0.2	0.4	0.4	0.3	0.3	10.4	0.8	0.4	1.9	0.2	6.8	0.4	0.4
Oxidation Reduction Potential (mv)	-	232.2	6.5	93.5	-40.8	-40.8	-53.9	-19.4	255.6	65.6	-54.7	53.2	29.2	63.1	-75.8	-111.3
pH	-	6.5	6.5	5.2	6.6	6.6	6.5	6.5	6.8	7.1	6.5	6.9	6.4	6.6	6.6	7.6
Specific Conductivity (µS/cm)	-	26	114	67	816	816	832	151	47	479	659	154	627	921	848	548

Notes:

Shaded areas with bold numbers indicate cleanup level exceedance -

B = value within 5 times of the greater amount detected in the equipment or preparation blank samples

J = estimated value

N = Matrix Spike sample recovery outside acceptance limits

* = duplicate analysis Relative Percent Difference outside acceptance limits

H = holding time exceeded

NA = not analyzed

(1) Cleanup values as developed in the ROD (unless otherwise noted)

(2) No cleanup value was developed so the Federal Maximum Contamination Level was used

(3) No cleanup value was developed so the Massachusetts Maximum Contamination Level was used

(4) No cleanup value was developed so the Massachusetts Contingency Plan GW-1 standard was used

TABLE 7-3
Groundwater Analytical Results - May 22, 2002 Sampling Event
Molunco Road Wells (RE: Shepley's Hill Landfill)
Ayer, Massachusetts
(Sheet 1 of 1)

PARAMETERS	Well No.	SHM-99-31A	SHM-99-31B	SHM-99-31C	SHM-99-32X
	CLEANUP LEVEL (1) µg/L	µg/L	µg/L	µg/L	µg/L
VOLATILES (8260B)					
Xylenes	10,000 (2)	<5.0	<5.0	<5.0	<5.0
Acetone	3,000 (4)	<5.0	<5.0	<5.0	<5.0
2-Butanone	-	<5.0	<5.0	<5.0	<5.0
4-Methyl-2-Pentanone	-	<5.0	<5.0	<5.0	<5.0
Benzene	5 (2)	<5.0	2.1 J	1.5 J	<5.0
Methyl-t-Butyl Ether	70 (4)	<5.0	<5.0	1.7 J	2.0 J
1,1-Dichloroethane	70 (4)	<5.0	<5.0	2.0 J	2.0 J
1,2-Dichloroethene (total)	70 (2)	<5.0	<5.0	2.5 J	2.8 J
1,2-Dichloroethane	5	<5.0	<5.0	<5.0	<5.0
1,3-Dichlorobenzene	600 (2)	<5.0	<5.0	<5.0	<5.0
1,4-Dichlorobenzene	5	<5.0	<5.0	<5.0	<5.0
1,2-Dichlorobenzene	600	<5.0	<5.0	<5.0	<5.0
METALS (6010B or as noted)					
Aluminum	6,870	80.7	<19.8	<19.8	21.4
Arsenic	50	16.6 B	75.1	345	176
Barium	2,000 (2)	9.0	71.3	103	55.5
Cadmium	5 (2)	0.73 B	0.77 B	1.1 B	1.2 B
Chromium	100	2.0 B	1.8 B	2.3 B	1.8 B
Copper	1,300 (3)	1.7 B	1.7 B	3.2 B	3.1 B
Iron	9,100	4,670	25,400	54,100	51,900
Lead	15	1.3 B	1.9 B	<0.80	1.5 B
Manganese	1,715	386	2,780	7,720	3,960
Mercury (7470A)	2 (2)	0.40	<0.10	<0.10	<0.10
Nickel	100	<2.8	<2.8	17.5	8.8
Selenium	50 (2)	<2.0	<2.0	9.3 B	4.7 B
Silver	40 (4)	1.4	1.4	2.4	1.4
Sodium	20,000	9,130	14,200	47,600	40,600
Zinc	2,000 (4)	4.8 B	8.5 B	12.2 B	7.6 B
GENERAL CHEMISTRY					
Alkalinity as CaCO ₃	-	196,000	4,000	432,000	388,000
Biochemical Oxygen Demand ₅	-	<1,300 H	2,000 H	<1,300	<1,300 H
Chloride	-	6,300	19,800	60,100	60,000
Chemical Oxygen Demand	-	14,100	22,200	36,300	28,200
Cyanide (Total)	200 (2)	<10.0	<10.0	<10.0	<10.0
Hardness as CaCO ₃	-	26,100	145,000	391,000	334,000
Nitrate as Nitrogen	10,000 (2)	<200	<200	<200	<200
Sulfate	500,000 (2)	8,000	2,800	2,100	2,300
Total Dissolved Solids	-	72,000	243,000	584,000	507,000
Total Suspended Solids	-	1,200	8,900	60,000	36,900
Total Organic Carbon	-	4,200	5,800	7,100	5,300
FIELD READINGS (units as noted below)					
Dissolved Oxygen (mg/L)	-	0.2	0.4	0.4	0.3
Oxidation Reduction Potential (mv)	-	51.7	32.6	-72.1	-62.8
pH	-	5.8	5.3	6.6	6.5
Specific Conductivity (µS/cm)	-	103	407	1,053	939

Notes:

Shaded areas with bold numbers indicate cleanup level exceedance -

25

B = value within 5 times of the greater amount detected in the equipment or preparation blank samples

J = estimated value

N= Matrix Spike sample recovery outside acceptance limits

* = duplicate analysis Relative Percent Difference outside acceptance limits

H = holding time exceeded

NA = not analyzed

(1) Cleanup values as developed in the ROD (unless otherwise noted)

(2) No cleanup value was developed so the Federal Maximum Contamination Level was used

(3) No cleanup value was developed so the Massachusetts Maximum Contamination Level was used

(4) No cleanup value was developed so the Massachusetts Contingency Plan GW-1 standard was used

TABLE 7-4
Groundwater Analytical Results - October 28-30, 2002 Sampling Event
Shepley's Hill Landfill Compliance Point Wells
Devens, Massachusetts
(Sheet 1 of 1)

PARAMETERS		Well No. CLEANUP LEVEL (1) µg/L	SHL-3 µg/L	SHL-4 µg/L	SHL-5 µg/L	SHM-96-5B µg/L	SHM-96-5B DUP µg/L	SHM-96-5C µg/L	SHL-9 µg/L	SHL-10 µg/L	SHM-93-10C µg/L	SHL-11 µg/L	SHL-19 µg/L	SHL-20 µg/L	SHL-22 µg/L	SHM-96-22B µg/L	SHM-93-22C µg/L	
VOLATILES (8260B)																		
Xylenes	10,000 (2)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	
Acetone	3,000 (4)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	
2-Butanone	-	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	
4-Methyl-2-Pentanone	-	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	
Benzene	5 (2)	<5.0	<5.0	<5.0	<5.0	<5.0	0.92 J	<5.0	<5.0	<5.0	<5.0	2.0 J	<5.0	<5.0	<5.0	<5.0	<5.0	
Methyl-t-Butyl Ether	70 (4)	<5.0	<5.0	<5.0	1.0 J	0.98 J	1.2 J	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	1.2 J	<5.0	1.0 J	
1,1-Dichloroethane	70 (4)	<5.0	<5.0	<5.0	1.6 J	1.6 J	1.9 J	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	1.9 J	<5.0	1.3 J	
1,2-Dichloroethane (total)	70 (2)	<5.0	<5.0	<5.0	2.6 J	2.6 J	2.7 J	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	1.4 J	2.4 J	<5.0	1.2 J
1,2-Dichloroethane	5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	
1,3-Dichlorobenzene	600 (2)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	
1,4-Dichlorobenzene	5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	2.0 J	<5.0	<5.0	<5.0	<5.0	<5.0	
1,2-Dichlorobenzene	600	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	
METALS (6010B or as noted)																		
Aluminum	6,870	<16.1	<16.1	199	20.0	19.0	<16.1	60.0	<16.1	38.3	<16.1	<16.1	<16.1	<16.1	<16.1	18.4	21.1	
Arsenic	50	<3.2	58.1	<3.2	1,970	1,960	41.3	29.0	<3.2	7.1	648	184	175	77.1	158		30.1	
Barium	2,000 (2)	<9.2	46.0	15.9	45.6	45.6	56.4	14.2	<9.2	<9.2	112	25.0	105	12.7	<9.2		72.7	
Cadmium	5 (2)	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	0.46	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	
Chromium	100	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	
Copper	1,300 (3)	1.9	<1.8	<1.8	5.8	<1.8	<1.8	<1.8	<1.8	<1.8	11.3	<1.8	<1.8	19.6	<1.8	<1.8	<1.8	
Iron	9,100	<22.6	4,380	1,120	18,700	18,700	44,800	8,430	<22.6	52.8	64,500	27,600	9,100	707	446		778	
Lead	15	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	
Manganese	1,715	<2.5	436	259	13,000	12,800	4,110	484	<2.5	46.9	1,990	3,400	7,200	1,760	11.9		407	
Mercury (7470A)	2 (2)	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	
Nickel	100	<13.5	<13.5	<13.5	<13.5	<13.5	<13.5	<13.5	<13.5	<13.5	<13.5	<13.5	<13.5	<13.5	<13.5	<13.5	<13.5	
Selenium	50 (2)	<3.9	<3.9	<3.9	6.3	6.0	6.8	<3.9	<3.9	<3.9	4.4	4.5	8.9	<3.9	4.2		<3.9	
Silver	40 (4)	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	
Sodium	20,000	1,570	2,640	2,180	36,200	35,800	35,400	2,560	1,520	8,180	29,800	4,240	35,600	45,500	114,000		19,500	
Zinc	2,000 (4)	<6.9	<6.9	<6.9	8.9	7.3	<6.9	<6.9	<6.9	<6.9	<6.9	7.5	7.9	<6.9	16.4	<6.9	<6.9	
GENERAL CHEMISTRY																		
Alkalinity as CaCO ₃	-	24,900	86,100	32,600	367,000	366,000	307,000	54,000	27,300	200,000	218,000	75,800	263,000	378,000	193,000		121,000	
Biochemical Oxygen Demand ₅	-	<1,500	<1,500	<1,500	<1,500	<1,500	<1,500	<1,500	<1,500	<1,500	<1,500	<1,500	<1,500	<1,500	<1,500	<1,500	1,500	
Chloride	-	1,200	<200	2,100	42,200	41,200	45,600	1,800	<200	31,700	28,900	3,100	44,000	48,000	45,500		36,100	
Chemical Oxygen Demand	-	27,500	19,600	35,200	87,900 *	13,700 *	41,000	25,500	11,800	23,500	37,300	29,400	21,600	17,600	39,200		17,600	
Cyanide (Total)	200 (2)	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	
Hardness as CaCO ₃	-	29,700	90,600	38,900	315,000	314,000	246,000	74,500	29,400	228,000	183,000	62,800	284,000	437,000	28,000		246,000	
Nitrate as Nitrogen	10,000 (2)	400	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	
Sulfate	500,000 (2)	7,500	11,400	13,000	6,300	6,300	6,600	10,700	2,600	18,700	390	13,600	11,600	5,600	2,900		13,500	
Total Dissolved Solids	-	53,000 H	123,000 H	99,000 H	467,000 H	475,000 H	382,000 H	148,000 H	48,000 H	312,000 H	336,000 H	130,000 H	462,000 H	565,000 H	395,000 H		350,000 H	
Total Suspended Solids	-	<500	1,100	7,000	26,900	25,600	44,400	<500	900	1,600	58,700	9,900	11,000	1,600	700		4,100	
Total Organic Carbon	-	<1,000	2,200	8,100	5,400 *	4,200 *	6,400	8,300	<1,000	<1,000	4,000	1,200	2,100	4,100	4,000		3,400	
FIELD READINGS (units as noted below)																		
Dissolved Oxygen (mg/L)	-	7.9	0.3	0.6	0.3	0.3	0.3	0.1	9.4	0.5	0.6	0.3	0.3	0.8	0.4		0.5	
Oxidation Reduction Potential (mv)	-	209.9	28.0	27.5	-62.7	-62.7	-55.8	-46.9	219.4	-5.3	-46.3	-6.9	-31.1	7.4	14.4 #		-135.1	
pH	-	6.3	6.1	5.7	6.6	6.6	6.5	6.6	6.9	7.5	6.5	6.5	6.5	6.6	8.7		7.5	
Specific Conductivity (µS/cm)	-	67	221	94	846	846	822	182	68	491	756	254	751	927	824		549	

Notes:

Shaded areas with bold numbers indicate cleanup level exceedance -

25

B = value within 5 times of the greater amount detected in the equipment or preparation blank samples

J = estimated value

N = Matrix Spike sample recovery outside acceptance limits

* = duplicate analysis Relative Percent Difference outside acceptance limits

H = holding time exceeded

= value circumspect due to potential field equipment failure

NS = not sampled

NA = not analyzed

(1) Cleanup values as developed in the ROD (unless otherwise noted)

(2) No cleanup value was developed so the Federal Maximum Contamination Level was used

(3) No cleanup value was developed so the Massachusetts Maximum Contamination Level was used

(4) No cleanup value was developed so the Massachusetts Contingency Plan GW-1 standard was used

TABLE 7-5
Groundwater Analytical Results - October 31, 2002 Sampling Event
Molunco Road Wells (RE: Shepley's Hill Landfill)
Ayer, Massachusetts
(Sheet 1 of 1)

PARAMETERS	Well No.	SHM-99-31A	SHM-99-31B	SHM-99-31C	SHM-99-32X
	CLEANUP LEVEL (1) µg/L	µg/L	µg/L	µg/L	µg/L
VOLATILES (8260B)					
Xylenes	10,000 (2)	<5.0	<5.0	NA	NS
Acetone	3,000 (4)	<5.0	<5.0	NA	NS
2-Butanone	-	<5.0	<5.0	NA	NS
4-Methyl-2-Pentanone	-	<5.0	<5.0	NA	NS
Benzene	5 (2)	<5.0	1.7 J	NA	NS
Methyl-t-Butyl Ether	70 (4)	<5.0	<5.0	NA	NS
1,1-Dichloroethane	70 (4)	<5.0	<5.0	NA	NS
1,2-Dichloroethene (total)	70 (2)	<5.0	<5.0	NA	NS
1,2-Dichloroethane	5	<5.0	<5.0	NA	NS
1,3-Dichlorobenzene	600 (2)	<5.0	<5.0	NA	NS
1,4-Dichlorobenzene	5	<5.0	<5.0	NA	NS
1,2-Dichlorobenzene	600	<5.0	<5.0	NA	NS
METALS (6010B or as noted)					
Aluminum	6,870	54.1	22.7	<16.1	NS
Arsenic	50	11.6	71.1	332	NS
Barium	2,000 (2)	<9.2	63.4	98.0	NS
Cadmium	5 (2)	<0.30	<0.30	<0.30	NS
Chromium	100	<4.6	<4.6	<4.6	NS
Copper	1,300 (3)	3.5	<1.8	<1.8	NS
Iron	9,100	3,760	19,500	45,500	NS
Lead	15	1.2	<1.1	<1.1	NS
Manganese	1,715	655	2,270	6,740	NS
Mercury (7470A)	2 (2)	<0.10	<0.10	NA	NS
Nickel	100	<13.5	<13.5	13.5	NS
Selenium	50 (2)	<3.9	<3.9	<3.9	NS
Silver	40 (4)	<1.4	<1.4	<1.4	NS
Sodium	20,000	8,200	11,600	47,200	NS
Zinc	2,000 (4)	<6.9	<6.9	<6.9	NS
GENERAL CHEMISTRY					
Alkalinity as CaCO ₃	-	23,800	155,000	448,000	NS
Biochemical Oxygen Demand ₅	-	<1,500	1,900	<1,500	NS
Chloride	-	8,400	16,200	61,800	NS
Chemical Oxygen Demand	-	11,800	37,300	51,000	NS
Cyanide (Total)	200 (2)	<10.0	<10.0	<10.0	NS
Hardness as CaCO ₃	-	26,000	123,000	382,000	NS
Nitrate as Nitrogen	10,000 (2)	<200	<200	<200	NS
Sulfate	500,000 (2)	14,200	3,500	2,500	NS
Total Dissolved Solids	-	45,000 H	208,000 H	575,000 H	NS
Total Suspended Solids	-	1,500	2,200	49,300	NS
Total Organic Carbon	-	3,800	5,900	NA	NS
FIELD READINGS (units as noted below)					
Dissolved Oxygen (mg/L)	-	0.2	0.5	0.3	NS
Oxidation Reduction Potential (mv)	-	-15.2	-4.8	-94.8	NS
pH	-	5.9	6.1	6.7	NS
Specific Conductivity (µS/cm)	-	104	362	1,059	NS

Notes:

Shaded areas with bold numbers indicate cleanup level exceedance -

25

B = value within 5 times of the greater amount detected in the equipment or preparation blank samples

J = estimated value

N = Matrix Spike sample recovery outside acceptance limits

* = duplicate analysis Relative Percent Difference outside acceptance limits

H = holding time exceeded

NS = not sampled

NA = not analyzed

(1) Cleanup values as developed in the ROD (unless otherwise noted)

(2) No cleanup value was developed so the Federal Maximum Contamination Level was used

(3) No cleanup value was developed so the Massachusetts Maximum Contamination Level was used

(4) No cleanup value was developed so the Massachusetts Contingency Plan GW-1 standard was used

Table 7-6
Comparison of Historic Arsenic Results
Shepley's Hill Landfill and Molumco Road
Groundwater Monitoring

Landfill Compliance Point Monitoring Well ID	Arsenic (ug/L)																
	Aug-91	Dec-91	Mar-93	Jun-93	Nov-96	May-97	Oct-97	May-98	Nov-98	May-99	Nov-99	May-00	Nov-00	May-01	Oct-01	May-02	Oct-02
SHL-3	35	120	6.5	NS	NS	<10	<10	<5	<5.4	2.7 B	<1.9	<2.5	17.4	<4.1	<1.5	2.8 B	<3.2
SHL-4	260	140	2.54	NS	48.8	73.6 J	180	37.4	89.1	78.2	61.3	116	91.5	50.8	66.0	47.8 B	56.1
SHL-5	23	38	11.4	NS	12	<10	<10	<5	11.5	5.0 B	6.5	<2.5	13.8	13.8	14.8	11.9 B	<3.2
SHM-96-5B	NS	NS	NS	NS	1,440	3,300 J	2,040	4,300	3,080	3,490	2,700	5,110	2,500	3,800	1,850	3,800	1,970
SHM-96-5C	NS	NS	NS	NS	71	43.2	43.1	49.5	46.8	57.0	44.8	52.2	40.3	80.5	41.1	50.4 B	41.3
SHL-9	37	67	42.4	NS	46.9	16.1 J	25.2	15	27.2	71.3	28.5	15.0	31.4	15.1	28.1	144	29.0
SHL-10	67	120	280	NS	3.4 B	<10	209	<5	<5.4	2.7 B	<1.9	<2.5	<4.2	<4.1	<1.5	4.0 B	<3.2
SHM-93-10C	NS	NS	21.3	18.1	12.4	<10	10.5	7.5	10.2	10.8 B	8.7	5.9 J	8.8	6.9	10.1	11.0 B	7.1
SHL-11	320	320	340	NS	332	252 J	366	346	376	431	492	404	523	487	573	469	648
SHL-19	340	710	390	NS	138	<10	298	77.5	145	156	176	41.4	154	129	183	66.9	164
SHL-20	98	89	330	NS	244	<10	227	238	218	216	215	216	172	186	165	154	175
SHL-22	27	25	32.9	NS	24.8	<10	34.8	10.6	<5.4	12.2 B	7.3	14.6	45.0	47.6	44.2	55.9 B	77.1
SHM-96-22B	NS	NS	NS	NS	324	318 J	352	365	406	707	1,440	1,360	1,180	1,540	1,670	2,040	159
SHM-93-22C	NS	NS	68.9	49.8	44.6	40.4	<10	31.6	51.1	42.8	33.2	34.4	47.8	19.7	31.6	30.5 B	30.1

Molumco Road Monitoring Well ID	Arsenic (ug/L)																
	Aug-91	Dec-91	Mar-93	Jun-93	Nov-96	May-97	Oct-97	May-98	Nov-98	Jun-99	Nov-99	May-00	Nov-00	May-01	Oct-01	May-02	Oct-02
SHM-99-31A*	NS	NS	NS	NS	NS	NS	NS	NS	NS	<5.2	14.5	8.1 J	21.3	14.2	9.6	16.6 B	11.6
SHM-99-31B*	NS	NS	NS	NS	NS	NS	NS	NS	NS	57.9	63.7	44.3	65.5	57.9	66.8	75.1	71.1
SHM-99-31C*	NS	NS	NS	NS	NS	NS	NS	NS	NS	345	311	332	316	321	317	345	332
SHM-99-32X*	NS	NS	NS	NS	NS	NS	NS	NS	NS	188	185	188	198	181	187	176	NS

Notes:

J: estimated value

B: value within five times of the greater amount detected in the equipment or preparation blank samples

NS: not sampled

*: Molumco Road monitoring wells are not compliance point wells - data is provided for comparison purposes
 bold numbers indicate cleanup level exceedances (MCL cleanup level is 50 ug/L)

TABLE 8-1
Sample Preparation and Analysis Methods,
Containers, Holding Times, and Preservatives

Parameter	Preparation Method ¹	Analysis Method ¹	Sample Container ²	Minimum Volume	Preservative	Holding Time (VTS) ³
VOCs	5030B	8260B	3 X 40 mL vials with Teflon septa screw caps ⁴	40 mL	HCl to pH < 2 (No Headspace) 4° +/- 2°C	14 days
Metals ⁵	3010A	6010B - Trace ICAP or 7000 series	1-Liter HDPE	300 mL	HNO ₃ to pH < 2	180 days (except Hg) 28 days (Hg)
Hardness	NA	SM2340B		100 mL		180 days
Cyanide	NA	335.4	500-mL HDPE	500 mL	NaOH to pH > 12, 4° +/- 2°C	14 days
Anions ⁶	NA	300	500-mL HDPE	100 mL	4° +/- 2°C	48 hours for ortho-Phosphate and Nitrate; 28 days for Sulfate and Chloride
Alkalinity	NA	310.1		100 mL		14 days
TDS	NA	160.1		100 mL		48 hours
COD	NA	410.1	250-mL HDPE	250 mL	H ₂ SO ₄ to pH < 2, 4° +/- 2°C	28 days
BOD	NA	405.1	1-Liter HDPE	1000 mL	4° +/- 2°C	48 hours
TSS	NA	160.2	1-Liter HDPE	1000 mL	4° +/- 2°C	7 days
TOC	NA	9060	3 X 40 mL vials with Teflon septa screw caps ⁴	40 mL	H ₂ SO ₄ to pH < 2, 4° +/- 2°C	28 days

1 "Methods for Chemical Analysis of Water and Wastes", Cincinnati, OH, March 1979, EPA 600-4-79-020.

"Test Methods for Evaluating Solid Waste, Physical and Chemical Methods", U.S. EPA SW-846, 3rd Edition.

"Standard Methods for the Examination of Water and Wastewater", APHA/AWWA/WPCF, 17th Edition.

2 Additional sample containers/volume is required for matrix quality control samples.

3 VTS - Verified Time when the Sample was collected.

4 Two vials will be shipped to the laboratory; one will be measured for pH in the field to verify that the sample has been preserved correctly (i.e. pH less than 2).

5 TAL metals include Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Mercury, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium, and Zinc.

6 Anions include Nitrate, Sulfate, Orthophosphate and Chloride.

NA = Not Applicable

Hg = Mercury

FIGURES

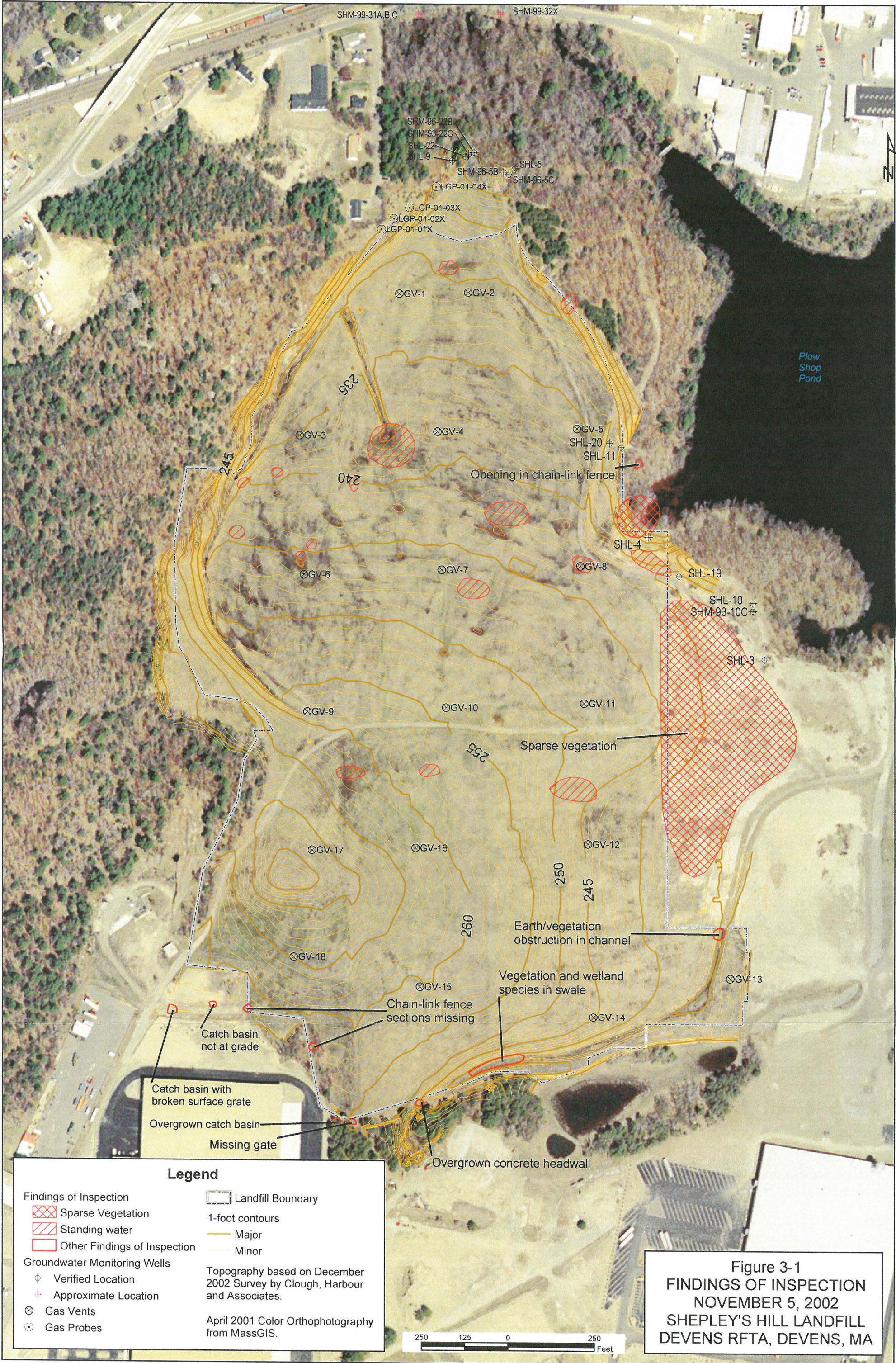
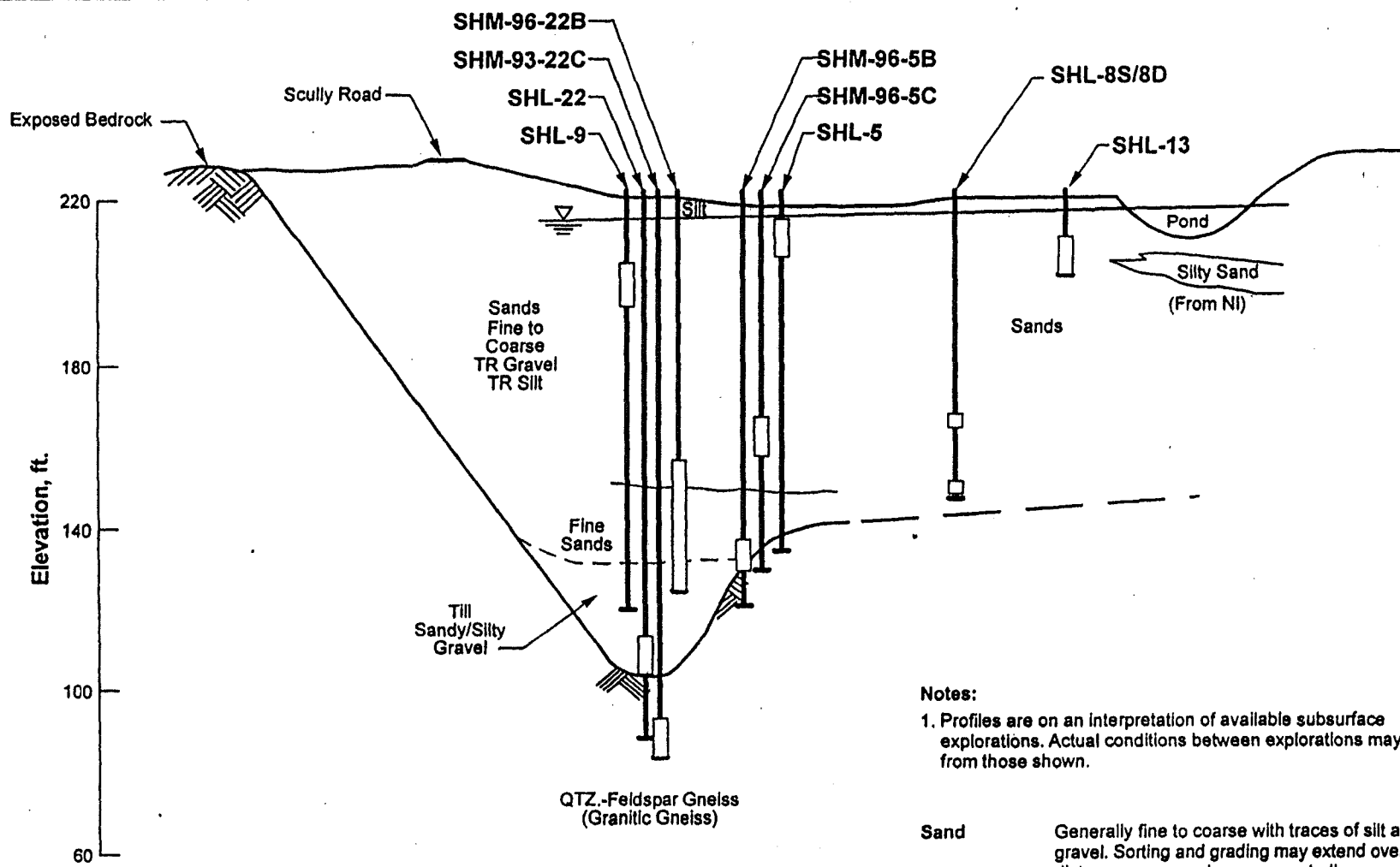
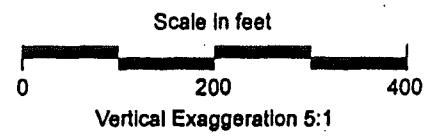
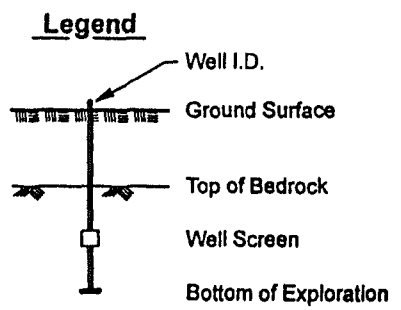


Figure 3-1
FINDINGS OF INSPECTION
NOVEMBER 5, 2002
SHEPLEY'S HILL LANDFILL
DEVENS RFTA, DEVENS, MA



Notes:
 1. Profiles are on an interpretation of available subsurface explorations. Actual conditions between explorations may vary from those shown.

Sand	Generally fine to coarse with traces of silt and gravel. Sorting and grading may extend over long distances or may change repeatedly over short distances.
Gravelly Sand	Zones of potentially higher permeability.
Till	Very dense; well graded from silt to gravel.
Silt	Hydraulically restrictive zones relative to sands.

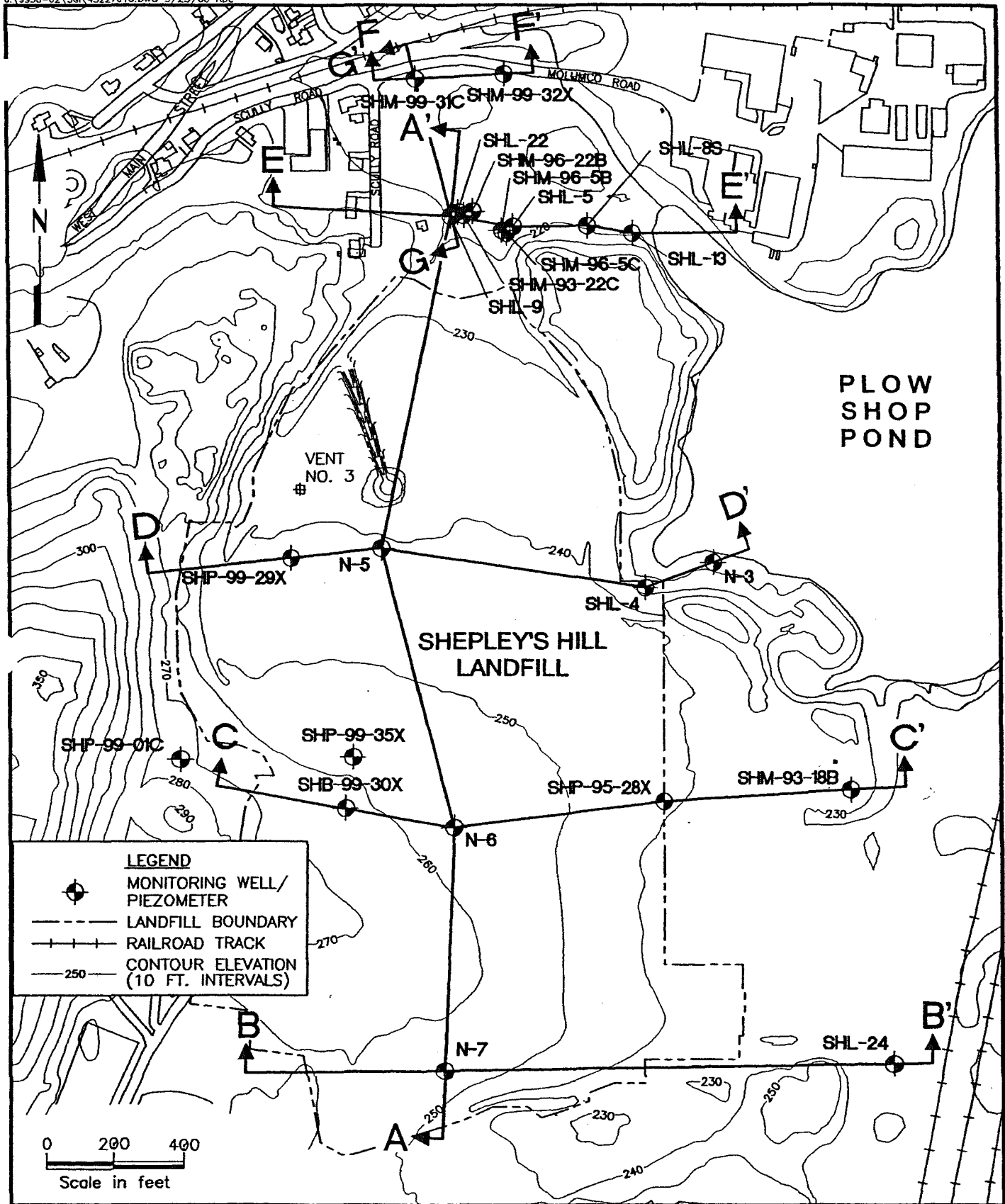


Harding Lawson Associates
 Engineering and
 Environmental Services

Geologic Cross Section E-E'
 Shepley's Hill Landfill
 Devens Reserve Forces Training Area
 Devens, MA

DRAWN: BGF	JOB NUMBER: 09938-02	FILE NUMBER: W9903003(b)	APPROVED:	DATE: 03/99	REVISED DATE: 07/12/00
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FIGURE
5-1



LOCATION OF GEOLOGIC CROSS-SECTIONS
SHEPLEY'S HILL LANDFILL SUPPLEMENTAL
GROUNDWATER INVESTIGATION
DEVENS RFTA, DEVENS, MA

FIGURE

5-2



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Engineering and
Environmental Services

DRAWN
RDC

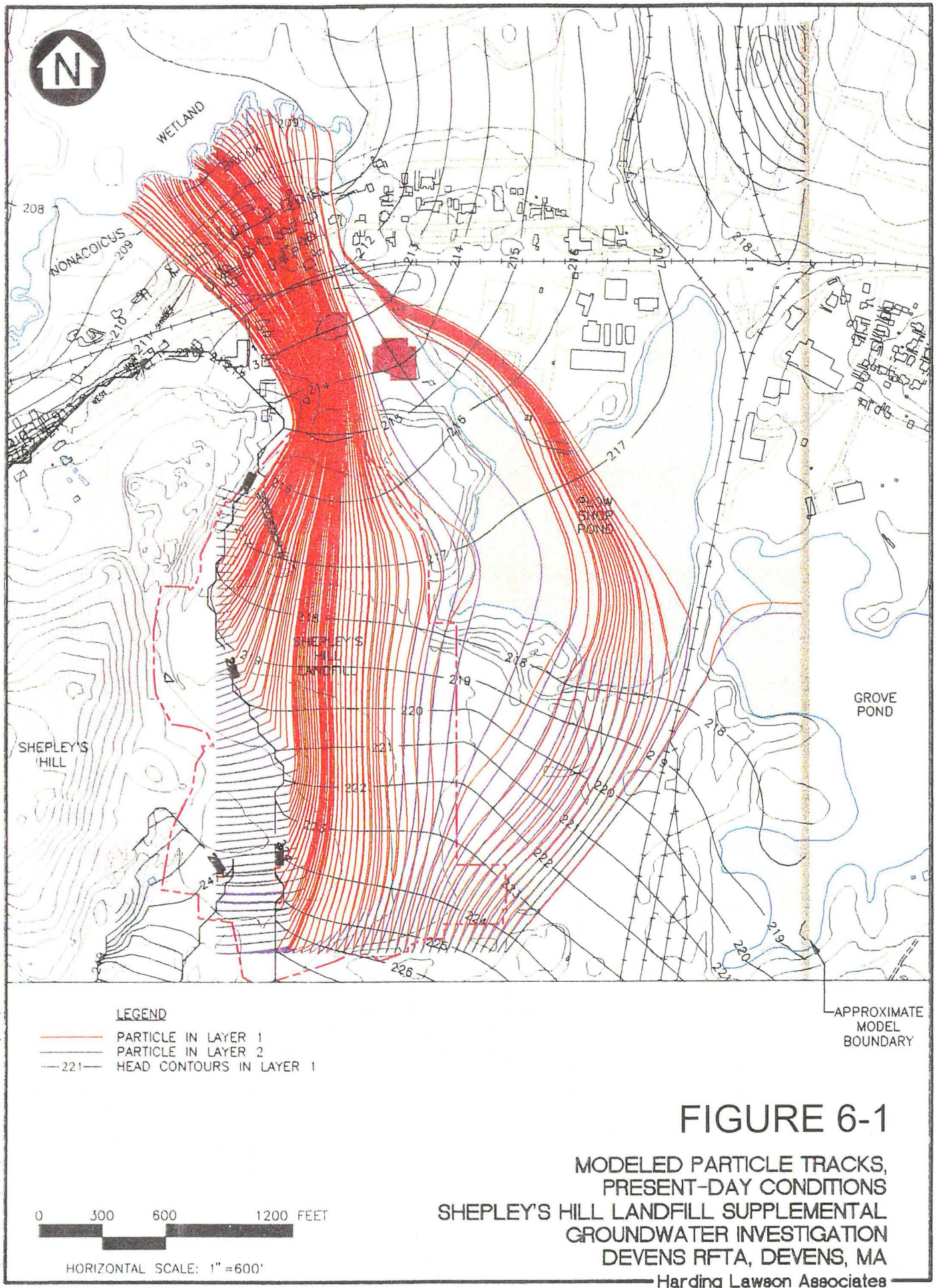
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DATE
5/25/00

REVISED DATE
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APPENDIX A

LANDFILL MAINTENANCE CHECKLIST

APPENDIX A
Landfill Maintenance Checklist

To be completed in indelible ink.

Inspections are to be performed annually.

DATE: 5 November 2002

INSPECTOR: Jonathan Kullberg & Scott Michalak

ORGANIZATION: U.S Army Corps of Engineers, New England District

LANDFILL ATTRIBUTE	OBSERVATIONS	RECOMMENDATIONS	SAT/ UNSAT
Cover Surface	<p>1. Vegetative cover is generally satisfactory except as noted in the comments that follow. Various species growing; mowed to about 8 inches height.</p> <p>2. There are several areas where possible settlement is occurring.</p> <p>3. Trees have been removed from the vicinity of GV-13, the southern perimeter, and the eastern perimeter GV-13 area is unmowed.</p>	<p>1. See specific comments under the sections that follow.</p> <p>2. Survey and compare to original.</p> <p>3. Monitor for tree growth in future</p> <p>4. GV-13 area should be mowed during future maintenance.</p>	<p>SAT</p> <p>SAT</p> <p>SAT</p>
Vegetative Growth	<p>1. In the vicinity of gas vents 8, 11 and 12, the perimeter of the cap has some areas of sparse/eroded vegetation. The soil in the bare areas is mostly sand and is eroded in some areas. The area should be graded to fill in the eroded areas and topsoil should be placed to a depth of 6 inches over the sand to allow grass to grow. The grass cover should extend at least twenty feet beyond the limits of the cap.</p>	<p>1. This area should be reseeded, with hay or straw placed on the surface, to prevent further erosion.</p>	UNSAT
Landfill Gas Vent Wells	<p>1. The gas vents are in good condition. All screens and pipes are in functional condition and no repairs are required at this time.</p>	<p>1. None</p>	SAT

LANDFILL ATTRIBUTE	OBSERVATIONS	RECOMMENDATIONS	SAT/ UNSAT
Drainage Swales	<p>1. Most of the drainage swale on the south side is being invaded by vegetation/wetland species. There are also intermittent zones of standing water indicating a lack of proper channel slope and drainage.</p> <p>2. In the east side drainage swale, in the vicinity of gas vent #13 and continuing downstream to the new rock-lined channel, the drainage swale is heavily overgrown with vegetation and wetland species. It appears to be heavily silted in and has a large area of standing water. There is an earth and vegetation obstruction just upstream of the new rock section preventing the drainage of water and turning the channel into a pond.</p>	<p>1. The south side drainage swale should be cleared of vegetation and regraded as needed to properly drain all areas of standing water. Depending on water velocities, the channel should then be reseeded or riprap should be placed.</p> <p>2. This reach of the drainage swale should be cleared of the obstruction, all vegetation and accumulated silt and sand, and regraded to drain properly. Seeding, or riprap placement, should follow, depending on water velocities. Survey the swale to determine how to promote proper drainage (note – this task is underway).</p>	<p>UNSAT</p> <p>UNSAT</p>
Culverts	<p>1. The concrete drainage structure at the terminus of the catch basin and underground conduit system on the south side is overgrown with vegetation and is silting in. Standing water is present and wetland species are becoming established as well.</p>	<p>1. The structure and channel immediately downstream should be cleaned out and the channel regraded as required to properly drain.</p>	UNSAT
Catch Basins	<p>1. Catch Basin #2 near the entrance to the site has a broken surface grate.</p> <p>2. Catch Basin #3 near the entrance to the site is not set at grade. The rim of the basin is about six to eight inches higher than the surrounding ground.</p> <p>3. Catch basin #7 near the southwest corner of the site is substantially overgrown by the adjacent vegetation and will soon be completely overgrown and hidden from view.</p>	<p>1. The surface grate should be replaced.</p> <p>2. The rim of this catch basin should be lowered to meet the surrounding grade.</p> <p>3. This catch basin should be cleared of encroaching vegetation.</p>	<p>UNSAT</p> <p>UNSAT</p> <p>UNSAT</p>

Settlement	1. It appears that many areas of the landfill may be settling. The extent and its effect on the function of the landfill is unknown.	1. A topographic survey was conducted and compared to the original as-built topo. This indicated where and how much settlement has taken place.	SAT
Erosion	1. No substantial erosion observed. Areas along the east side perimeter in the vicinity of GV-8, 11 & 12 have sparse vegetation.	1. Reseed perimeter of cap and establish vegetative cover at least 20 feet beyond cap limits. Continue monitoring east perimeter of cap for advancing erosion in sandy areas	SAT
Access Roads	1. The access roads on the site are in good condition.	1. There are no problems on access roads which warrant repair at this time.	SAT
Security Fencing	1. The perimeter chain-link security fence is in poor condition. Fence sections and gates are missing and unrestricted access to the site is available at many locations. Some evidence of off-road vehicles (ATV's, dirt bikes, etc.) using the turfed cap area was seen.	1. The security fence should be repaired, with all missing fence sections, including gates, replaced or repaired.	UNSAT
Wetland Encroachment	1. Wetland encroachment is taking place at several locations, but is not happening on a wide scale. Overall, the areas of encroachment are small. These locations have been noted in above comments.	1. Wetland encroachment should be eliminated by simple mowing in some areas, and by regrading channels in other areas. The above comments address the actions to take at specific locations.	UNSAT
<p>Immediate Action Required: The following problem areas, from among those mentioned in the comments above, are the most critical and should be addressed before the next inspection;</p> <p>(1) Repair and replace the security fence and gates as required to control access to the site;</p> <p>Along with the corrective actions listed in the report, the following are recommended:</p> <p>(1) Repair and regrade around the catch basins on the south side of the landfill,</p> <p>(2) Based upon recent topographic survey conducted, determine if corrective action required for historic ponding areas due to settlement or disturbance of drainage system. Note that feasibility study is being conducted to determine options to address this and other problems.</p>			
<p>General Comments: With the exception of the items mentioned above, and the other recommended repairs, the landfill is in fair condition and appears to be functioning adequately.</p>			

APPENDIX B

GROUNDWATER FIELD ANALYSIS FORMS

**Groundwater Field Analysis Forms
Spring 2002**

GWM WELL # SHL-3
 SCREEN INTERVAL DEPTH: 25.1'-35.1' WELL DIAMETER: 2"
 H2O LEVEL: DEPTH, PRE PUMP INSERTION 30.23'
 DEPTH, POST PUMP INSERTION 30.15'
 DEPTH SAMPLED: 33' REFERENCE POINT: PVC OR CASING
 DATE: 20 May 2002 TIME: 0855 (DEPTHS RECORDED BENEATH) 248.5 NGVD
 SAMPLED BY: JK DL PY BW/MK SIGNATURE: [Signature]
 RECORDED BY: JK DL PY BW/MK SIGNATURE: [Signature]

US Army Corps of Engineers
 Groundwater Sampling Log Sheet
 Project Name: Shepley's Hill Landfill, Devens, MA

SAMPLE METHOD: EPA LOW STRESS METHOD
 Metals/Hardness 1 x 1L HDPE (ph<2) VOC'S 3 x 40ml glass vials (ph<2)
 Cyanide 1 x 250ml HDPE (ph>12 + AscAc) BOD 1 x 1L HDPE
 Anions,Alkalinity,TDS 1 x 500ml HDPE COD 1 x 250mL HDPE (ph<2)
 TSS 1 x 1L HDPE TOC 3 x 40ml glass vials

TIME 24hr	WATER DPTH BELOW MP feet	PUMP SETTING	PURGE RATE ml/min	CUM. VOLUME PURGED	H2O TEMP C	SPECIFIC CONDUCTANCE	pH	ORP/Eh mv	D. O. mg/L	TURBIDITY NTU's	COMMENTS
1100											
1100	30.60	118.7	300		11.23	38	7.14	213.4	11.71	50.2	
1104	30.50	118.6	200	.5 gal	11.91	32	6.59	183.8	11.03	25.2	dropping off
1108	30.4	118.5			14.14	29	6.60	187.7	10.73	-	Surged pump
1115	30.0	118.3	500	1.25 gal.	16.01	28	6.57	167.2	10.61	10.7	
1118	30.7	118.2	500		14.12	27	6.58	196.6	10.74	7.14	dropping off
1121	30.55	119.1	250	2 gal	13.93	27	6.56	212.3	10.67		Surged pump
1126	30.70	119.1	500		15.01	27	6.50	189.2	10.51	9.53	
1129	30.75	119.1	500	2.75 gal	14.32	27	6.54	192.3	10.73	5.80	
1132	30.70	119.1	500	3.25 gal	13.81	27	6.52	202.2	10.71	4.49	
1135	30.70	119.1	450	4 gal	13.71	27	6.51	208.2	10.68	3.79	
1140	30.61	119.1	250		13.84	26	6.52	213.4	10.61	3.58	dropping off
1143	31.15	121.3	1000	5.25	13.40	27	6.50	212.4	10.98	4.50	Surged.
1148	31.19	121.3	800	6.50	12.10	26	6.47	225.1	10.97	4.52	
1152	31.20	121.3	850		12.00	26	6.46	229.8	10.97	4.30	
1155	31.20	121.3	850	7.25	11.96	26	6.45	232.2	10.96	3.90	

NOTES:

SAMPLE TAKEN AT: 1157

3% 3% +0.1 unit +10 mv 10% 10%
 wetted screen volume = $\pi (\frac{1}{2}')^2 (35.1' - 30.23') (7.48 \text{ gal/ft}^3) = 0.8 \text{ gal}$

YSI # 015085 TURBIDITY # 76

Pump - Grunfos Redi-flow II

NOTES: 3% 3% +0.1 unit +10 mv 10% 10%

SAMPLE TAKEN AT: 1351 wetted screen volume = $\pi (\frac{1}{2}')^2 (15.7' - 10.23') (7.48 \text{ gal/ft}^3) = 0.9 \text{ gal}$

NOTES: 3% 3% +0.1 unit +10 mv 10% 10%

SAMPLE TAKEN AT: 1444 wetted screen volume = $TP \left(\frac{t}{t_2} \right)^2 (15.1' - 5.1') (7.48 \text{ gal/ft}^3) = 1.6 \text{ gal}$

NOTES: 3% 3% +0.1 unit +10 mv 10% 10%

SAMPLE TAKEN AT: 7406 1606 wetted screen volume = $\pi (\frac{3}{12})^2 (91.3' - 81.3') (7.48 \text{ gal} / \text{ft}^3) = 6.5 \text{ gal}$

Pump - Grunfos Redi-flow II

GWM WELL # <u>SHM-96-5C</u> SCREEN INTERVAL DEPTH: <u>50.8' - 60.8'</u> WELL DIAMETER: <u>4"</u> H2O LEVEL: DEPTH, PRE PUMP INSERTION <u>4.34'</u> DEPTH, POST PUMP INSERTION <u>4.33'</u> DEPTH SAMPLED: <u>55'</u> REFERENCE POINT: <u>PVC OR CASING</u> DATE: <u>5/21/02</u> TIME: <u>1435</u> (DEPTH RECORDED BENEATH) <u>0219.75</u> NGVD SAMPLED BY: <u>JK DL PY BW MK</u> SIGNATURE: <u>[Signature]</u> RECORDED BY: <u>JK DL PY BW MK</u> SIGNATURE: <u>[Signature]</u>						US Army Corps of Engineers Groundwater Sampling Log Sheet Project Name: <u>Shepley's Hill Landfill, Devens, MA</u>					
SAMPLE METHOD: EPA LOW STRESS METHOD Metals/Hardness 1 x 1L HDPE (ph<2) VOC'S 3 x 40ml glass vials (ph<2) Cyanide 1 x 250ml HDPE (ph>12 + AscAc) BOD 1 x 1L HDPE Anions, Alkalinity, TDS 1 x 500ml HDPE COD 1 x 250mL HDPE (ph<2) TSS 1 x 1L HDPE TOC 3 x 40ml glass vials											

TIME 24hr	WATER DPTH BELOW MP feet	PUMP SETTING	PURGE RATE ml/min	CUM. VOLUME PURGED	H2O TEMP C	SPECIFIC CONDUCTANCE	pH	ORP/Eh mv	D. O. mg/L	TURBIDITY NTU's	COMMENTS
1439	4.40	52.7	550		10.29	479	6.16	-26.3	2.84	4.08	
1443	4.40	52.7	550	1.0gal	10.00	835	6.34	-36.4	0.76	0.85	
1446	4.40	52.7	550		10.19	839	6.38	-43.4	0.55	0.48	
1449	4.40	52.6	550	2.0gal	10.22	837	6.42	-46.9	0.45	0.40	
1453	4.40	52.7	550		10.31	838	6.48	-49.8	0.37	0.54	
1457	4.40	52.7	550	3.0gal	10.72	837	6.44	-51.1	0.34	0.50	
1500	4.40	52.7	550		10.33	836	6.48	-52.7	0.33	0.68	
1503	4.40	52.7	550	4.0gal	10.35	836	6.47	-53.1	0.31	0.72	
1506	4.40	52.7	550		10.37	833	6.48	-53.9	0.29	1.78	
1509	4.40	52.7	550	5.0gal	10.40	832	6.46	-53.8	0.29	1.63	
1512	4.40	62.7	550		10.42	832	6.46	-53.9	0.28	1.53	

NOTES: 3% 3% +0.1 unit +10 mv 10% 10%
 SAMPLE TAKEN AT: 1516 wetted screen volume = $\pi (7.2')^2 (60.8' - 50.8') (7.48 \text{ gal/ft}^3) = 6.5 \text{ gal}$

SCREEN INTERVAL DEPTH: 15.0 - 25.0 WELL DIAMETER: 2"
H2O LEVEL: DEPTH, PRE PUMP INSERTION 7.85'
DEPTH, POST PUMP INSERTION 8.01'
DEPTH SAMPLED: 20' REFERENCE POINT: PVC OR CASING
DATE: 5/21/02 TIME: 0955 (DEPTHS RECORDED BENEATH) 212.84 NGVD
SAMPLED BY: JK DL PY BW MK SIGNATURE: David L. L...
RECORDED BY: JK DL PY BW MK SIGNATURE: David L. L...

US Army Corps of Engineers
Groundwater Sampling Log Sheet
Project Name: Shepley's Hill Landfill, Devens, MA

SAMPLE METHOD: EPA LOW STRESS METHOD	
Metals/Hardness 1 x 1L HDPE (ph<2)	VOC'S 3 x 40ml glass vials (ph<2)
Cyanide 1 x 250ml HDPE (ph>12 + AscAc)	BOD 1 x 1L HDPE
Anions,Alkalinity,TDS 1 x 500ml HDPE	COD 1 x 250mL HDPE (ph<2)
TSS 1 x 1L HDPE	TOC 3 x 40ml glass vials

[illegible]

NOTES: 3% 3% +0.1 unit +10 mv 10% 10%

SAMPLE TAKEN AT: 1035 wetted screen volume = $\pi (\frac{1}{2}')^2 (25.0' - 15.0') (7.48 \text{ gal/ft}^3) = 1.4 \text{ gal}$

YSI # 015085 / TURBIDITY # 39575

Pump - Grunfos Redi-flow II

NOTES: 3% 3% +0.1 unit +10 mv 10% 10%

SAMPLE TAKEN AT: 1007 wetted screen volume = $\pi (\frac{1}{2})^2 (38.5' - 30.58') (7.48 \text{ gal/ft}^3) = 1.3 \text{ gal}$

* bottom of well has been filling w/silt(?) - depth was recently restored to 38.5'. Original well depth is 41.8' down from PVC.

NOTES: 3% 3% +0.1 unit +10 mv 10% 10%

SAMPLE TAKEN AT: 1008 wetted screen volume = $\pi \left(\frac{3}{12}\right)^2 (55.7' - 45.7') (7.48 \text{ gal/ft}^3) = 6.5 \text{ gal}$

Pump - Grunfos Redi-flow II

GWM WELL # <u>SHL-19</u> SCREEN INTERVAL DEPTH: <u>17.0'-32.0'</u> WELL DIAMETER: <u>4"</u> H2O LEVEL: DEPTH, PRE PUMP INSERTION <u>22.20'</u> DEPTH, POST PUMP INSERTION <u>22.20'</u> DEPTH SAMPLED: <u>27'</u> REFERENCE POINT: <u>PVC DR CASING</u> DATE: <u>20 May 2002</u> TIME: <u>1140</u> (DEPTHS RECORDED BENEATH) <u>2741.34 NGVD</u> SAMPLED BY: <u>JK DLPY BW MK</u> SIGNATURE: <i>David L. Lutz</i> RECORDED BY: <u>JK DLPY BW MK</u> SIGNATURE: <i>David L. Lutz</i>						US Army Corps of Engineers Groundwater Sampling Log Sheet Project Name: <u>Shepley's Hill Landfill, Devens, MA</u>					
SAMPLE METHOD: EPA LOW STRESS METHOD Metals/Hardness 1 x 1L HDPE (ph<2) VOC'S 3 x 40ml glass vials (ph<2) Cyanide 1 x 250ml HDPE (ph>12 + AscAc) BOD 1 x 1L HDPE Anions,Alkalinity,TDS 1 x 500ml HDPE COD 1 x 250mL HDPE (ph<2) TSS 1 x 1L HDPE TOC 3 x 40ml glass vials											

TIME 24hr	WATER DPTH BELOW MP feet	PUMP SETTING	PURGE RATE ml/min	CUM. VOLUME PURGED	H2O TEMP C	SPECIFIC CONDUCTANCE	pH	ORP/Eh mv	D. O. mg/L	TURBIDITY NTU's	COMMENTS
1200	22.22	101.6	400		10.95	239	5.94	17.6	2.43	65.3	
1204	22.23	101.6	400		11.71	229	5.96	17.7	1.48	72.2	
1207	22.23	101.6	400	1.0 gal	12.04	233	5.96	19.1	1.09	66.3	
1210	22.23	101.5	400		12.30	232	5.95	22.5	0.86	63.2	
1214	22.23	101.5	400	2.0 gal	12.43	220	5.94	26.4	0.77	55.4	
1218	22.23	101.6	400		12.14	216	5.94	30.3	0.72	49.1	
1223	22.23	101.5	450		12.39	202	5.93	33.0	0.68	40.1	
1227	22.23	101.5	425	3.0 gal	12.50	197	5.92	35.4	0.70	37.4	
1230	22.23	101.5	425		12.44	191	5.92	38.4	0.84	36.8	
1234	22.23	101.5	450	4.0 gal	12.47	185	5.90	40.6	0.97	34.4	
1239	22.23	101.5	450		12.45	180	5.90	43.4	1.18	33.3	
1243	22.23	101.5	425	5.0 gal	12.43	175	5.88	45.7	1.40	34.4	
1248	22.23	101.5	425		12.26	166	5.87	48.4	1.64	30.1	
1252	22.23	101.5	400	6.0 gal	12.26	163	5.89	49.3	1.72	28.2	
1255	22.23	101.5	425		12.38	162	5.91	49.9	1.78	29.5	
1258	22.23	101.5	400	7.0 gal	12.49	159	5.90	51.1	1.87	27.1	
1301	22.23		450		12.49	157	5.92	51.9	1.94	23.7	
1304	22.23				12.63	154	5.86	53.2	1.94	21.7	

NOTES: 3% 3% +0.1 unit +10 mv 10% 10%
 SAMPLE TAKEN AT: py 1210 1310 $\text{wetted screen volume} = \pi \left(\frac{3}{12}\right)^2 (32.0' - 22.20') (7.48 \text{ gal/ft}^3) = 6.4 \text{ gal}$

NOTES: 3% 3% +0.1 unit +10 mv 10% 10%

SAMPLE TAKEN AT: 1600 wetted screen volume = $\pi \left(\frac{3}{2}\right)^2 (51.0' - 41.0') (7.48 \text{ gal/ft}^3) = 6.5 \text{ gal}$

YSI # 98#0769 TURBIDITY # 75

Pump - Grunfos Redi-flow II

GWM WELL # <u>SHL-22</u> SCREEN INTERVAL DEPTH: <u>106'-116'</u> WELL DIAMETER: <u>4'</u> H2O LEVEL: DEPTH, PRE PUMP INSERTION <u>5.73'</u> DEPTH, POST PUMP INSERTION <u>5.73'</u> DEPTH SAMPLED: <u>111'</u> REFERENCE POINT: <u>PVC OR CASING</u> DATE: <u>21 May 02</u> TIME: <u>0925</u> (DEPTHS RECORDED BENEATH) <u>220.45' NGVD</u> SAMPLED BY: JK DL PY BW (MK) SIGNATURE: <u>Mark R. Koenig</u> RECORDED BY: JK DL PY BW (MK) SIGNATURE: <u>Mark R. Koenig</u>						US Army Corps of Engineers Groundwater Sampling Log Sheet Project Name: <u>Shepley's Hill Landfill, Devens, MA</u>					
SAMPLE METHOD: EPA LOW STRESS METHOD Metals/Hardness 1 x 1L HDPE (ph<2) VOC'S 3 x 40ml glass vials (ph<2) Cyanide 1 x 250ml HDPE (ph>12 + AscAc) BOD 1 x 1L HDPE Anions, Alkalinity, TDS 1 x 500ml HDPE COD 1 x 250mL HDPE (ph<2) TSS 1 x 1L HDPE TOC 3 x 40ml glass vials											

TIME 24hr	WATER DPTH BELOW MP feet	PUMP SETTING	PURGE RATE ml/min	CUM. VOLUME PURGED	H2O TEMP C	SPECIFIC CONDUCTANCE	pH	ORP/Eh mv	D. O. mg/L	TURBIDITY NTU's	COMMENTS
1000	5.87	59.1	100	0.3	10.33	561	7.08	57.0	68.7	1.53	
1005	6.01	60.3	320	0.7	9.82	845	6.39	45.3	28.8	1.02	
1010	6.13	61.3	320	1.0	10.11	906	6.40	50.0	17.2	0.73	
1014	6.14	61.3	300	1.2	10.16	914	6.40	54.9	13.8	0.65	
1019	6.14	61.3	300	1.6	10.16	920	6.41	57.9	11.7	0.57	
1023	6.15	61.3	300	2.0	10.16	922	6.45	59.6	10.5	0.55	
1027	6.15	61.3	300	2.2	10.11	925	6.46	60.6	9.7	0.41	
1031	6.15	61.3	300	2.6	9.85	921	6.54	62.1	9.1	0.37	
1035	6.16	61.3	300	3.0	10.08	915	6.60	62.0	8.1	0.34	
1038	6.16	61.3	300	3.3	10.00	921	6.61	62.5	7.3	0.39	
1042	6.16	61.3	300	3.8	10.29	921	6.59	63.1	6.8	0.45	

NOTES: 3% 3% +0.1 unit +10 mv 10% 10%

SAMPLE TAKEN AT: 1047 wetted screen volume = $\pi (1/2')^2 (116.0' - 106.0') (7.48 \text{ gal/ft}^3) = 6.5 \text{ gal}$

NOTES: 3% 3% +0.1 unit +10 mv 10% 10%

SAMPLE TAKEN AT: 1254 wetted screen volume = $\pi (\frac{1}{2}')^2 (92.7' - 62.7') (7.48 \text{ gal/ft}^3) = 4.9 \text{ gal}$

GWM WELL # <u>SHm-93-22c</u>						US Army Corps of Engineers Groundwater Sampling Log Sheet Project Name: <u>Shepley's Hill Landfill, Devens, MA</u>					
SCREEN INTERVAL DEPTH: <u>124.3' - 124.3'</u> WELL DIAMETER: <u>4"</u>						SAMPLE METHOD: EPA LOW STRESS METHOD Metals/Hardness 1 x 1L HDPE (ph<2) VOC'S 3 x 40ml glass vials (ph<2) Cyanide 1 x 250ml HDPE (ph>12 + AscAc) BOD 1 x 1L HDPE Anions, Alkalinity, TDS 1 x 500ml HDPE COD 1 x 250mL HDPE (ph<2) TSS 1 x 1L HDPE TOC 3 x 40ml glass vials					
H2O LEVEL: DEPTH, PRE PUMP INSERTION <u>6.82'</u>											
DEPTH, POST PUMP INSERTION <u>5.88'</u>											
DEPTH SAMPLED: <u>124.3' - 130.0' - 130.0'</u> REFERENCE POINT: <u>(PVC) OR CASING</u> (DEPTHS RECORDED BENEATH) <u>221.55 NGVD</u>											
DATE: <u>5/21/02</u> TIME: <u>1100</u>											
SAMPLED BY: <u>JDL PY BW MK</u> SIGNATURE: <u>[Signature]</u>											
RECORDED BY: <u>JDL PY BW MK</u> SIGNATURE: <u>[Signature]</u>											

TIME 24hr	WATER DPTH BELOW MP feet	PUMP SETTING	PURGE RATE ml/min	CUM. VOLUME PURGED	H2O TEMP C	SPECIFIC CONDUCTANCE	pH	ORP/Eh mv	D. O. mg/L	TURBIDITY NTU's	COMMENTS
1133	13.44	103.7	1800	4 gal	10.57	650	7.54	-126.2	0.47	1.23	clear
1138	17.45	100.0	1300	7 gal	10.56	638	7.57	-131.8	0.37	1.42	(slight Hydrogen Sulfide odor)
1145	20.56	100.2	700	9 gal	10.41	627	7.60	-134.2	0.37	1.32	
1154	23.05	109.0	900	11 gal	10.87	587	7.62	-136.8	0.30	1.50	
1204	25.42	112.7	800	13 gal	10.47	520	7.58	-131.0	0.30	1.56	
1209	26.49	112.7	500	14 gal	10.80	502	7.58	-130.5	0.28	1.36	
1219	27.29	113.8	250	15 gal	10.38	519	7.57	-129.0	0.32	1.53	
1225	27.42	113.8	200		10.31	543	7.58	-122.1	0.34	1.70	
1229	27.48	113.8	200		10.07	533	7.58	-118.8	0.34	1.79	
1234	27.51	113.8	150		9.98	539	7.58	-114.3	0.35	1.60	
1242	27.53	113.8	150	16 gal	9.92	547	7.57	-111.0	0.38	1.61	
1246	27.53	113.8	150		9.93	548	7.58	-111.3	0.39	1.74	

NOTES:

SAMPLE TAKEN AT: 1250 3% 3% +0.1 unit +10 mv 10% 10%
wetted screen volume = $\pi (\frac{3}{12})^2 (134.3' - 124.3') (7.48 \text{ gal/ft}^3) = 6.5 \text{ gal}$

Well has history of limited to no re-charge until the water level is drawn down 20-30 ft, so a higher rate of discharge is used until that point.

YSI # 0150851

TURBIDITY # 75

Pump - Grunfos Redi-flow II #2

NOTES: 3% 3% +0.1 unit +10 mv 10% 10%

SAMPLE TAKEN AT: 12/4/74 wetted screen volume = $\pi (\frac{1}{12})^2 (15.7 - 5.7) (7.48 \text{ gal/ft}^3) = 1.4 \text{ gal}$

NOTES: 3% 3% +0.1 unit +10 mv 10% 10%

SAMPLE TAKEN AT: 1307 wetted screen volume = $\pi \left(\frac{1}{2}\right)^2 (62.3' - 52.3') (7.48 \text{ gal/ft}^3) = 1.6 \text{ gal}$

Pump - Grunfos Redi-flow II

NOTES: 3% 3% +0.1 unit +10 mv 10% 10%

SAMPLE TAKEN AT: 1020 wetted screen volume = $\pi (\frac{1}{2}')^2 (80.2' - 70.2') (7.48 \text{ gal}/\text{ft}^3) = 1.6 \text{ gal}$

YSI # 98F0769 TURBIDITY # 39576 Pump - Grunfos Redi-flow II

**Groundwater Field Analysis Forms
Fall 2002**

RECORDED BY: JK KM DL PY MK WM SIGNATURE: Mark R Koenig

Project Name: Shepley's Hill Landfill, Devens, MA

TSS 1 x 1L HDPE TOC 3 x 40ml glass vials

Pump - Grunfos Redi-flow II

Pump - Grunfos Redi-flow II

2. Shore to shore

TOC 3 x 40ml glass vials

Pump - Grunfos Redi-flow II

[illegible]

Pump - Grunfos Redi-flow II

Pump - Grunfos Redi-flow II

RECORDED BY: JK KM DPY MK WM SIGNATURE: *[Signature]*

Groundwater Sampling Log Sheet
Project Name: Shepley's Hill Landfill, Devens, MA

TSS 1 x 1L HDPE TOC 3 x 40ml glass vials

Pump - Grunfos Redi-flow II

RECORDED BY: JK KM DL PY MK WM SIGNATURE: 

Project Name: Shepley's Hill Landfill, Devens, MA

TSS 1 x 1L HDPE

Pump - Grunfos Redi-flow II

RECORDED BY: JK KM DL PY MK WM SIGNATURE: Paul Young

TOC 3 x 40ml glass vials

Pump - Grunfos Redi-flow II

NOTES: 3% 3% +0.1 unit +10 mv 10% 10%

SAMPLE TAKEN AT: 1057 wetted screen volume = $\pi (4.2')^2 (15.7' - 5.7') (7.48 \text{ gal/ft}^3) = 1.60 \text{ gal}$

RECORDED BY: JK KM DL PY MK *WM* SIGNATURE:

1 TSS 1 x 1L HDPE

TOC 3 x 40ml glass vials

Pump - Grunfos Redi-flow II

APPENDIX C

CHAIN OF CUSTODY FORMS

Severn Trent Laboratories, Inc.

208 South Park Drive, Suite 1, Colchester, VT 05446 Tel: (802) 655-1203

CHAIN OF CUSTODY RECORD

Report to: Company: <u>U.S. ARMY CORPS OF ENG.</u> Address: <u>696 VIRGINIA ROAD</u> <u>CONCORD, MA 01742</u> Contact: <u>MARIE WOOTAS</u> Phone: <u>978/318-8175</u> Fax: _____ Contract/Quote: _____				Invoice to: Company: _____ Address: _____ Contact: _____ Phone: _____ Fax: _____				ANALYSIS REQUESTED <div style="border: 1px solid black; padding: 5px; transform: rotate(-90deg); transform-origin: center;"> VOCs - 8260B METALS - 6010B / HARDNESS - 2340B CYANIDE - 9010B ANIONS - 300 / ALK - 310 / TDS - 160.1 COD - 410.1 BOD - 4105.1 TSS - 160.2 TOC - 9060 </div>				Lab Use Only Due Date: _____ Temp. of coolers when received (C°): <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr> </table> Custody Seal N / Y Intact N / Y Screened For Radioactivity <input type="checkbox"/>				1	2	3	4	5
1	2	3	4	5																
Sampler's Name: <u>David Lubianez</u> <u>Brian Waz</u>				Sampler's Signature: <u>David Lubianez</u> <u>Brian Waz</u>																
Proj. No. <u>ED776</u>		Project Name <u>SHEPLEY'S HILL LTM</u>		No/Type of Containers*																
Matrix	Date	Time	Comp	Grab	Identifying Marks of Sample(s)	VOA	A/G	250 ml	P/O	Lab/Sample ID (Lab Use Only)										
W	5/20/02	1007		X	SHL-10	3	3	1	5	3	1	1	1	1	1	3				
W	5/20/02	1008		X	SHM-93-10C	3	3	1	5	3	1	1	1	1	1	3				
W	5/20/02	1310		X	SHL-19	3	3	1	5	3	1	1	1	1	1	3				
W	5/20/02	1310		X	SHL-19ms	3	3	1	2	3	1	1	1	-	-	3				
W	5/20/02	1310		X	SHL-19msD	3	3	1	1	3	1	1	-	-	-	3				
W	5/20/02	1157		X	SHL-3	3	3	1	5	3	1	1	1	1	1	3				
W	5/20/02	1351		X	SHL-4	3	3	1	5	3	1	1	1	1	1	3				
W	5/20/02	1550		X	SHL-11	3	3	1	5	3	1	1	1	1	1	3				
W	5/20/02	1600		X	SHL-20	3	3	1	5	3	1	1	1	1	1	3				
W	5/20/02	-		X	TRIP BLANK	1	-	-	-	1	-	-	-	-	-	-				
Relinquished by: (Signature) <u>Paul Young</u>		Date <u>5/20/02</u>	Time <u>1830</u>	Received by: (Signature) <u>Fed. Express</u> <u>airbill # 827491009516</u>		Date	Time	Remarks <u>3 coolers shipped</u> Client's delivery of samples constitutes acceptance of Severn Trent Laboratories terms and conditions contained in the Price Schedule.												
Relinquished by: (Signature)		Date	Time	Received by: (Signature)		Date	Time													
Relinquished by: (Signature)		Date	Time	Received by: (Signature)		Date	Time													
*Matrix WW - Wastewater W - Water S - Soil L - Liquid - A - Air bag C - Charcoal Tube SL - Sludge O - Oil *Container VOA - 40 ml vial A/G - Amber / Or Glass 1 Liter 250 ml - Glass wide mouth P/O - Plastic or other																				

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CHAIN OF CUSTODY RECORD

Report to: Company: <u>U.S. Army Corps of Eng.</u> Address: <u>696 VIRGINIA ROAD</u> <u>CONCORD, MA 01742</u> Contact: <u>MARIE WOTTAS</u> Phone: <u>978/315-8175</u> Fax: _____ Contract/Quote: _____				Invoice to: Company: _____ Address: _____ Contact: _____ Phone: _____ Fax: _____				ANALYSIS REQUESTED <div style="display: flex; flex-direction: column; align-items: center;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">VOCs - 8260B</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">METALS - 6010B / HANNESS - 2340B</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">CYANIDE - 9010B</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">ARSENIC - 300 / ALK - 310.1 / PDS - 160.1</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">CCD - 4110.1</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">BOD - 405.1</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">TSS - 160.2</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">TDC - 9060</div> </div>										Lab Use Only Due Date: _____ Temp. of coolers when received (C°): <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td> </tr> </table> Custody Seal N / Y Intact N / Y Screened For Radioactivity <input type="checkbox"/>					1	2	3	4	5
1	2	3	4	5																							
Sampler's Name: <u>Jack A. Keenan</u> <u>Mark R. Keenig</u> <u>David Liberman</u>				Sampler's Signature: <u>Mark R. Keenig</u>																							
Proj. No.		Project Name				No./Type of Containers?																					
EB 77C		Shepley's Hill LTM																									
Matrix	Date	Time	Comp	Grab	Identifying Marks of Sample(s)	VOA	AVG	250 ml	P/O																		
W	5/21/02	1035		X	SHL-9	3	3	1	5	3	1	1	1	1	1	1	3										
W	5/21/02	1047		X	SHL-22	3	3	1	5	3	1	1	1	1	1	1	3										
W	5/21/02	1250		X	SHM-93-22C	3	3	1	5	3	1	1	1	1	1	1	3										
W	5/21/02	1254		X	SHM-96-22B	3	3	1	5	3	1	1	1	1	1	1	3										
W	5/21/02	1444		X	SHL-5	3	3	1	5	3	1	1	1	1	1	1	3										
W	5/21/02	1516		X	SHM-96-5C	3	3	1	5	3	1	1	1	1	1	1	3										
W	5/21/02	1606		X	SHM-96-5B	3	3	1	5	3	1	1	1	1	1	1	3										
W	5/21/02	1606		X	SHM-DUP-02A	3	3	1	5	3	1	1	1	1	1	1	3										
W	5/21/02	1748		X	EB-5B	3	3	1	5	3	1	1	1	1	1	1	3										
W	5/21/02	-		X	TRIP BLANK	1	-	-	-	1	-	-	-	-	-	-	-										

Relinquished by: (Signature)		Date	Time	Received by: (Signature)		Date	Time	Remarks
<u>Paul Young</u>		5/21/02	1930	<u>Fed. Express</u> <u>AIRBILL # 827491009527</u>				
Relinquished by: (Signature)		Date	Time	Received by: (Signature)		Date	Time	
Relinquished by: (Signature)		Date	Time	Received by: (Signature)		Date	Time	Client's delivery of samples constitutes acceptance of Severn Trent Laboratories terms and conditions contained in the Price Schedule.

*Matrix WW - Wastewater W - Water S - Soil L - Liquid A - Air bag C - Charcoal Tube SL - Sludge O - Oil
 *Container 40 ml vial A/G - Amber / Or Glass 1 Liter 250 ml - Glass wide mouth P Plastic or other

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**Severn Trent Laboratories, Inc.**

208 South Park Drive, Suite 1, Colchester, VT 05446 Tel: (802) 655-1203

CHAIN OF CUSTODY RECORD

Report to: Company: <u>U.S. ARMY CORPS OF ENG.</u> Address: <u>696 VIRGINIA ROAD</u> <u>CONCORD, MA 01742</u> Contact: <u>MARIE WOJTAS</u> Phone: <u>978/318-8175</u> Fax: _____ Contract/Quote: _____				Invoice to: Company: _____ Address: _____ Contact: _____ Phone: _____ Fax: _____				ANALYSIS REQUESTED <div style="writing-mode: vertical-rl; transform: rotate(180deg);">VOCs - 8260B METALS - 6010B / HARDNESS - 2340B CYANIDE - 9010B ANIONS - 300 ALKALINITY - 301, TDS - 601 COD - 410.1 BOD - 405.1 TSS - 160.2 TDC 9060</div>				Lab Use Only Due Date: _____ Temp. of coolers when received (C°): <table border="1" style="width:100%"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr></table> Custody Seal N / Y Intact N / Y Screened For Radioactivity <input type="checkbox"/>				1	2	3	4	5
1	2	3	4	5																
Sampler's Name <u>David Lusiano</u> <u>Jack Keenan</u> <u>Mark R. Koenig</u>				Sampler's Signature <u>David Lusiano</u> <u>Jack Keenan</u> <u>Mark R. Koenig</u>				Lab/Sample ID (Lab Use Only)												
Proj. No. <u>E0776</u>		Project Name <u>SHEPLEY'S HILL LTM</u>		No./Type of Containers																
Matrix	Date	Time	Comp	Grab	Identifying Marks of Sample(s)	VOA	40 ml A/G 1 L Glass	250 ml	P/O											
W	5/22/02	1039		X	SHM-99-32X	3	3	1	5	3	1	1	1	1	1	1	3			
W	5/22/02	1020		X	SHM-99-31C	3	3	1	5	3	1	1	1	1	1	1	3			
W	5/22/02	1244		X	SHM-99-31A	3	3	1	5	3	1	1	1	1	1	1	3			
W	5/22/02	1307		X	SHM-99-31B	3	3	1	5	3	1	1	1	1	1	1	3			
W	5/22/02	-		X	TRIP BLANK	1	-	-	-	1	-	-	-	-	-	-	-			
Paul Young																				
Relinquished by: (Signature) <u>Paul Young</u>		Date <u>5/22/02</u>		Time <u>1530</u>		Received by: (Signature) <u>Fed. Express</u>		Date		Time		Remarks <u>2 sample coolers shipped</u> Client's delivery of samples constitutes acceptance of Severn Trent Laboratories terms and conditions contained in the Price Schedule.								
Relinquished by: (Signature)		Date		Time		Received by: (Signature)		Date		Time										
Relinquished by: (Signature)		Date		Time		Received by: (Signature)		Date		Time										
<div style="display: flex; justify-content: space-between;"><div>¹Matrix WW - Wastewater W - Water S - Soil L - Liquid A - Air bag C - Charcoal Tube SL - Sludge O - Oil</div><div>²Container VOA - 40 ml vial A/G - Amber / Or Glass 1 Liter 250 ml - Glass wide mouth P/O - Plastic or other</div></div> <div style="text-align: right;">STL cannot accept verbal changes. Please Fax written changes to (802) 655-1248</div>																				

U.S. ARMY CORPS OF ENGINEERS

7308

Severn Trent Laboratories, Inc.

208 South Park Drive, Suite 1, Colchester, VT 05446 Tel: (802) 655-1203

CHAIN OF CUSTODY RECORD

page 101

Report to: Company: <u>U.S. Army Corps of Engineers</u> Address: <u>1696 Virginia Road</u> <u>Concord, MA 01742</u> Contact: <u>Mark Koenig</u> Phone: <u>978 318-8312</u> Fax: _____ Contract/ Quote: _____						Invoice to: Company: <u>Same</u> Address: _____ Contact: _____ Phone: _____ Fax: _____						ANALYSIS REQUESTED <div style="transform: rotate(-45deg); transform-origin: center; white-space: nowrap;"> VOC's 8260B TOC 9010 TAL Metals 6010B/Hardness 2040B Cyanide 9010B Amiens 300/Alkalinity 310.1/TDS 160.1 COD 410.4 BOD 405.1 TSS 160.2 </div>						Lab Use Only Due Date: _____ <hr/> Temp. of coolers when received (C°): <table border="1" style="width:100%; text-align: center;"> <tr> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr> </table> <hr/> Custody Seal: N / Y Intact: N / Y <hr/> Screened For Radioactivity <input type="checkbox"/>						1	2	3	4	5
1	2	3	4	5																								
Sampler's Name <u>MAEK Koenig</u> <u>- David LUSIAEZ</u>						Sampler's Signature <u>Mark R. Koenig</u> <u>Daniel J. Lusiaz</u>																						
Proj. No.		Project Name				No./Type of Containers*																						
<u>EPT776</u>		<u>Shepley's Hill LTM</u>																										
Matrix¹	Date	Time	Cmp	Grab	Identifying Marks of Sample(s)	VOA	A/G or Glass	250 ml	P/O																			
<u>W</u>	<u>28 Oct 2002</u>	<u>1013</u>		X	<u>SHL-3</u>	<u>3</u>	<u>3</u>	<u>6</u>																				
		<u>1056</u>		X	<u>SHM-93-10C</u>	<u>3</u>	<u>3</u>	<u>6</u>																				
		<u>1227</u>		X	<u>SHL-10</u>	<u>3</u>	<u>3</u>	<u>6</u>																				
		<u>1330</u>		X	<u>SHL-19</u>	<u>3</u>	<u>3</u>	<u>6</u>																				
		<u>1330</u>		X	<u>SHL-19MS</u>	<u>3</u>	<u>-</u>	<u>3</u>																				
		<u>1330</u>		X	<u>SHL-19MSD</u>	<u>3</u>	<u>-</u>	<u>2</u>																				
		<u>-</u>		X	<u>TRIP BLANK</u>	<u>3</u>	<u>-</u>	<u>2</u>																				
<u>↓</u>	<u>↓</u>	<u>1509</u>		X	<u>SHI-4</u>	<u>3</u>	<u>3</u>	<u>6</u>																				
*																												

Relinquished by: (Signature) <u>Katherine Miller</u>		Date <u>10-28-02</u>	Time <u>1600</u>	Received by: (Signature) <u>FEDER</u>		Date	Time	Remarks <div style="font-size: 2em; font-weight: bold;">2 Coolers Shipped</div>
Relinquished by: (Signature)		Date	Time	Received by: (Signature)		Date	Time	
Relinquished by: (Signature)		Date	Time	Received by: (Signature)		Date	Time	

Client's delivery of samples constitutes acceptance of Severn Trent Laboratories terms and conditions contained in the Price Schedule.

¹Matrix WW - Wastewater W - Water S - Soil L - Liquid A - Air bag C - Charcoal Tube SL - Sludge O - Oil
 *Container VOA - 40 ml vial A/G - Amber / Or Glass 1 Liter 250 ml - Glass wide mouth P/O - Plastic or other

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CHAIN OF CUSTODY RECORD

Report to:

Company: U.S. Army Corps of EngineersAddress: 696 Virginia RoadConcord MA 01742Contact: Mark KoenigPhone: 978 318 8312

Fax: _____

Contract/

Quote: _____

Invoice to:

Company: same

Address: _____

Contact: _____

Phone: _____

Fax: _____

ANALYSIS
REQUESTEDLab Use Only
Due Date:Temp. of coolers
when received (C°):

1	2	3	4	5
---	---	---	---	---

Custody Seal N / Y

Intact N / Y

Screened
For Radioactivity ☐
 Sampler's Name
Paul Young
Mark Koenig
David Lubianez
Sampler's Signature Paul YoungMark R. Koenig

Proj. No.

E0776

Project Name

Shepley's Hill LTM

No./Type of Containers

Matrix ¹	Date	Time	Comp	Grab	Identifying Marks of Sample(s)	VOA	40 ml A/G Glass	250 ml	P/O
W	29 Oct 2002	1029		X	SHL-20	3	3		6
W		1042		X	SHL-11	3	3		6
W		1220		X	SHL-9	3	3		6
W		1235		X	SHL-22	3	3		6
W		1355		X	SHM-93-22C	3	3		6
W		1439		X	SHM-96-22B	3	3		6
W	↓	—		X	TRIP BLANK	1			

Lab/Sample ID (Lab Use Only)

Relinquished by: (Signature)

Paul Young

Date

29 Oct 02

Time

1700Received by: (Signature) Fed Ex Air Bill8353 1023 1147

Date

29 Oct 02

Time

Remarks

2 Coolers shipped

Relinquished by: (Signature)

Date

Time

Received by: (Signature)

Date

Time

Relinquished by: (Signature)

Date

Time

Received by: (Signature)

Date

Time

Client's delivery of samples constitutes acceptance of Severn Trent Laboratories terms and conditions contained in the Price Schedule.

¹Matrix WW - Wastewater W - Water S - Soil L - Liquid A - Air bag C - Charcoal Tube SL - Sludge O - Oil
²Container V 40 ml vial A/G - Amber / Or Glass 1 Liter 250 ml - Glass wide mouth P/C Plastic or other _____

STL cannot accept verbal changes.

Please Fax written change

(802) 655-1248

CHAIN OF CUSTODY RECORD

Report to: Company: <u>U.S. Army Corps of Engineers</u> Address: <u>1696 Virginia Road</u> <u>Concord MA 01742</u> Contact: <u>Mark Koenig</u> Phone: <u>978 318 8312</u> Fax: _____ Contract/ Quote: _____		Invoice to: Company: <u>Same</u> Address: _____ Contact: _____ Phone: _____ Fax: _____		ANALYSIS REQUESTED												
Sampler's Name <u>Jack Keenan</u> <u>William Sullivan</u> <u>Mark Koenig</u>		Sampler's Signature <u>Mark R. Koenig</u>		<div>Analyses Requested</div> <div>VOL's 82100B TOC 9060 TAL Metals 60100 / Hardness 2340B Cyanide 4010B Amions 300 / Alkalinity 310.1 / TDS 160.1 BOD5 405.1 COD 410.4</div>												
Proj. No. <u>E0776</u>		Project Name <u>Shepley's Hill LTM</u>														
Identifying Marks of Sample(s)		No./Type of Containers ²														
Matrix ¹		Date														
W	30 OCT 2002	0935	X	SHM-96-5C	3	3	6	3	3	1	1	1	1	1	1	1
W		1050	X	SHL-5	3	3	6	3	3	1	1	1	1	1	1	1
W		1141	X	SHM-96-5B	3	3	6	3	3	1	1	1	1	1	1	1
W		1141	X	SHM-DVP	3	3	6	3	3	1	1	1	1	1	1	1
W		-	X	Trip Blank	1			1								
Relinquished by: (Signature) <u>Jack A. V.</u>		Date <u>30 OCT 2002</u>	Time <u>1730</u>	Received by: (Signature) <u>Fed Ex Airbill</u>	Date	Time	Remarks Client's delivery of samples constitutes acceptance of Severn Trent Laboratories terms and conditions contained in the Price Schedule.									
Relinquished by: (Signature)		Date	Time	Received by: (Signature)	Date	Time										
Relinquished by: (Signature)		Date	Time	Received by: (Signature)	Date	Time										
<div>¹Matrix WW- Wastewater W - Water S - Soil L - Liquid A - Air bag C - Charcoal Tube SL - Sludge O - Oil</div> <div>²Container VOA - 40 ml vial A/G - Amber / Or Glass 1 Liter 250 ml - Glass wide mouth P/O - Plastic or other</div>																

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CHAIN OF CUSTODY RECORD

[illegible]

Concord MA 01742 Mark Kuerin 978 318 8312 C

CHAIN OF CUSTODY RECORD

Q f

Distribution: Original Accompanies Shipment; Copy 1 to Sample Custodian; Copy 2 to Coordinator Field Files

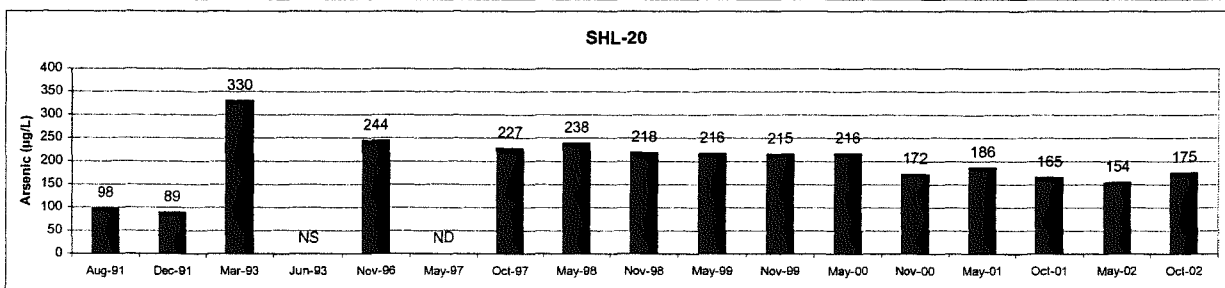
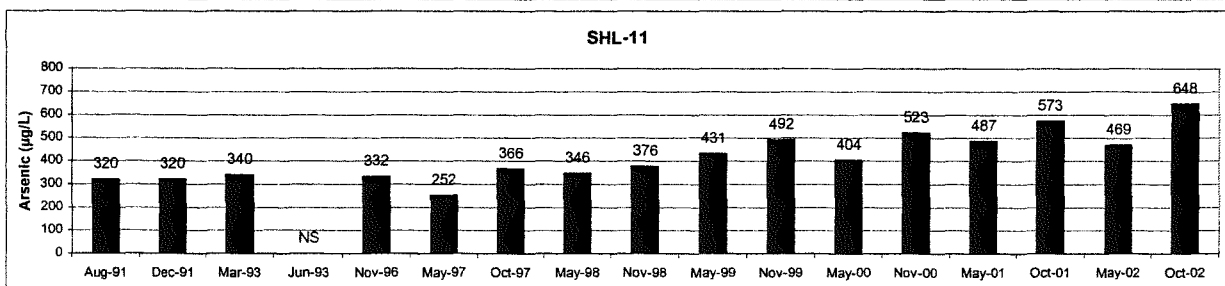
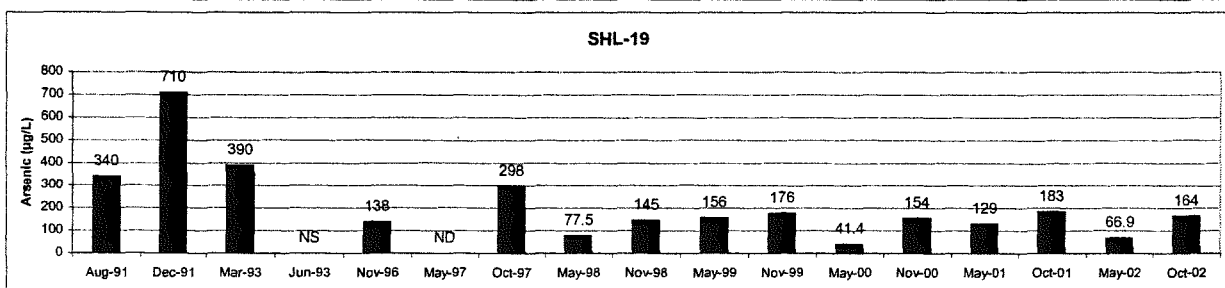
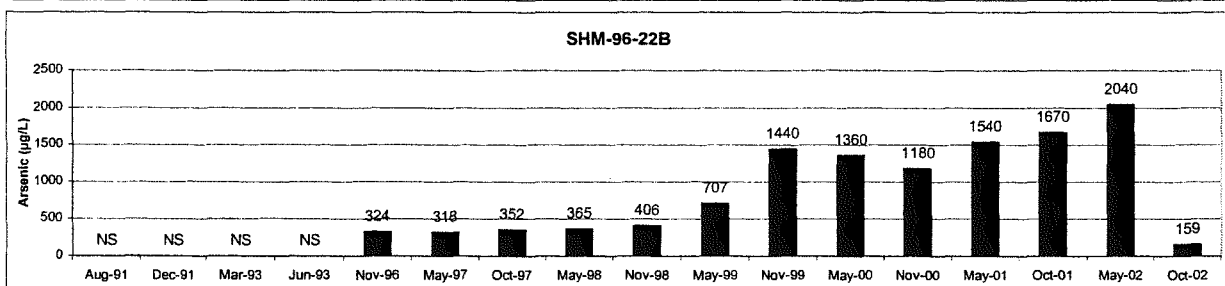
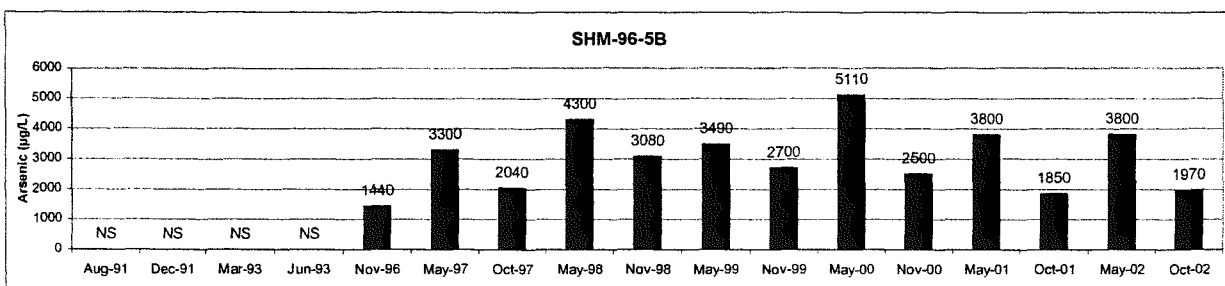
7310

APPENDIX D

COMPARISON OF ARSENIC RESULTS

**SHEPLEY'S HILL LANDFILL GROUNDWATER MONITORING
HISTORIC ARSENIC CONCENTRATION CHARTS
CLEANUP LEVEL = 50 µg/L**

(Sheet 1 of 3)



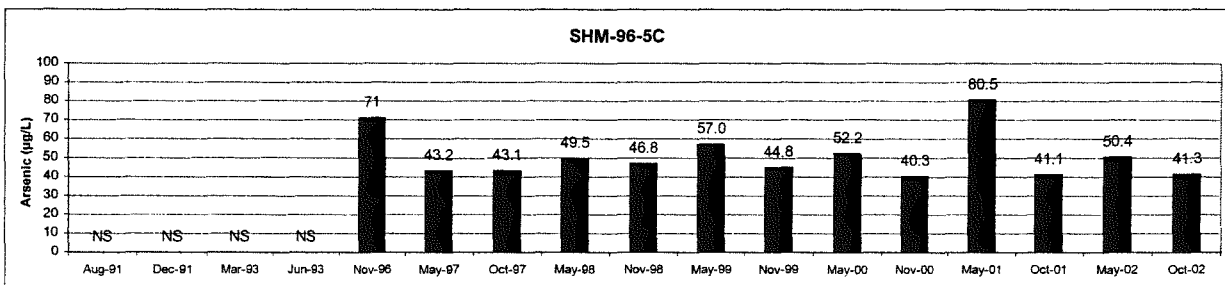
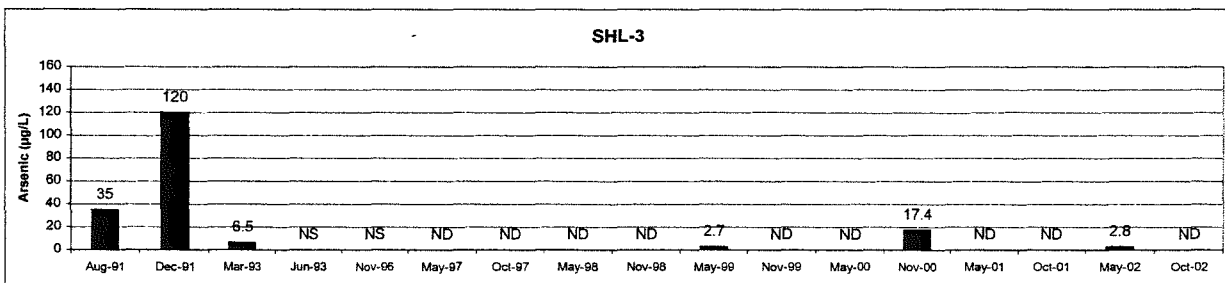
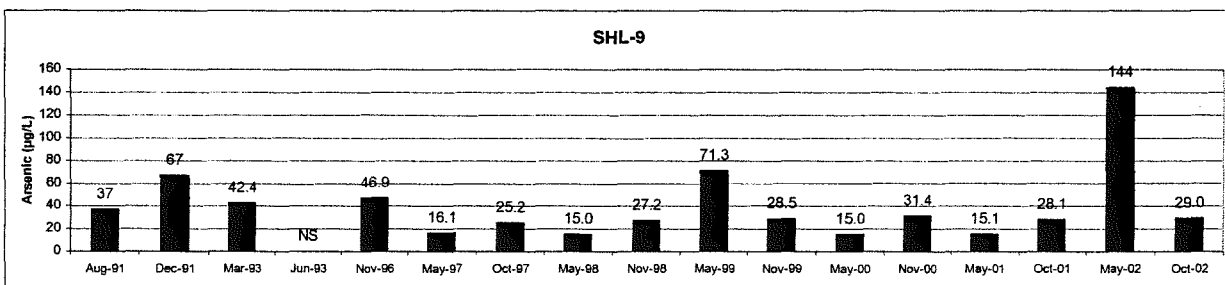
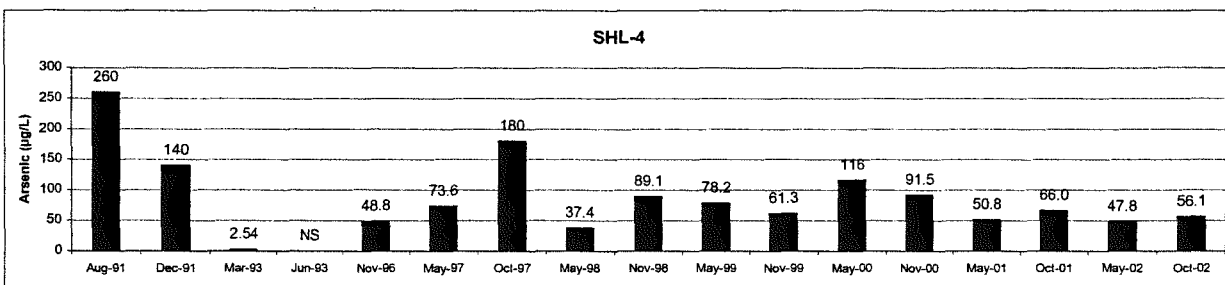
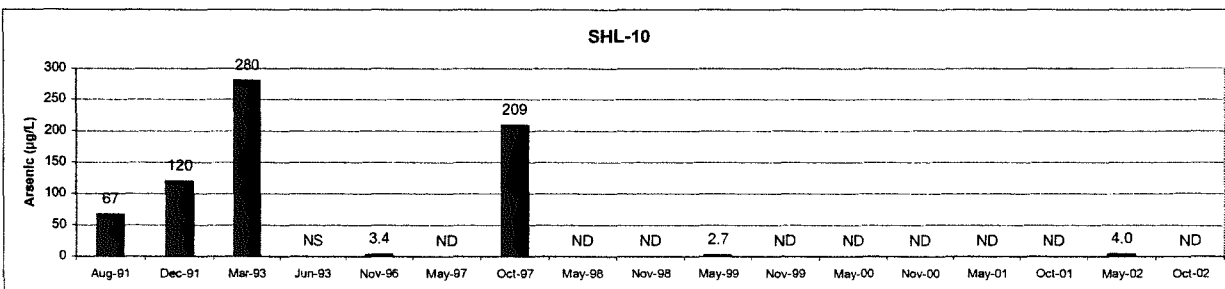
NOTES:

NS: Not Sampled
ND: Not Detected

Charts are displayed in order of decreasing historical maximum arsenic concentrations

SHEPLEY'S HILL LANDFILL GROUNDWATER MONITORING
HISTORIC ARSENIC CONCENTRATION CHARTS
CLEANUP LEVEL = 50 µg/L

(Sheet 2 of 3)



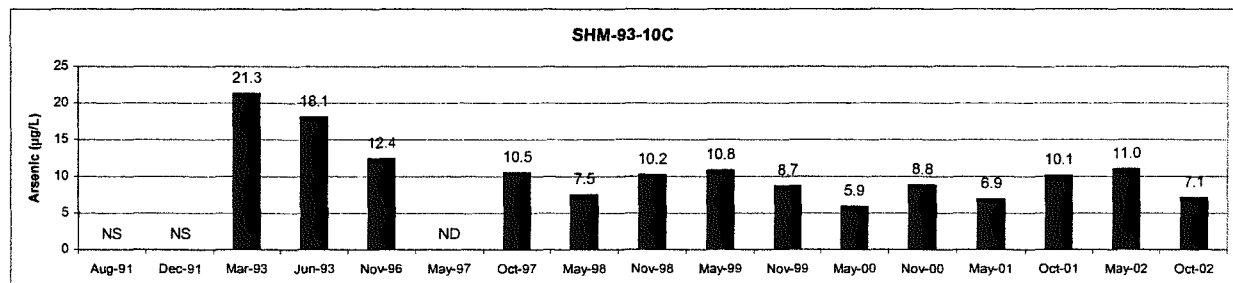
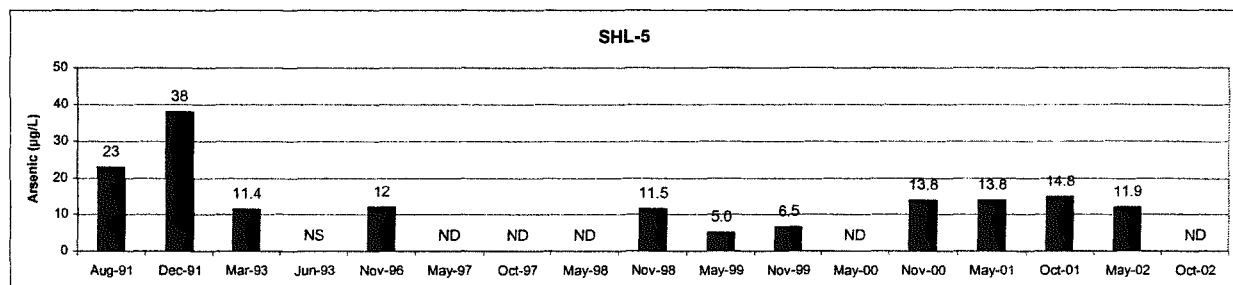
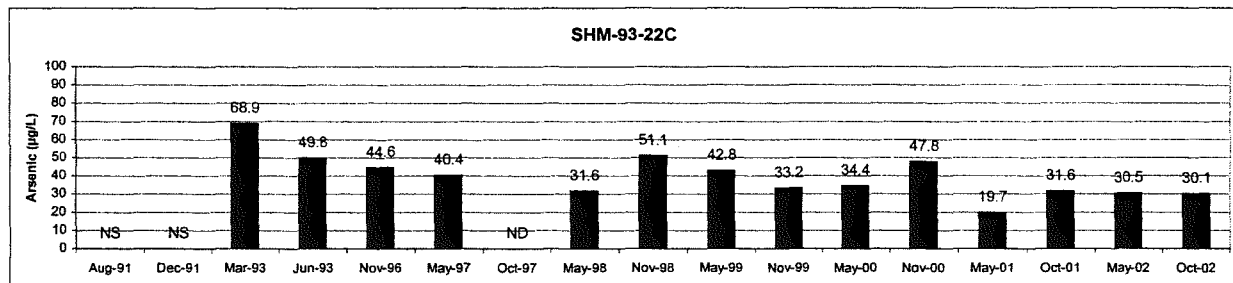
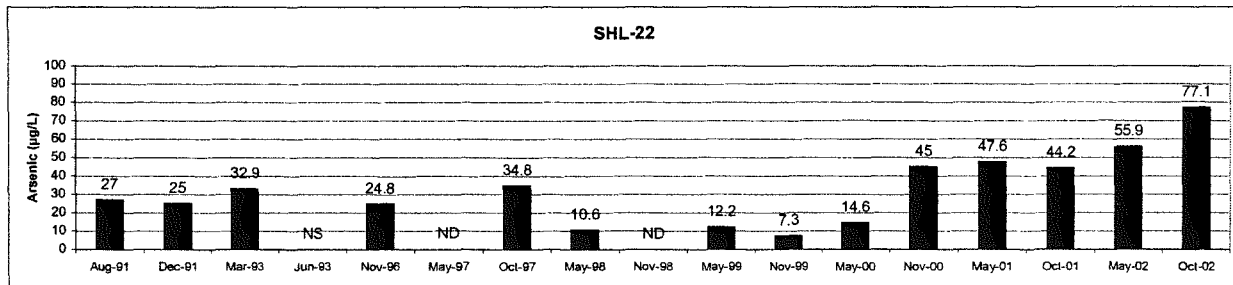
NOTES:

NS: Not Sampled
 ND: Not Detected

Charts are displayed in order of decreasing historical maximum arsenic concentrations

SHEPLEY'S HILL LANDFILL GROUNDWATER MONITORING
HISTORIC ARSENIC CONCENTRATION CHARTS
CLEANUP LEVEL = 50 µg/L

(Sheet 3 of 3)



NOTES:

NS: Not Sampled
 ND: Not Detected

Charts are displayed in order of decreasing historical maximum arsenic concentrations

APPENDIX E

CHEMICAL QUALITY ASSURANCE REPORTS

Chemical Quality Assurance Report
Spring 2002

**SHEPLEY'S HILL LANDFILL LONG TERM MONITORING
DEVENS, MASSACHUSETTS**

**CHEMICAL QUALITY ASSURANCE REPORT
No. E0776-092702**

MAY 21, 2002 SAMPLING EVENT

**PREPARED BY
THE
GEOLOGY
AND
CHEMISTRY SECTION
ENGINEERING/PLANNING DIVISION**

**DEPARTMENT OF THE ARMY
NEW ENGLAND DISTRICT, CORPS OF ENGINEERS
CONCORD, MASSACHUSETTS**

SEPTEMBER 27, 2002

**SHEPLEY'S HILL LANDFILL LONG TERM MONITORING
DEVENS, MASSACHUSETTS
MAY 21, 2002 SAMPLING EVENT**

**CHEMICAL QUALITY ASSURANCE REPORT
No. E0776-092702**

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Appendix A - Key to Comments on Data Comparison Code

Appendix B - Data Comparison Tables

Appendix C - Custody Documentation

**SHEPLEY'S HILL LANDFILL LONG TERM MONITORING
DEVENS, MASSACHUSETTS
May 21, 2002 - QA SAMPLING EVENT**

**CHEMICAL QUALITY ASSURANCE REPORT
No. E0776-092702**

Executive Summary

QA samples from one shipment for Shepley's Hill Landfill Long Term Monitoring, Devens, Massachusetts were analyzed by the QA laboratory, resulting in a total of 101 target analyte determinations. The shipment contained one QA water sample and one trip blank sample and was received in good condition. The data report from the QA laboratory, AMRO, Merrimack, NH, dated 14 December 2001, was used in the comparison. In 32 of these determinations target analytes were detected by one or both laboratories. Results from the analysis of QA samples were compared with results from analysis of the corresponding primary samples (Reference 12a). The primary and QA samples agreed overall in 98 out of 101 (97.0%) of the comparisons. Primary and QA samples agreed quantitatively in 32 out of 35 (91.4%) of the comparisons. Quantitative agreement represents only those determinations where an analyte was detected by at least one laboratory. Two major and one minor discrepancy between results from the primary and QA samples were noted. Refer to Table 1 for a QA split sample data comparison summary.

The QA laboratory's data report was evaluated based on the information that was provided. All of the data comparisons for Methods VOA's-8260, TAL Metals-6010B, CN, Anions, COD, BOD, Alkalinity, TDS, TSS, hardness and TOC were in good overall and quantitative agreement. There were two major data discrepancies noted in the metals comparisons which occurred in sample SHM-96-5B in which the QA laboratory reported aluminum at 310 ug/L and the primary laboratory reported a non-detect at 19.8 U ug/L. The second major data discrepancy was noted in sample SHM-96-5B-QA in which the QA laboratory reported copper at 12 J ug/L and the primary laboratory reported 2.9 B ug/L. This should not significantly affect the usability of the metals data.

The primary laboratory (STL-VT) was requested by the Corps to report hardness by the calculation of the separate determinations of calcium and magnesium from the ICP-metals by 6010B, expressed as mg equivalents of calcium carbonate per liter. This is the preferred method for determining hardness and yields the higher accuracy compared to Method 130.2, which employs an EDTA titration method. It appears that the previous discrepancies noted in the hardness results were caused by certain metal ions which interfere by causing fading, indistinct end points or by stoichiometric consumption of EDTA. If higher concentrations of heavy metals are present (Al, Ba, Cd, Co, Cu, Fe, Pb, Mn, Ni, Sr and Zn), the method recommends determining calcium and magnesium by a non-EDTA method and obtain hardness by calculation.

This method change appears to have resolved the past hardness data discrepancies noted between the QA and primary laboratories. Refer to Section 9, page 13, Data Comparison for hardness by calculation by Method 2340B, for a more detailed discussion. All the other quantitative results for all analyses compared closely. There was very little bias to any of the QA laboratory's sample results and only a few minor QC deviations were noted in their case narrative. The data appears to be complete and useable.

The primary laboratory's data report was evaluated based on the information that was provided. As stated above, all of the data comparisons for the majority of the analyses were in good overall and quantitative agreement. The primary laboratory's wet chemistry data report lacked some of the information necessary to completely evaluate the batch QC. Their data report lacked the analysis dates needed to verify holding time compliance, and the QC limits for accuracy and precision were not provided for most wet chemistry methods. The primary laboratory did not provide the missing information. Although there were numerous minor QC outages documented in the primary laboratory's case narrative, the sample results appear to be comparable, reasonably complete, and useable. The missing information is most likely available, but it just wasn't included in STL-VT's report format. The Corps has requested that the missing information be included in their future reports so that a more complete evaluation can be performed.

The QA and primary laboratory's reporting limits were comparable, except for thallium and COD which were not detected in the QA sample. The primary laboratory reported the sample ID's in which tentatively identified compounds (TIC's) were detected. The QA sample SHM-96-5B was also reported to contain TIC's. This CQAR is based on the laboratory reporting limits because the detection limits were not always provided or well defined.

QA analyses were performed by AMRO Environmental Laboratories, Inc., 111 Herrick Street, Merrimack, NH, 03054 and Severn Trent Laboratories, Inc., 450 William Pitt Way, Pittsburgh, PA 15238-1330. The primary laboratory was Severn Trent Services, 208 South Park Drive, Suite 1, Colchester, VT, 05446.

Table 1
Quality Assurance Split Sample
Data Comparison Summary

Project: Shepley's Hill Landfill Long Term Monitoring, Devens, Massachusetts,
May 21, 2002 Sampling Event

Method	Parameter	Overall Agreement (1)		Quantitative Agreement (2)	
		Number	Percent	Number	Percent
8260B	Volatiles	66/66	100	7/7	100
6020/7471	Metals/Mercury	20/23	87.0	17/20	85.0
9010B	Cyanide	1/1	100	NA	NA
300.0	Anions	4/4	100	3/3	100
410.1	COD	1/1	100	1/1	100
405.1	BOD	1/1	100	NA	NA
310.1	Alkalinity	1/1	100	1/1	100
130.2	Hardness	1/1	100	1/1	100
160.1	TDS	1/1	100	1/1	100
160.2	TSS	1/1	100	1/1	100
9060	TOC	1/1	100	1/1	100
Total		98/101	97.0	32/35	91.4

NOTES:

(1) Represents the number and percentage agreement of all determinations including analytes not detected by either laboratory.

(2) Represents the number and percentage agreement of only those determinations where an analyte was detected by at least one laboratory.

TABLE 2

QA ANALYSES PERFORMED

Sample ID	Matrix	Sample Date	ANALYSIS
SHM-96-5B-QA	Water	5-21-02	5030B/8260B-Volatiles 3010A/6010B-ICP Metals, 7470A-Mercury 9010B-Cyanide 300.0-Anions by Ion Chromatography 410.1-COD 405.1-BOD 310.1-Total Alkalinity as CaCO ₃ 2340B-Total Hardness by Calculation 160.1-Total Dissolved Solids (TDS) 160.2-Total Suspended Solids (TSS) 9060-Total Organic Carbon (TOC)
Trip Blank	Water	5-21-02	5030B/8260B-Volatiles

**SHEPLEY'S HILL LANDFILL LONG TERM MONITORING
DEVENS, MASSACHUSETTS
MAY 21, 2002 QA SAMPLING EVENT**

**CHEMICAL QUALITY ASSURANCE REPORT
No. E0776-090402**

QA Findings

1. QA sample shipping and chain-of-custody deficiencies.

AMRO Environmental Laboratories Corporation, Merrimack, NH, received one shipment containing one QA water sample and a trip blank. The samples were received in good condition on 22 May 2002. Proper sample handling protocols were followed for this shipment, except the cyanide sample container needed to be adjusted for pH at the lab to greater than 12 pH units.

Copies of the chain-of-custody form document and the cooler receipt form are appended to this report for reference.

2. Data comparison for volatiles (VOC) by Method 8260B.

There were 66 volatile determinations. In seven of these determinations, target analytes were detected by one or both laboratories. There was overall agreement in 66 (100%) of the cases and quantitative agreement in seven out of seven (100%) of the cases. No data discrepancies were noted.

The QA laboratory's target analyte list consisted of 66 volatile compounds which were all analyzed by the primary laboratory whose target analyte list consisted of 84 volatile compounds. The primary laboratory was requested to report the presence of Tentatively Identified Compounds (TIC's) in all the samples. QA sample SHM-96-5B-QA was reported to exhibit the presence of TIC's.

2a. Batch QC Evaluation for the QA Laboratory-AMRO.

Holding Times: All of the volatile samples were analyzed within the method prescribed holding times.

Method Blanks: Results of all the method blanks that were associated with the QA split samples showed no contamination above the laboratory's reporting limit for any of the target analytes.

Trip Blanks: Results of the trip blank that were associated with the QA split samples showed no contamination above the laboratory's reporting limit for any of the target analytes.

Laboratory Control Samples: The QA laboratory spiked the LCS with all of their 66 target

analytes. The spiking levels, percent recoveries and the QC limits were appropriately indicated in the report. The QA laboratory reported that the LCS, V-3 020531A, was within the acceptance limits for all of the target analytes except for five compounds. The target analyte 1,1-dichloropropene was marginally above the acceptance limits and isopropylbenzene, n-propylbenzene, sec-butylbenzene and n-butylbenzene were all marginally below the acceptance limits. According to the "Shell for Analytical Chemistry Requirements", Version 1.0, 2 November 1998, a target analyte list of 66 compounds would allow five sporadic marginal failures (SMF) to fall in the expanded recovery range of (60-140%). The sample results would not be affected, since this requirement was met and none of these target analytes were detected in the sample.

Matrix Spike/Matrix Spike Duplicate (MS/MSDs): The QA laboratory reported that all of the five target analytes that were spiked in the MS and MSD were within the acceptance limits for accuracy and precision. The MS/MSD's samples reported were from another client's project.

Surrogates: All of the surrogate recoveries for the samples and the QC samples were within the laboratory's acceptance limits.

2b. Batch QC Evaluation for the Primary Laboratory-STL-VT.

Holding Times: All of the samples were analyzed within the method prescribed holding times.

Method Blanks: The method blank results associated with the QA sample showed contamination below the laboratory's reporting limits for the following target analytes; isobutyl alcohol at 53 J ug/L, 1,4-dioane at 210 J ug/L, 1,2,4-trichlorobenzene at 1.5 J ug/L, hexachlorobutadiene at 2.5 J ug/L, naphthalene at 3.2 J ug/L, and 1,2,3-trichlorobenzene at 1.7 J ug/L which were detected in the method blank samples VBLKR1. These target analytes were not detected in the QA sample SHM-96-5B-QA and were below the reporting limits for these target analytes. The sample results for SHM-96-5B-QA would not be affected.

Trip Blanks: All of the trip blank results for all of the target analytes showed no contamination above the laboratory's reporting limits.

Laboratory Control Sample (LCSs): The primary laboratory reported that all of the target analytes in the three LCS samples, were within the acceptance limits for accuracy and precision, except for the following:

MWZI-LCS (water) 5-21-02	RDP= 0 out of 84 outside QC limits % Recoveries= 1 out of 84 outside QC limits,
NTLC-LCS (water) 5-21-02	RDP= 0 out of 84 outside QC limits % Recoveries= 4 out of 84 outside QC limits,
NTLD-LCS (water) 5-21-02	RDP= 0 out of 84 outside QC limits % Recoveries= 7 out of 168 outside QC limits,

All 84 of the target analytes were spiked into the LCS samples. The amount spiked, percent recoveries and control limits were provided in the report. None of the target analytes that were marginally above or below the acceptable limits were detected in any of the associated samples. Target analytes that were reported below the acceptable QC limits may indicate a slight low bias around the reporting limit. According to the, "Shell for Analytical Chemistry Requirements", Version 1.0, 2 November 1998, a target analyte list of 84 compounds would allow six sporadic marginal failures in the range of 60-140% recoveries before re-extraction and analysis of the entire analytical batch should occur. This requirement was only exceeded by the NTLD-LCS and would not affect the sample results.

Matrix Spike/Matrix Spike Duplicate (MS/MSD): The primary laboratory reported that all of the five target analytes were within the acceptance limits for accuracy and precision, except for the following:

SHL-19-MS/MSD (water) 5-21-02	RDP= 0 out of 84 outside QC limits % Recoveries= 7 out of 168 outside QC limits
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All 84 of the target analytes were spiked into the MS/MSD's. The amount spiked, percent recoveries and control limits were provided in the report. None of the target analytes that were above or below the acceptable limits were detected in any of the associated samples and the outages may be attributed to matrix effects. The sample results would not be affected.

Surrogates: All of the surrogate recoveries for the samples and the QC samples were within the laboratory's acceptance limits.

3. The data comparison for ICP metals by Methods 6010B and mercury by 7470A.

There were 22 ICP-metals determinations and one mercury determination. In 20 of these determinations, target analytes were detected by one or both laboratories. There was overall agreement in 20 (87.0%) of the cases and quantitative agreement in 17 out of 20 (85.0%) of the cases. Two major data discrepancies and one minor data discrepancy was noted.

The first major data discrepancy occurred in sample SHM-96-5B-QA in which the QA laboratory reported aluminum at 310 ug/L and the primary laboratory reported 19.8 U ug/L. The second major data discrepancy occurred in sample SHM-96-5B-QA in which the QA laboratory reported copper at 12 ug/L and the primary laboratory reported 2.9 B ug/L.

3a. Batch QC Evaluation for the QA Laboratory-AMRO.

Holding times: All of the samples were analyzed within the method prescribed holding times.

Method Blanks: All of the method blank sample results for all of the target analytes showed no contamination above the laboratory's reporting limits, except for iron which was reported below the at 58.84 J ug/L.

Laboratory Control Sample (LCS): The QA laboratory reported that all of the LCS results were within the laboratory's acceptance limits of 80-120%. The QA laboratory provided the spike amount, percent recoveries and the QC limits in all the data reports.

Matrix Spike/Matrix Spike Duplicate (MS/MSDs): The QA laboratory reported that all of the MS/MSDs were within the laboratory's acceptance limits for accuracy and precision for all the ICP-metal target analytes, except for arsenic, lead and selenium. The high MS/MSD recoveries for arsenic were due to the high sample concentration relative to the spike concentration. The lead (63.4% and 63.0%) and selenium (48.5% and 42.7%) outages were possibly due to a matrix interference. All of the spike levels, percent recoveries and QC limits were provided in the reports.

Laboratory Duplicate: The QA laboratory did not report any laboratory duplicate results.

3b. Batch QC Evaluation for the Primary Laboratory-STL-VT.

Holding times: All the samples were analyzed within the method prescribed holding times.

Method Blanks: All of the method blank sample results for all of the target analytes showed no contamination above the laboratory's reporting limit.

Laboratory Control Samples (LCS/LCSDs): The primary laboratory reported that all of the target analytes were recovered within the assumed acceptance limits of 80-120% recoveries. The primary laboratory did not provide LCS acceptance limits in their report.

Matrix Spike (MS): The primary laboratory performed a matrix spike on sample SHL-19. The primary laboratory reported that all the target analytes in the MS recoveries were within the assumed acceptance limits (75-125%) for accuracy, except for iron which was recovered at 66.0%. The primary laboratory did not provide acceptance limits for the MS sample results. The post digestion spike recovery for iron was within the assumed acceptance limits at 97.0%.

Laboratory Duplicate: The primary laboratory reported the laboratory duplicate SHL-19D was within the assumed acceptance limits of 20% RPD for precision for all of the target analytes that were above the CRDL. The primary laboratory did not provide the acceptance limits for laboratory duplicates. The blind duplicate sample SHM-DUP-02A was in close agreement with the original sample SHM-DUP-02A. Refer to the data comparison table for the RPD's.

4. Data comparison for cyanide by Method 9010B.

There was one cyanide determination. No cyanide was detected by either laboratory. There was 100% overall agreement for this determination. No data discrepancy was noted.

4a. Batch QC Evaluation for the QA laboratory-AMRO.

Holding Times: All the samples were analyzed within the method prescribed holding times.

Method Blanks: The method blank result for cyanide showed no contamination above the laboratory's reporting limit.

Laboratory Control Sample (LCS): The QA laboratory reported that the LCS result for cyanide was within the laboratory's acceptance limits of 90-110%, at 90%. All of the spike levels, percent recoveries and QC limits were appropriately indicated in the QA laboratory's report.

Matrix Spike/Matrix Spike Duplicate (MS/MSDs): The QA laboratory did not report any MS/MSD results for cyanide and they were not requested to on the C-O-C.

Laboratory Duplicate: The QA laboratory did not report any laboratory duplicate results for cyanide.

4b. Batch QC Evaluation for the Primary Laboratory-STL-VT.

Holding Times: All of the samples were analyzed within the method prescribed holding times.

Method Blanks: All of the method blank results showed no contamination above the laboratory's reporting limit for cyanide.

Laboratory Control Sample (LCS): The primary laboratory reported the LCS for cyanide was within the assumed acceptance limits of 90-110% at 103.0%. The spike amount added and the percent recoveries were all provided in the report, but no QC limits were provided.

Matrix Spike (MS): The primary laboratory reported that the MS sample SHL-19MS was recovered within the acceptance limits of 75-125% for cyanide at 102.4%.

Laboratory Duplicate: The primary laboratory reported that the laboratory duplicate sample results (both non-detects) were within the laboratory's acceptance limits for cyanide.

5. Data comparison for anions by Method 300.0.

There were four anion determinations. In three of the determinations, target analytes were detected by one or both laboratories. There was overall agreement in four (100%) of the cases and quantitative agreement in three out of three (100%) of the cases. No data discrepancies were noted.

5a. Batch QC Evaluation for the QA laboratory-AMRO.

Holding Times: All of the samples were analyzed within the method prescribed holding times.

Method Blanks: The method blank results for anions showed no contamination above the laboratory's reporting limit. Ortho-phosphate was analyzed by Method 365.2.

Laboratory Control Samples (LCS): The QA laboratory reported that the LCS results for anions were within the laboratory's acceptance limits of 90-110%. All of the spike levels, percent recoveries and QC limits were appropriately indicated in the QA laboratory's report.

Matrix Spike/Matrix Spike Duplicate (MS/MSDs): The QA laboratory reported that the MS for anions were within the laboratory's acceptance limits for accuracy. The QA laboratory did not provide any MSD results (except for ortho-phosphate at 3.17% RPD) and precision could not be determined for chloride, nitrate and sulfate. All of the spike levels, percent recoveries and QC limits were appropriately indicated in the QA laboratory's report.

Laboratory Duplicate: The QA laboratory reported that all the anions laboratory duplicate results were within the acceptance limits of 20% RPD.

5b. Batch QC Evaluation for the Primary Laboratory-STL-VT.

Holding Times: All of the samples were analyzed within the method prescribed holding times.

Method Blanks: All of the method blank results showed no contamination above the laboratory's reporting limit for anions.

Laboratory Control Samples (LCSs): The primary laboratory reported that all the LCS's for anions were within the assumed acceptance limits of 90-110%. The spike amount added and percent recoveries were all provided in the report, but the QC limits were not provided. No LCSD was provided and no evaluation of precision could be made. The QA laboratory provides multiple sample analysis dates for their method blanks and LCS's and it is not possible to associate the supporting batch QC to any particular sample or analytical batch of samples.

Matrix Spike (MS): The primary laboratory reported that the MS sample SHL-19MS was recovered within the assumed acceptance limits of 80-120% for all the anions. No acceptance limits were provided for the matrix spike.

Laboratory Duplicate: The primary laboratory reported that the laboratory duplicate results were within reasonable acceptance limits for precision, but no acceptance limits were provided.

6. Data comparison for COD by Method 410.1.

There was one COD determination. The primary laboratory reported COD at 43.5 mg/L which was below the QA laboratory's reporting limit of 50 ug/L. There was 100% overall agreement for this determination, however the primary laboratory's reporting limit was ten times lower at 5.0 ug/L. No data discrepancy was noted based on the higher reporting limit.

6a. Batch QC Evaluation for the QA laboratory-AMRO.

Holding Times: The QA sample was analyzed within the method prescribed holding time.

Method Blanks: The method blank results for COD showed no contamination above the laboratory's reporting limit.

Laboratory Control Samples (LCS): The QA laboratory reported that the LCS result for COD was within the laboratory's acceptance limits of 80-120%, at 98.6%. All of the spike levels, percent recoveries and QC limits were appropriately indicated in the QA laboratory's report.

Matrix Spike/Matrix Spike Duplicate (MS/MSDs): The QA laboratory reported that the MS/MSD's for COD were within the laboratory's acceptance limits of 80-120% for accuracy and precision, at 90.4% and 91.9% with a RPD of 1.27%. All of the spike levels, percent recoveries and QC limits were appropriately indicated in the QA laboratory's report.

Laboratory Duplicate: The QA laboratory did not report any laboratory duplicate result for COD.

6b. Batch QC Evaluation for the Primary Laboratory-STL-VT.

Holding Times: All of the samples were analyzed within the method prescribed holding times.

Method Blanks: All of the method blank results showed no contamination above the laboratory's reporting limit for COD.

Laboratory Control Sample (LCS): The primary laboratory reported that the LCS for COD was within the assumed acceptance limits of 90-110%. The spike amount added and percent recoveries were all provided in the report, but the QC limits were not provided. No LCSD was provided and no evaluation of precision could be made.

Matrix Spike/Matrix Spike Duplicate (MS/MSDs): The primary laboratory was not requested to perform MS/MSD's on any of the samples for COD and no evaluation of accuracy and precision based on matrix effects could be made.

Laboratory Duplicate: The primary laboratory did not report any laboratory duplicate results for COD and no evaluation of precision could be made.

7. Data comparison for BOD by Method 405.1.

There was one BOD determination. No BOD was detected by either laboratory. There was 100% overall agreement for this determination. No data discrepancy was noted.

7a. Batch QC Evaluation for the QA laboratory-AMRO.

Holding Times: The QA sample was analyzed within the method prescribed holding time.

Method Blanks: The method blank results for BOD showed no contamination above the laboratory's reporting limit.

Laboratory Control Samples (LCS/LCSDs): The QA laboratory reported that the LCS/LCSD recoveries for BOD were within the laboratory's acceptance limits for accuracy and precision at 108% and 97.4% recoveries, with a RPD of 10.3%. All of the spike levels, percent recoveries and QC limits were appropriately indicated in the QA laboratory's report.

Matrix Spike/Matrix Spike Duplicate (MS/MSDs): MS/MSD's are not applicable to BOD analysis. Refer to LCS/LCSD data for accuracy and precision verification.

Laboratory Duplicate: The QA laboratory did not report any laboratory duplicate results for BOD and no evaluation of precision could be made.

7b. Batch QC Evaluation for the Primary Laboratory-STL-VT.

Holding Times: The QA split sample SHM-96-5B was analyzed within the method prescribed holding times.

Method Blanks: All of the method blank results showed no contamination above the laboratory's reporting limit for BOD.

Laboratory Control Sample (LCS): The primary laboratory reported that all the LCS's for BOD were within the assumed acceptance limits of 90-110%. The spike amount added and percent recoveries were all provided in the report, but the QC limits were not provided. Precision could not be evaluated because no LCSD was performed for the BOD analysis.

Matrix Spike/Matrix Spike Duplicate (MS/MSDs): MS/MSD's are not applicable to BOD analysis and were not requested on the C-O-C. Refer to LCS for accuracy verification.

Laboratory Duplicate: The primary laboratory did not provide any laboratory duplicate results for BOD.

8. Data comparison for alkalinity by Method 310.1.

There was one alkalinity determination. Both laboratories detected alkalinity in the QA sample SHM-96-5B. There was 100% overall and quantitative agreement for this determination. No data discrepancy was noted.

8a. Batch QC Evaluation for the QA laboratory-AMRO.

Holding Times: The QA sample was analyzed within the method prescribed holding time.

Method Blanks: The method blank results for alkalinity showed no contamination above the laboratory's reporting limit.

Laboratory Control Sample (LCS): The QA laboratory reported that the LCS recovery for alkalinity was within the laboratory's acceptance limits of 80-120% at 102%. All of the spike levels, percent recoveries and QC limits were appropriately indicated in the QA laboratory's report.

Matrix Spike/Matrix Spike Duplicate (MS/MSDs): The QA laboratory reported that the MS/MSD's for alkalinity were within the laboratory's acceptance limits for accuracy (80-120%) and precision (20%RPD), at 98% and 100% recoveries with an RPD of 0.382%.

Laboratory Duplicate: The QA laboratory did not report any laboratory duplicate results for alkalinity.

8b. Batch QC Evaluation for the Primary Laboratory-STL-VT.

Holding Times: The QA split sample SHM-96-5B was analyzed within the method prescribed holding times.

Method Blanks: All of the method blank results showed no contamination above the laboratory's reporting limit for alkalinity.

Laboratory Control Sample (LCS): The primary laboratory reported that the LCS for alkalinity was within the assumed acceptance limits of 90-110% at 103.4%. The spike amount added and percent recoveries were all provided in the report, but the QC limits were not provided for accuracy and precision. Precision could not be evaluated because no LCSD was performed for alkalinity.

Matrix Spike/Matrix Spike Duplicate (MS/MSDs): The primary laboratory reported that the MS for alkalinity was recovered within the assumed acceptance limits of 80-120% at 92.0%. No acceptance limits were provided for accuracy and precision. Precision could not be evaluated because no MSD was requested on the C-O-C for alkalinity.

Laboratory Duplicate: The primary laboratory reported the laboratory duplicate results for sample SHL-19 were within reasonable acceptance limits at 2.7% RPD. No QC limits for precision were provided.

9. Data comparison for hardness by calculation by Method 2340B.

There was one hardness determination. Both laboratories detected hardness in the QA sample SHM-96-5B. There was 100% overall and quantitative agreement for this determination and no data discrepancy was noted.

The primary laboratory was requested to perform hardness by the calculation of the separate determinations of calcium and magnesium from the ICP-metals by 6010B (Method 2340B), expressed as mg equivalents of calcium carbonate per liter. The results of the 15 May 2001 QA sampling event indicated a major discrepancy which occurred in sample SHM-96-5B in which the QA laboratory reported 300 mg/L hardness and the primary laboratory reported 90 mg/L. The QA laboratory reported hardness by Standard Method 2340B. This is the preferred method for determining hardness and yields the higher accuracy compared to Method 130.2 which employs an EDTA titration method. Also, some metal ions interfere by causing fading or indistinct end points or by stoichiometric consumption of EDTA. If higher concentrations of heavy metals are present (Al, Ba, Cd, Co, Cu, Fe, Pb, Mn, Ni, Sr and Zn), the method recommends determining calcium and magnesium by a non-EDTA method and obtain hardness by calculation. Previous sampling events have indicated several data discrepancies when the calculated hardness was compared to hardness by titration, Method 130.2. Hardness will be determined from the 6010B calcium and magnesium metals (Method 2340B) results to avoid this possible interference in the future long term monitoring testing. The following table compares the primary lab's hardness by Method 130.2 to hardness by calculation and to the May 2002 sampling event results:

Sample ID	Calculated Hardness 5-15-01 (mg/L)	Hardness by 130.2 5-15-01 (mg/L)	Calculated Hardness 5-21-02 (mg/L)
SHL-10	17.6	20.0	18.4
SHM-93-10C	240	232	237
SHL-3	13.3	18.0	9.5
SHL-19	23.0	28.0	37.4
SHL-4	80.8	82.0	31.0
SHL-11	193	184	162
SHL-20	341	20.0	250 (As=154)
SHL-9	68.2	76.0	68.4
SHM-93-22C	201	196	238
SHL-22	450	472	433
SHM-96-22B-91.7'	289	150	249 (As=2040)
SHM-96-5B	313	90.0	304 (As=3800)
SHM-DUP-02A	316	144	301 (As=3830)
SHM-96-5C	288	300	258
SHL-5	30.3	34.0	28.2
EB-5B	0	< 2.0	< 1.0
SHM-99-32X	349	356	334
SHM-99-31C	392	400	391
SHM-99-31A	27.6	28.0	26.1
SHM-99-31B	128	124	145

The four samples in bold-faced print represent the historical data discrepancies that were most likely the result of heavy metal interference with the EDTA titration Method 130.2. The results from the hardness by calculation from 15 May 2001 compare reasonably close to the results from the hardness by calculation from 21 May 2002.

9a. Batch QC Evaluation for the QA laboratory-AMRO.

Holding Times: The QA sample was analyzed within the method prescribed holding time.

Method Blanks: The method blank results for hardness showed no contamination above the laboratory's reporting limit.

Laboratory Control Sample (LCS): The QA laboratory reported that the LCS recovery for hardness was within the laboratory's acceptance limits of (80-120%) at 102%. All of the spike levels, percent recoveries and QC limits were appropriately indicated in the QA laboratory's report.

Matrix Spike/Matrix Spike Duplicate (MS/MSDs): The QA laboratory reported that the MS/MSD's for hardness were within the laboratory's acceptance limits for accuracy (75-125%) and precision (20%RPD), 105% and 103% recoveries with an RPD of 0.678%.

Laboratory Duplicate: The QA laboratory did not report any laboratory duplicate results for hardness.

9b. Batch QC Evaluation for the Primary Laboratory-STL-VT.

Holding Times: The QA split sample SHM-96-5B was analyzed within the method prescribed holding times.

Method Blanks: All of the method blank results showed no contamination above the laboratory's reporting limit for hardness.

Laboratory Control Samples (LCS/LCSD's): The primary laboratory did not report any LCS results for hardness. No evaluation of method performance (accuracy and precision) on an interference free matrix could be made.

Matrix Spike/Matrix Sipke Duplicate (MS/MSDs): The primary laboratory did not report any MS/MSD results for hardness. No evaluation of accuracy and precision based on matrix effects could be made. The primary laboratory did not provide hardness results on the samples SHL-19MS and MSD which were requested on the chain-of-custody.

Laboratory Duplicate: The primary laboratory did not report any laboratory duplicate results for hardness for SHL-19. No QC limits for precision were provided.

10. Data comparison for TDS and TSS by Methods 160.1 and 160.2.

There was one total dissolved solids determination (TDS) and one total suspended solids (TSS) determination. Both laboratories reported detectable levels of TDS and TSS in the QA sample SHM-96-5B. There was 100% overall and quantitative agreement for the TDS determination and 100% overall and quantitative agreement for the TSS determination. No data discrepancies were noted for the TDS and TSS determinations.

10a. Batch QC Evaluation for the QA laboratory-AMRO.

Holding Times: The QA sample was analyzed within the method prescribed holding times.

Method Blanks: The method blank results for TDS and TSS showed no contamination above the laboratory's reporting limits.

Laboratory Control Sample (LCS): The QA laboratory reported that the LCS recoveries for TDS and TSS were within the laboratory's acceptance limits at 102% and 96%, respectively. All of the spike levels, percent recoveries and QC limits were appropriately indicated in the QA laboratory's report.

Matrix Spike/Matrix Spike Duplicate (MS/MSDs): MS/MSD's are not applicable for TDS and TSS.

Laboratory Duplicate: The QA laboratory reported that the TDS and TSS laboratory duplicates were within the laboratory's acceptance limits of 20% RPD at 2.26% and 2.94%, respectively.

10b. Batch QC Evaluation for the Primary Laboratory-STL-VT.

Holding Times: The QA split sample SHM-96-5B was analyzed within the method prescribed holding times.

Method Blanks: All of the method blank results showed no contamination above the laboratory's reporting limit for TDS and TSS.

Laboratory Control Sample (LCS): The primary laboratory reported that all the LCS's for TDS and TSS were within the assumed acceptance limits of 90-110%. The spike amount added and percent recoveries were all provided in the report, but the QC limits were not provided for accuracy and precision. No LCSD's were performed and no evaluation of precision could be made.

Matrix Spike/Matrix Sipke Duplicate (MS/MSDs): MS/MSD's are not applicable for TDS and TSS.

Laboratory Duplicate: The primary laboratory reported the duplicate sample results for SHL-19 were within reasonable acceptance limits for TDS at 0.0% RPD. No duplicate sample result for TSS was provided. No QC limits for precision were provided.

11. Data comparison for total organic carbon (TOC) by Method 9060.

There was one TOC determination. Both laboratories detected TOC in the QA sample SHM-96-5B. There was 100% overall and quantitative agreement for this determination. No data discrepancy was noted. The cooler was at the proper temperature when received at the sub-contracted laboratory, STL Pittsburgh, PA.

11a. Batch QC Evaluation for the QA laboratory-AMRO.

Holding Times: The QA sample was analyzed within the method prescribed holding time.

Method Blanks: The method blank results for TOC showed no contamination above the laboratory's reporting limit.

Laboratory Control Sample (LCS): The QA laboratory reported that the LCS recovery for TOC was within the laboratory's acceptance limits at 106%. All of the spike levels, percent recoveries and QC limits were appropriately indicated in the QA laboratory's report.

Matrix Spike/Matrix Spike Duplicate (MS/MSDs): The QA laboratory reported that the MS/MSD's for TOC were within the laboratory's acceptance limits for accuracy (80-120%) and precision (20%RPD), at 91% and 89% recoveries with an RPD of 1.8%.

Laboratory Duplicate: The QA laboratory did not report any laboratory duplicate results for TOC.

11b. Batch QC Evaluation for the Primary Laboratory-STL-VT.

Holding Times: The QA split sample SHM-96-5B was analyzed within the method prescribed holding times.

Method Blanks: All of the method blank results showed no contamination above the laboratory's reporting limit for TOC.

Laboratory Control Samples (LCS's): The primary laboratory reported that the LCS's for TOC was within the assumed acceptance limits of 90-110%. The spike amount added and percent recoveries were all provided in the report, but the QC limits were not provided. No LCSD's were provided and no evaluation of precision could be made.

Matrix Spike/Matrix Spike Duplicate (MS/MSDs): The primary laboratory reported the MS recovery at 113.3%. No matrix spike QC limits were provided. The primary laboratory did not provide any MSD results for TOC and no evaluation of precision could be made.

Laboratory Duplicate: The primary laboratory reported the duplicate sample results for SHL-19 were above the acceptance limits at 200% RPD. No QC limits for precision were provided.

12. References.

a. Data Reports for Shepley's Hill Landfill Long Term Monitoring, Devens, Massachusetts, prepared by the primary laboratory, Severn Trent Laboratories, Inc., 208 South Park Drive, Suite 1, Colchester, VT, 05446, were received 18 June 2002. The QA laboratory's data report, prepared by AMRO Environmental Laboratories Corporation, 111 Herrick Street, Merrimack, NH. 03054, were received 2 July 2002.

b. EM 200-1-6, Chemical Quality Assurance for Hazardous, Toxic and Radioactive Waste (HTRW) Projects, dated 10 October 1997.

c. Shell for Analytical Chemistry Requirements, Version 1.0, USACE, 2 November 1998.

APPENDIX A
KEY TO COMMENTS ON DATA COMPARISON TABLES

0 - Data agrees if any one of the following apply:

- both values are less than respective detection limit ($N < MDL$)
- $N_1 < MDL_1$ and $N_2 > MDL_2$ but $< MDL_1^*$
- both values are above respective detection limit ($N > MDL$) and difference between two values satisfies conditions below

For **all** analyses in a **water** matrix and for **metals** analysis in **soil**:

$\leq 2X$ difference

For **all** other analyses:

$\leq 4X$ difference

1 - Minor contamination by laboratory contaminant

2 - Not tested by both laboratories

3 - Minor data discrepancy, disagreement not serious, if any one of the following apply:

- $N_1 < MDL_1$ and $N_2 > MDL_2$ and the difference between values N_2^* does not exceed the upper limit (described below) defining a minor data discrepancy
- both values are above respective detection limit ($N > MDL^*$) and conditions described below apply to the difference between the two values

For **all** analyses in a **water** matrix and for **metals** analysis in **soil**:

$2X < \text{difference} \leq 3X$

For **all** other analyses:

$4X < \text{difference} \leq 5X$

4 - Major data discrepancy, disagreement serious, if any one of the following apply:

- $N_1 < MDL_1$ and $N_2 > MDL_2$ and the difference between values N_2 and MDL_1^* exceeds the limit (described below) defining a major data discrepancy
- both values are above respective detection limit ($N > MDL^*$) and conditions described below apply to the difference between the two values

For **all** analyses in a **water** matrix and for **metals** analysis in **soil**:

$> 3X$ difference

For **all** other analyses:

>5X difference

MDL = Method Detection Limit

N = Analytical result

* - not all < values are MDLs. Values which are not MDLs will be noted.

Key to data qualifiers:

B - detected in method blank

DO - Diluted out

J - estimated value, above MDL but below practical quantitation limit

NA - Not analyzed

ND - Not detected

NR - Not reported

APPENDIX B
DATA COMPARISON TABLES

COMPARISON OF QA & CONTRACTOR RESULTS
PROJECT: SHEPLEY'S HILL LANDFILL, SPRING 2002

Page 1 of 2

QA SAMPLE No.:	0205216-01A	CONTRACTORS SAMPLE No.:	488701		
QA FIELD ID:	SHM-96-5B-QA	CONTRACTORS FIELD ID:	SHM-96-5B		
QA ANALYSIS DATE:	6/1/02	CONTRACTOR'S ANALYSIS DATE:	5/28/02		
QA LABORATORY:	AMRO	CONTRACTOR'S LABORATORY:	STL, VT		
EXTRACTION METHOD:	5030B	EXTRACTION METHOD:	5030B		
ANALYSIS METHOD:	8260B	ANALYSIS METHOD:	8260B		
MATERIAL DESCRIPTION:		WATER			
DATE SAMPLED:		5/21/02			
UNITS:		ug/L			
Target Analyte	AMRO QA LAB LRL	AMRO RESULTS QA LAB	STL-VT CONTRACTOR LRL	STL-VT RESULTS CONTRACTOR	COMPARISON CODE
Dichlorodifluoromethane			< 5.0		0
Chloromethane	< 5.0		< 5.0		0
Vinyl Chloride	< 2.0		< 5.0		0
Bromomethane	< 2.0		< 5.0		0
Chloroethane					0
Trichlorofluoromethane	< 2.0		< 5.0		0
Acrolein	NR		< 5.0		2
Freon TF	NR		< 5.0		2
1,1-Dichloroethene	< 1.0		< 5.0		0
Acetone	< 10		< 5.0		0
Methyl Iodide	NR		< 5.0		2
Carbon Disulfide	< 2.0		< 5.0		0
Allyl Chloride	NR		< 5.0		2
Methylene Chloride	< 5.0		< 5.0		0
Acrylonitrile	NR		< 5.0		2
trans-1,2-Dichloroethene	< 2.0		< 5.0		0
1,2-Dichloroethene (total)	NR				2
Methyl-t-Butyl Ether	< 2.0				0
1,1-Dichloroethane					0
Vinyl Acetate	NR		< 5.0		2
Chloroprene	NR		< 5.0		2
cis-1,2-Dichloroethene					0
2-Butanone	< 10		< 5.0		0
Proionitrile	NR		< 20		2
Methacrylonitrile	NR		< 5.0		2
Bromochloromethane	< 2.0		< 5.0		0
Tetrahydrofuran	NR		< 50		2
Chloroform	< 2.0		< 5.0		0
1,1,1-Trichloroethane	< 2.0		< 5.0		0
Carbon Tetrachloride	< 2.0		< 5.0		0
Isobutyl Alcohol	NR		< 250		2
Benzene					0
1,2-Dichloroethane	< 2.0		< 5.0		0
Trichloroethene	< 2.0		< 5.0		0
1,2-Dichloropropane	< 2.0		< 5.0		0
Methyl Methacrylate	NR		< 5.0		2
Dibromomethane	< 2.0		< 5.0		0
1,4-Dioxane	NR		< 250		2
Bromodichloromethane	< 2.0		< 5.0		0
2-Chloroethyl Vinyl Ether	NR		< 5.0		2
cis-1,3-Dichloropropene	< 1.0		< 5.0		0
SEE APPENDIX A FOR KEY TO COMMENTS					
NR=NOT REPORTED					
J=Estimated value greater than one half the reporting limit.					
B=Analyte was detected in method blank.					

COMPARISON OF QA & CONTRACTOR RESULTS
PROJECT: SHEPLEY'S HILL LANDFILL, SPRING 2002

Page 2 of 2

QA SAMPLE No.:	0205216-01A	CONTRACTORS SAMPLE No.:	488701
QA FIELD ID:	SHM-96-5B-QA	CONTRACTORS FIELD ID:	SHM-96-5B
QA ANALYSIS DATE:	6/1/02	CONTRACTOR'S ANALYSIS DATE:	5/28/02
QA LABORATORY:	AMRO	CONTRACTOR'S LABORATORY:	STL, VT
EXTRACTION METHOD:	5030B	EXTRACTION METHOD:	5030B
ANALYSIS METHOD:	8260B	ANALYSIS METHOD:	8260B

MATERIAL DESCRIPTION: WATER
 DATE SAMPLED: 5/21/02
 UNITS: ug/L

Target Analyte	AMRO QA LAB LRL	AMRO RESULTS QA LAB	STL-VT CONTRACTOR LRL	STL-VT RESULTS CONTRACTOR	COMPARISON CODE
4-Methyl-2-pentanone	< 10		< 5.0		0
Toluene	< 2.0		< 5.0		0
trans-1,3-Dichloropropene	< 1.0		< 5.0		0
Ethyl Methacrylate	NR		< 5.0		2
1,1,2-Trichloroethane	< 2.0		< 5.0		0
Tetrachloroethene	< 2.0		< 5.0		0
2-Hexanone	< 10		< 5.0		0
Dibromochloromethane	< 2.0		< 5.0		0
1,2-Dibromoethane	< 2.0		< 5.0		0
Chlorobenzene	< 2.0		< 5.0		0
1,1,1,2-Tetrachloroethane	< 2.0		< 5.0		0
Ethylbenzene	< 2.0		< 5.0		0
Xylene (m,p)	< 2.0		< 5.0		0
Xylene (total)	< 2.0		< 5.0		0
Xylene (o)	< 2.0		< 5.0		0
Styrene	< 2.0		< 5.0		0
Bromoform	< 2.0		< 5.0		0
Isopropylbenzene	< 2.0		< 5.0		0
cis-1,4-Dichloro-2-butene	NR		< 5.0		2
1,1,2,2-Tetrachloroethane	< 2.0		< 5.0		0
1,2,3-Trichloropropane	< 2.0		< 5.0		0
trans-1,4-Dichloro-2-butene	NR		< 5.0		2
1,3-Dichlorobenzene	< 2.0		< 5.0		0
1,4-Dichlorobenzene			< 5.0		0
1,2-Dichlorobenzene	< 2.0		< 5.0		0
1,2-Dibromo-3-Chloropropane	< 5.0		< 5.0		0
1,2,4-Trichlorobenzene	< 2.0		< 5.0		0
Hexachlorobutadiene	< 2.0		< 5.0		0
Naphthalene	< 5.0		< 5.0		0
2,2-Dichloropropane	< 2.0		< 5.0		0
1,1-Dichloropropene	< 2.0		< 5.0		0
1,3-Dichloropropane	< 2.0		< 5.0		0
Bromobenzene	< 2.0		< 5.0		0
n-Propylbenzene	< 2.0		< 5.0		0
2-Chlorotoluene	< 2.0		< 5.0		0
4-Chlorotoluene	< 2.0		< 5.0		0
1,3,5-Trimethylbenzene	< 2.0		< 5.0		0
tert-Butylbenzene	< 2.0		< 5.0		0
1,2,4-Trimethylbenzene	< 2.0		< 5.0		0
sec-Butylbenzene	< 2.0		< 5.0		0
4-Isopropyltoluene	< 2.0		< 5.0		0
n-Butylbenzene	< 2.0		< 5.0		0
1,2,3-Trichlorobenzene	< 2.0		< 5.0		0

SURROGATE RECOVERIES (%)	QA	PRIMARY
Dibromofluoromethane (85-120)	94.8	Toluene-d8 (88-110) 101
1,2-Dichloroethane-d4 (80-125)	92.5	1,2-Dichloroethane-d4 (72-141) 103
Toulene-d8 (88-109)	92.9	Bromofluorobenzene (72-122) 104
4-Bromofluorobenzene (77-117)	98.8	1,2-Dichlorobenzene-d4 (69-124) 96

SEE APPENDIX A FOR KEY TO COMMENTS

NR=NOT REPORTED

J=Estimated value greater than one half the reporting limit.

B=Analyte was detected in method blank.

* = Surrogates outside of acceptable limits

COMPARISON OF QA & CONTRACTOR RESULTS
PROJECT: SHEPLEY'S HILL LANDFILL, SPRING 2002

QA SAMPLE No.:	0205216-01B	CONTRACTORS SAMPLE No.:	488701
QA FIELD ID:	SHM-96-5B-QA	CONTRACTORS FIELD ID:	SHM-96-5B
QA ANALYSIS DATE:	5/28/02	CONTRACTOR'S ANALYSIS DATE:	5/30/02
QA LABORATORY:	AMRO	CONTRACTOR'S LABORATORY:	STL, VT
EXTRACTION METHOD:	3010A	EXTRACTION METHOD:	3010A
ANALYSIS METHOD:	6010B,Hg-7470A	ANALYSIS METHOD:	6010, Hg-7470

MATERIAL DESCRIPTION: **WATER**
DATE SAMPLED: **5/21/02**
UNITS: **ug/L**

Target Analyte	AMRO		STL-VT		STL-VT		COMPARISON	
	QA LAB	AMRO	CONTRACTOR	CONTRACTOR			Dup-	CODE
	LRL	RESULTS	LRL	RESULTS	Dup	RPD's		
Aluminum	< 200	31	19.8 U	19.8 U	NC	4		
Antimony	< 20	2.5 U	2.1 B	NC	3			
Arsenic	< 5.0 (SW7060A)	2.2 U	3830	0.79	0			
Barium	< 200	6.3 U	60.9 B	1.32	0			
Beryllium	< 5.0	0.11 U	0.24 B	4.08	0			
Cadmium	< 5.0	0.50 U	0.94 B	6.86	0			
Calcium	< 2500	128 U	95200	1.04	0			
Chromium	< 10	1.2 U	2.7 B	16.9	0			
Colbalt	< 50	2.9 U	19.2 B	2.11	0			
Copper	< 25	1.4 U	4.2 B	36.6	4			
Iron	< 100	61.4 U	39800	0.75	0			
Lead	< 5.0 (SW7421)	1.0 U	1.8 B	53.1	0			
Magnesium	< 2500	132 U	15300	0.65	0			
Manganese	< 15	0.50 U	10900	0.91	0			
Mercury	< 0.20 (SW7470A)	0.10 U	0.10 U	NC	0			
Nickel	< 40	2.8 U	14.9 B	1.99	0			
Potassium	< 2500	273 U	11700	0	0			
Selenium	< 5.0 (SW7740)	2.7 U	2.4 B	58.8	0			
Silver	< 7.0	1.3 U	3.1 B	38.5	0			
Sodium	< 2500	350 U	37000	1.09	0			
Thallium	< 5.0 (SW7841)	3.3 U	3.3 U	NC	0			
Vanadium	< 50	2.0 U	2.0 U	NC	0			
Zinc	< 20	1.1 U	8.8 B	1.13	0			

SEE APPENDIX A FOR KEY TO COMMENTS

NR=NOT REPORTED

ND= Not Detected at the Reporting Limit

U= Not Detected at the Reporting Limit

B= Less than the Contract Required Detection Limit (CRDL),
but greater than the Instrument Detction Limit (IDL).

J= Analyte detected below quantitation limit.

COMPARISON OF QA & CONTRACTOR RESULTS
PROJECT: SHEPLEY'S HILL LANDFILL, SPRING 2002

QA SAMPLE No.:	0205216-01	CONTRACTORS SAMPLE No.:	488701
QA FIELD ID:	SHM-96-5B-QA	CONTRACTORS FIELD ID:	SHM-96-5B
QA ANALYSIS DATE:	See Below	CONTRACTOR'S ANALYSIS DATE:	NR
QA LABORATORY:	AMRO	CONTRACTOR'S LABORATORY:	STL, VT
EXTRACTION METHOD:	NA	EXTRACTION METHOD:	NA
ANALYSIS METHOD:	9010B	ANALYSIS METHOD:	335.4

MATERIAL DESCRIPTION: WATER
DATE SAMPLED: 5/21/02
UNITS: mg/L

Target Analyte	AMRO QA LAB LRL	AMRO RESULTS QA LAB	STL-VT CONTRACTOR LRL	STL-VT RESULTS CONTRACTOR	COMPARISON CODE
Cyanide (CN)	< 0.020		< 0.010		0

SEE APPENDIX A FOR KEY TO COMMENTS
NR=NOT REPORTED

*Note: Cyanide sample was adjusted for pH to >12 until it was received at the lab.

COMPARISON OF QA & CONTRACTOR RESULTS
PROJECT: SHEPLEY'S HILL LANDFILL, SPRING 2002

QA SAMPLE No.:	0205216-01	CONTRACTORS SAMPLE No.:	488701
QA FIELD ID:	SHM-96-5B-QA	CONTRACTORS FIELD ID:	SHM-96-5B
QA ANALYSIS DATE:	See Below	CONTRACTOR'S ANALYSIS DATE:	NR
QA LABORATORY:	AMRO	CONTRACTOR'S LABORATORY:	STL, VT
EXTRACTION METHOD:	NA	EXTRACTION METHOD:	NA
ANALYSIS METHOD:	300.0	ANALYSIS METHOD:	300.0

MATERIAL DESCRIPTION: **WATER**
DATE SAMPLED: **5/21/02**
UNITS: **mg/L**

Target Analyte	AMRO	AMRO	STL-VT	STL-VT	COMPARISON
	QA LAB	RESULTS	CONTRACTOR	RESULTS	
	LRL	QA LAB	LRL	CONTRACTOR	CODE
Chloride, CL	(5-29-02) < 5.0		< 0.20		0
Nitrate, as N	(5-23-02) < 0.20		< 0.20		0
Othophosphate, as P	(5-23-02) < 0.050		< 0.20		0
Sulfate, SO4	(5-28-02) < 1.0		< 0.20		0

SEE APPENDIX A FOR KEY TO COMPARISON CODES
NR= NOT REPORTED
ND= Not detected at the Reporting Limit
J= Estimated value, below the Reporting Limit
LRL= Laboratory Reporting Limit

COMPARISON OF QA & CONTRACTOR RESULTS									
PROJECT: SHEPLEY'S HILL LANDFILL, SPRING 2002									
QA SAMPLE No.:	0205216-01			CONTRACTORS SAMPLE No.:	488701				
QA FIELD ID:	SHM-96-5B-QA			CONTRACTORS FIELD ID:	SHM-96-5B				
QA ANALYSIS DATE:	6/4/2002			CONTRACTOR'S ANALYSIS DATE:	NR				
QA LABORATORY:	AMRO			CONTRACTOR'S LABORATORY:	STL, VT				
EXTRACTION METHOD:	NA			EXTRACTION METHOD:	NA				
ANALYSIS METHOD:	410.4			ANALYSIS METHOD:	410.1				
MATERIAL DESCRIPTION:				WATER					
DATE SAMPLED:				5/21/02					
UNITS:				mg/L					
Target Analyte	AMRO	AMRO	STL-VT	STL-VT					
	QA LAB	RESULTS	CONTRACTOR	RESULTS	COMPARISON				
	LRL	QA LAB	LRL	CONTRACTOR	CODE				
Chemical Oxygen Demand (COD)	< 50		< 5.0		0				
SEE APPENDIX A FOR KEY TO COMMENTS									
NR=NOT REPORTED									
ND= Not Detected at the Reporting Limit									

COMPARISON OF QA & CONTRACTOR RESULTS						
PROJECT: SHEPLEY'S HILL LANDFILL, SPRING 2002						
QA SAMPLE No.:	0205216-01	CONTRACTORS SAMPLE No.:		488701		
QA FIELD ID:	SHM-96-5B-QA	CONTRACTORS FIELD ID:		SHM-96-5B		
QA ANALYSIS DATE:	5/23/02	CONTRACTOR'S ANALYSIS DATE:		NR		
QA LABORATORY:	AMRO	CONTRACTOR'S LABORATORY:		STL, VT		
EXTRACTION METHOD:	NA	EXTRACTION METHOD:		NA		
ANALYSIS METHOD:	405.1	ANALYSIS METHOD:		405.1		
MATERIAL DESCRIPTION:		WATER				
DATE SAMPLED:		5/21/02				
UNITS:		mg/L				
Target Analyte	AMRO	AMRO	STL-VT	STL-VT		
	QA LAB	RESULTS	CONTRACTOR	RESULTS	COMPARISON	
	LRL	QA LAB	LRL	CONTRACTOR	CODE	
Biological Oxygen Demand (5 Day)	< 2.0		< 0.20		0	
SEE APPENDIX A FOR KEY TO COMMENTS						
NR=NOT REPORTED						

COMPARISON OF QA & CONTRACTOR RESULTS
PROJECT: SHEPLEY'S HILL LANDFILL, SPRING 2002

QA SAMPLE No.:	0205216-01	CONTRACTORS SAMPLE No.:	488701
QA FIELD ID:	SHM-96-5B-QA	CONTRACTORS FIELD ID:	SHM-96-5B
QA ANALYSIS DATE:	5/31/02	CONTRACTOR'S ANALYSIS DATE:	NR
QA LABORATORY:	AMRO	CONTRACTOR'S LABORATORY:	STL, VT
EXTRACTION METHOD:	NA	EXTRACTION METHOD:	NA
ANALYSIS METHOD:	310.1	ANALYSIS METHOD:	310.1

MATERIAL DESCRIPTION: **WATER**
DATE SAMPLED: **5/21/02**
UNITS: **mg/L**

Target Analyte	AMRO	AMRO	STL-VT	STL-VT	
	QA LAB	RESULTS	CONTRACTOR	RESULTS	COMPARISON
	LRL	QA LAB	LRL	CONTRACTOR	CODE
Total Alkalinity as CaCO ₃	< 5.0		< 1.0		0

SEE APPENDIX A FOR KEY TO COMMENTS
NR=NOT REPORTED

COMPARISON OF QA & CONTRACTOR RESULTS
PROJECT: SHEPLEY'S HILL LANDFILL, SPRING 2002

QA SAMPLE No.:	0205216-01	CONTRACTORS SAMPLE No.:	488701
QA FIELD ID:	SHM-96-5B-QA	CONTRACTORS FIELD ID:	SHM-96-5B
QA ANALYSIS DATE:	5/28/02	CONTRACTOR'S ANALYSIS DATE:	NR
QA LABORATORY:	AMRO	CONTRACTOR'S LABORATORY:	STL, VT
EXTRACTION METHOD:	NA	EXTRACTION METHOD:	NA
ANALYSIS METHOD:	6010B (2340B)	ANALYSIS METHOD:	6010B (2340B)

MATERIAL DESCRIPTION: WATER
DATE SAMPLED: 5/21/02
UNITS: mg/L

Target Analyte	AMRO	AMRO	STL-VT	STL-VT	
	QA LAB	RESULTS	CONTRACTOR	RESULTS	COMPARISON
	LRL	QA LAB	LRL	CONTRACTOR	CODE

Total Hardness as CaCO3*	< 33		NR		0
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SEE APPENDIX A FOR KEY TO COMMENTS

NR=NOT REPORTED

*Note: Hardness as calculated by the separate determinations of calcium and magnesium, expressed as mg equivalent CaCO3/L by Method 2340B.

COMPARISON OF QA & CONTRACTOR RESULTS
PROJECT: SHEPLEY'S HILL LANDFILL, SPRING 2002

QA SAMPLE No.:	0205216-01	CONTRACTORS SAMPLE No.:	488701
QA FIELD ID:	SHM-96-5B-QA	CONTRACTORS FIELD ID:	SHM-96-5B
QA ANALYSIS DATE:	5/24/02	CONTRACTOR'S ANALYSIS DATE:	NR
QA LABORATORY:	AMRO	CONTRACTOR'S LABORATORY:	STL, VT
EXTRACTION METHOD:	NA	EXTRACTION METHOD:	NA
ANALYSIS METHOD:	160.1 and 160.2	ANALYSIS METHOD:	160.1 and 160.2

MATERIAL DESCRIPTION: **WATER**
DATE SAMPLED: 5/21/02
UNITS: mg/L

Target Analyte	AMRO	AMRO	STL-VT	STL-VT	COMPARISON
	QA LAB	RESULTS	CONTRACTOR	RESULTS	
	LRL	QA LAB	LRL	CONTRACTOR	CODE
Total Dissolved Solids (TDS by 160.1)	< 10		< 5.0		0
Total Suspended Solids (TSS by 160.2)	< 4.0		< 0.50		0

SEE APPENDIX A FOR KEY TO COMMENTS
NR=NOT REPORTED
LRL=Laboratory Reporting Limit

COMPARISON OF QA & CONTRACTOR RESULTS
PROJECT: SHEPLEY'S HILL LANDFILL, SPRING 2002

QA SAMPLE No.:	0205216-01	CONTRACTORS SAMPLE No.:	488701
QA FIELD ID:	SHM-96-5B-QA	CONTRACTORS FIELD ID:	SHM-96-5B
QA ANALYSIS DATE:	5/24/02	CONTRACTOR'S ANALYSIS DATE:	NR
QA LABORATORY:	STL-Pittsburgh (subcontracted)	CONTRACTOR'S LABORATORY:	STL, VT
EXTRACTION METHOD:	NA	EXTRACTION METHOD:	NA
ANALYSIS METHOD:	9060.0	ANALYSIS METHOD:	9060.0
MATERIAL DESCRIPTION:		WATER	
DATE SAMPLED:		5/21/02	
UNITS:		mg/L	
Target Analyte	AMRO	AMRO	STL-VT
	QA LAB	RESULTS	CONTRACTOR
	LRL	QA LAB	LRL
			STL-VT
			RESULTS
			CONTRACTOR
			COMPARISON
			CODE
Total Organic Carbon (TOC)	< 1.0		< 1.0
			0
SEE APPENDIX A FOR KEY TO COMMENTS			
NR=NOT REPORTED			

APPENDIX C

SAMPLE RECEIPT & CUSTODY DOCUMENTATION

CHAIN OF CUSTODY RECORD

7200

Project No.: E0776		Project Name: SHEPLEY'S HILL CTM				Project Manager:		Samplers (Signature): CC		AMRO Project No.: 0205216						
		Project State: MA														
Sample ID	Date/Time Sampled	Matrix A= Air S= Soil GW= Ground W. WW= Waste W. DW= Drinking W. O= Oil Other= Specify	Total # of Cont. & Size	Comp	Grab	Analysis Required										Remarks
DIH SHM-96-SB-QA	5/21/02 1606	AQ	3-40 mL		✓	TOC 9060										
Preservative: Cl-HCl, MeOH, N-HNO3, S-H2SO4, Na-NaOH, O- Other																
Container Type: P- Plastic, G-Glass, V-Vial, T- Teflon, O-Other																
Send Results To: AMRO ENVIRONMENTAL 111 HERRICK ST. MERRIMACK NH 03054		FAX No.: 603 429 8496		Seal Intact? Yes No N/A		P.O. No:		GW-1* GW-2 GW-3		MCP Level Needed: _____						
Relinquished By C Cearley		Date/ Time 5/23/02 1645		Received By Patrick R. Donat		Results Needed By: STD		*= May require additional cost								
								PRIORITY TURNAROUND TIME AUTHORIZATION								
								Before submitting samples for expedited TAT, you must have requested in advance and received a coded AUTHORIZATION NUMBER.								
								Samples arriving after 12:00 noon will be tracked and billed as received on the following day.								
								AUTHORIZATION No. _____ BY: _____								
Please print clearly, legibly and completely. Samples can not be logged in and the turnaround time clock will not start until any ambiguities are resolved.				NOTES: Preservatives, Special reporting limits, Known Contamination, etc; QC PACKAGE				AMRO policy requires notification in writing to the laboratory in cases where the samples were collected from highly contaminated sites.								
White: Lab Copy				Yellow: Accompanies Report				Pink: Client Copy				SHEET / OF /				

Chemical Quality Assurance Report
Fall 2002

SHEPLEY'S HILL LANDFILL LONG TERM MONITORING
DEVENS, MASSACHUSETTS

CHEMICAL QUALITY ASSURANCE REPORT
No. E0776-011703

OCTOBER 30, 2002 SAMPLING EVENT

PREPARED BY
THE
GEOLOGY
AND
CHEMISTRY SECTION
ENGINEERING/PLANNING DIVISION

DEPARTMENT OF THE ARMY
NEW ENGLAND DISTRICT, CORPS OF ENGINEERS
CONCORD, MASSACHUSETTS

FEBRUARY 3, 2003

**SHEPLEY'S HILL LANDFILL LONG TERM MONITORING
DEVENS, MASSACHUSETTS
OCTOBER 30, 2002 SAMPLING EVENT**

**CHEMICAL QUALITY ASSURANCE REPORT
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**SHEPLEY'S HILL LANDFILL LONG TERM MONITORING
DEVENS, MASSACHUSETTS
OCTOBER 30, 2002 - QA SAMPLING EVENT**

**CHEMICAL QUALITY ASSURANCE REPORT
No. E0776-011703**

Executive Summary

QA samples from one shipment for Shepley's Hill Landfill Long Term Monitoring, Devens, Massachusetts were analyzed by the QA laboratory, resulting in a total of 101 target analyte determinations. The shipment contained one QA water sample and one trip blank sample and was received in good condition. The data report from the QA laboratory, AMRO, Merrimack, NH, dated 1 January 2003, was used in the comparison. In 31 of these determinations target analytes were detected by one or both laboratories. Results from the analysis of QA samples were compared with results from analysis of the corresponding primary samples (Reference 12a). The primary and QA samples agreed overall in 101 out of 101 (100%) of the comparisons. Primary and QA samples agreed quantitatively in 31 out of 31 (100%) of the comparisons. Quantitative agreement represents only those determinations where an analyte was detected by at least one laboratory. No major or minor discrepancies between results from the primary and QA samples were noted. Refer to Table 1 for a QA split sample data comparison summary.

The QA laboratory's data report was evaluated based on the information that was provided. All of the data comparisons for Methods VOA's-8260B, TAL Metals-6010B, CN, Anions, COD, BOD, Alkalinity, TDS, TSS, hardness and TOC were in complete overall and quantitative agreement. There was very little bias to any of the QA laboratory's sample results and only a few minor QC deviations were noted in their case narrative. The data is complete, usable and satisfies the DQO's of the project.

The primary laboratory's data report was evaluated based on the information that was provided. As stated above, all of the data comparisons for all of the analyses were in excellent overall and quantitative agreement. The primary laboratory's wet chemistry data report has historically lacked some of the information necessary to completely evaluate the batch QC. The primary laboratory has changed their report format and most of the missing supporting QC information is now present in the report. STL-VT has responded to the Corps request to supply the missing information needed to perform a complete evaluation of the data quality.

The QA and primary laboratory's reporting limits were comparable, except for thallium and COD which were not detected in the QA sample. The primary laboratory reported the sample ID's in which tentatively identified compounds (TIC's) were detected. The QA sample SHM-96-5B was also reported to contain TIC's. This CQAR is based on the laboratory reporting limits because the detection limits were not always provided or well defined.

QA analyses were performed by AMRO Environmental Laboratories, Inc., 111 Herrick Street, Merrimack, NH, 03054 and Severn Trent Laboratories, Inc., 450 William Pitt Way, Pittsburgh, PA 15238-1330. The primary laboratory was Severn Trent Services, 208 South Park Drive, Suite 1, Colchester, VT, 05446.

Table 1
Quality Assurance Split Sample
Data Comparison Summary

Project: Shepley's Hill Landfill Long Term Monitoring, Devens, Massachusetts,
October 30, 2002 Sampling Event

Method	Parameter	Overall Agreement (1)		Quantitative Agreement (2)	
		Number	Percent	Number	Percent
8260B	Volatiles	66/66	100	8/8	100
6020/7471	Metals/Mercury	23/23	100	15/15	100
9010B	Cyanide	1/1	100	NA	NA
300.0	Anions	4/4	100	2/2	100
410.1	COD	1/1	100	1/1	100
405.1	BOD	1/1	100	NA	NA
310.1	Alkalinity	1/1	100	1/1	100
130.2	Hardness	1/1	100	1/1	100
160.1	TDS	1/1	100	1/1	100
160.2	TSS	1/1	100	1/1	100
9060	TOC	1/1	100	1/1	100
Total		101/101	100	31/31	100

NOTES:

(1) Represents the number and percentage agreement of all determinations including analytes not detected by either laboratory.

(2) Represents the number and percentage agreement of only those determinations where an analyte was detected by at least one laboratory.

TABLE 2

QA ANALYSES PERFORMED

Sample ID	Matrix	Sample Date	ANALYSIS
SHM-96-5B-QA	Water	10-30-02	5030B/8260B-Volatiles 3010A/6010B-ICP Metals, 7470A-Mercury 9010B-Cyanide 300.0-Anions by Ion Chromatography 410.1-COD 405.1-BOD 310.1-Total Alkalinity as CaCO ₃ 2340B-Total Hardness by Calculation 160.1-Total Dissolved Solids (TDS) 160.2-Total Suspended Solids (TSS) 9060-Total Organic Carbon (TOC)
Trip Blank	Water	10-30-02	5030B/8260B-Volatiles

SHEPLEY'S HILL LANDFILL LONG TERM MONITORING
DEVENS, MASSACHUSETTS
OCTOBER 30, 2002 QA SAMPLING EVENT

CHEMICAL QUALITY ASSURANCE REPORT
No. E0776-011703

QA Findings

NOVA -
Book Reviews

1. QA sample shipping and chain-of-custody deficiencies.

AMRO Environmental Laboratories Corporation, Merrimack, NH, received one shipment containing one QA water sample and a trip blank. The samples were received in good condition on 31 October 2002. Proper sample handling protocols were followed for this shipment, except the cyanide sample container needed to be adjusted for pH at the lab to greater than 12 pH units. The sample SHM-96-5B-QA has historically required additional NaOH to be added by the QA laboratory in order to adjust the pH to greater than 12 pH units.

Copies of the chain-of-custody form document and the cooler receipt form are appended to this report for reference.

2. Data comparison for volatiles (VOC) by Method 8260B.

There were 66 volatile determinations. In seven of these determinations, target analytes were detected by one or both laboratories. There was overall agreement in 66 (100%) of the cases and quantitative agreement in eight out of eight (100%) of the cases. No data discrepancies were noted.

The QA laboratory's target analyte list consisted of 66 volatile compounds which were all analyzed by the primary laboratory whose target analyte list consisted of 84 volatile compounds. The primary laboratory was requested to report the presence of Tentatively Identified Compounds (TIC's) in all the samples. QA sample SHM-96-5B-QA was reported to exhibit the presence of TIC's. The pH of sample SHM-96-5B-QA was above the method recommended pH of < 2, at 5 pH units.

2a. Batch QC Evaluation for the QA Laboratory-AMRO.

Holding Times: All of the volatile samples were analyzed within the method prescribed holding times.

Method Blanks: Results of all the method blanks that were associated with the QA split sample showed no contamination above the laboratory's reporting limit for any of the target analytes, except for methylene chloride which was reported at 0.89 J ug/l.

Trip Blanks: Results of the trip blank that were associated with the QA split samples showed no contamination above the laboratory's reporting limit for any of the target analytes.

Laboratory Control Samples: The QA laboratory spiked the LCS with all of their 66 target analytes. The spiking levels, percent recoveries and the QC limits were appropriately indicated in the report. The QA laboratory reported that the LCS, V-3 021105A, was within the acceptance limits for all of the target analytes.

Matrix Spike/Matrix Spike Duplicate (MS/MSDs): The QA laboratory reported that all of the five target analytes that were spiked in the MS and MSD were within the acceptance limits for accuracy and precision, except for the recovery of trichloroethene (83-118%) in the MSD at 79.6%. Trichloroethene was not detected in the sample SHM-96-5B-QA. The MS/MSD's samples reported were from another client's project.

Surrogates: All of the surrogate recoveries for the samples and the QC samples were within the laboratory's acceptance limits.

2b. Batch QC Evaluation for the Primary Laboratory-STL-VT.

Holding Times: All of the samples were analyzed within the method prescribed holding times.

Method Blanks: The method blank results associated with the QA sample showed contamination below the laboratory's reporting limits for the following target analytes; isobutyl alcohol at 100 J ug/L, 1,4-dioxane at 520 ug/L, 1,2,4-trichlorobenzene at 1.1 J ug/L, hexachlorobutadiene at 2.8 J ug/L, naphthalene at 1.3 J ug/L, and 1,2,3-trichlorobenzene at 1.2 J ug/L which were detected in the method blank sample VBLKY9. These target analytes were not detected in the QA sample SHM-96-5B-QA and were below the reporting limits for these target analytes. The sample results for SHM-96-5B-QA would not be affected.

Trip Blanks: All of the trip blank results for all of the target analytes showed no contamination above the laboratory's reporting limits.

Laboratory Control Sample (LCS/LCSDs): The primary laboratory reported that all of the target analytes in the LCS/LCSD were within the acceptance limits for accuracy and precision. All 84 of the target analytes were spiked into the LCS samples. The amount spiked, percent recoveries and control limits were provided in the report.

Matrix Spike/Matrix Spike Duplicate (MS/MSD): The primary laboratory did not report the results of the MS/MSD for sample SHL-19 which was requested on the chain-of-custody. Refer to the LCS/LCSD for accuracy and precision.

Surrogates: All of the surrogate recoveries for the samples and the QC samples were within the laboratory's acceptance limits.

3. The data comparison for ICP metals by Methods 6010B and mercury by 7470A.

There were 22 ICP-metals determinations and one mercury determination. In 15 of these determinations, target analytes were detected by one or both laboratories. There was overall agreement in 23 (100%) of the cases and quantitative agreement in 15 out of 15 (100%) of the cases. No data discrepancies were noted.

3a. Batch QC Evaluation for the QA Laboratory-AMRO.

Holding times: All of the samples were analyzed within the method prescribed holding times.

Method Blanks: All of the method blank sample results for all of the target analytes showed no contamination above the laboratory's reporting limits, except for calcium, iron, magnesium, potassium, sodium and zinc which were all reported below the reporting limits.

Laboratory Control Sample (LCS): The QA laboratory reported that all of the LCS results were within the laboratory's acceptance limits of 80-120%. The QA laboratory provided the spike amount, percent recoveries and the QC limits in all the data reports.

Matrix Spike/Matrix Spike Duplicate (MS/MSDs): The QA laboratory reported that all of the MS/MSDs were within the laboratory's acceptance limits for accuracy and precision for all the ICP-metal target analytes. All of the spike levels, percent recoveries and QC limits were provided in the reports.

Laboratory Duplicate: The QA laboratory did not report any laboratory duplicate results.

3b. Batch QC Evaluation for the Primary Laboratory-STL-VT.

Holding times: All the samples were analyzed within the method prescribed holding times.

Method Blanks: All of the method blank sample results for all of the target analytes showed no contamination above the laboratory's reporting limit.

Laboratory Control Samples (LCS/LCSDs): The primary laboratory reported that all of the target analytes were recovered within the assumed acceptance limits of 80-120% recoveries. The primary laboratory did not provide LCS acceptance limits in their report.

Matrix Spike (MS): The primary laboratory performed a matrix spike on sample SHL-19. The primary laboratory reported that all the target analytes in the MS recoveries were within the assumed acceptance limits (75-125%) for accuracy, except for thallium which was recovered at 69.6%. The primary laboratory did not provide acceptance limits for the MS sample results. The post digestion spike recovery for thallium was within the assumed acceptance limits at 88.6%.

Laboratory Duplicate: The primary laboratory reported the laboratory duplicate SHL-19D was within the assumed acceptance limits of 20% RPD for precision for all of the target analytes that were above the CRDL. The primary laboratory did not provide the acceptance limits for laboratory duplicates. The blind field duplicate sample SHM-DUP-02A was in close agreement with the original sample SHM-DUP-02A. Refer to the data comparison table for the RPD's.

4. Data comparison for cyanide by Method 9010B.

There was one cyanide determination. No cyanide was detected by either laboratory. There was 100% overall agreement for this determination. No data discrepancy was noted.

4a. Batch QC Evaluation for the QA laboratory-AMRO.

Holding Times: All the samples were analyzed within the method prescribed holding times.

Method Blanks: The method blank result for cyanide showed no contamination above the laboratory's reporting limit.

Laboratory Control Sample (LCS): The QA laboratory reported that the LCS result for cyanide was within the laboratory's acceptance limits of 90-110%, at 108%. All of the spike levels, percent recoveries and QC limits were appropriately indicated in the QA laboratory's report.

Matrix Spike/Matrix Spike Duplicate (MS/MSDs): The QA laboratory did not report any MS/MSD results for cyanide and they were not requested to on the C-O-C.

Laboratory Duplicate: The QA laboratory did not report any laboratory duplicate results for cyanide.

4b. Batch QC Evaluation for the Primary Laboratory-STL-VT.

Holding Times: All of the samples were analyzed within the method prescribed holding times.

Method Blanks: All of the method blank results showed no contamination above the laboratory's reporting limit for cyanide.

Laboratory Control Sample (LCS): The primary laboratory reported the LCS for cyanide was within the assumed acceptance limits of 90-110% at 100.9%. The spike amount added and the percent recoveries were all provided in the report, but no QC limits were provided.

Matrix Spike (MS): The primary laboratory reported that the MS sample SHL-19MS was recovered below the acceptance limits of 75-125% for cyanide at 57.5%. The primary lab suspects the low cyanide recovery was due to a matrix effect.

Laboratory Duplicate: The primary laboratory reported that the laboratory duplicate sample results (both non-detects) were within the laboratory's acceptance limits for cyanide.

5. Data comparison for anions by Method 300.0.

There were four anion determinations. In three of the determinations, target analytes were detected by one or both laboratories. There was overall agreement in four (100%) of the cases and quantitative agreement in three out of three (100%) of the cases. No data discrepancies were noted.

5a. Batch QC Evaluation for the QA laboratory-AMRO.

Holding Times: All of the samples were analyzed within the method prescribed holding times.

Method Blanks: The method blank results for anions showed no contamination above the laboratory's reporting limit. Ortho-phosphate was analyzed by Method 365.2. Chloride was detected below the reporting limit of 0.50 mg/l at 0.05 mg/l.

Laboratory Control Samples (LCS): The QA laboratory reported that the LCS results for anions were within the laboratory's acceptance limits of 90-110%. All of the spike levels, percent recoveries and QC limits were appropriately indicated in the QA laboratory's report.

Matrix Spike/Matrix Spike Duplicate (MS/MSDs): The QA laboratory reported that the MS for anions were within the laboratory's acceptance limits for accuracy, except for ortho-phosphate at 0% recovery. The QA laboratory suspects a specific matrix interference. The sample was re-analyzed at a dilution with the same results and was qualified appropriately. The non-detect sample result should be considered biased low due to the poor recovery in the MS. All of the spike levels, percent recoveries and QC limits were appropriately indicated in the QA laboratory's report.

Laboratory Duplicate: The QA laboratory reported that all the anions laboratory duplicate results were within the acceptance limits of 20% RPD.

5b. Batch QC Evaluation for the Primary Laboratory-STL-VT.

Holding Times: All of the samples were analyzed within the method prescribed holding times.

Method Blanks: All of the method blank results showed no contamination above the laboratory's reporting limit for anions.

Laboratory Control Samples (LCSs): The primary laboratory reported that all the LCS/LCSD's for anions were within the laboratory acceptance limits for accuracy and precision. The spike amount added and percent recoveries were all provided in the report.

Matrix Spike (MS): The primary laboratory reported that the MS sample SHL-19MS was recovered within the acceptance limits of 80-120% for all the anions.

Laboratory Duplicate: The primary laboratory reported that the laboratory duplicate results were within reasonable acceptance limits for precision.

6. Data comparison for COD by Method 410.1.

There was one COD determination. The primary laboratory reported COD at 87.9 mg/L which was above the QA laboratory's reporting limit of 50 ug/L. There was 100% overall agreement for this determination, however the primary laboratory's reporting limit was ten times lower at 5.0 ug/L. No data discrepancy was noted based on the higher reporting limit.

6a. Batch QC Evaluation for the QA laboratory-AMRO.

Holding Times: The QA sample was analyzed within the method prescribed holding time.

Method Blanks: The method blank results for COD showed no contamination above the laboratory's reporting limit.

Laboratory Control Samples (LCS): The QA laboratory reported that the LCS result for COD was within the laboratory's acceptance limits of 80-120%, at 100%. All of the spike levels, percent recoveries and QC limits were appropriately indicated in the QA laboratory's report.

Matrix Spike/Matrix Spike Duplicate (MS/MSDs): The QA laboratory reported that the MS/MSD's for COD were within the laboratory's acceptance limits of 80-120% for accuracy and precision, at 99.9% and 101% with a RPD of 1.35%. All of the spike levels, percent recoveries and QC limits were appropriately indicated in the QA laboratory's report.

Laboratory Duplicate: The QA laboratory did not report any laboratory duplicate result for COD.

6b. Batch QC Evaluation for the Primary Laboratory-STL-VT.

Holding Times: All of the samples were analyzed within the method prescribed holding times.

Method Blanks: All of the method blank results showed no contamination above the laboratory's reporting limit for COD.

Laboratory Control Sample (LCS/LCSD): The primary laboratory reported that the LCS/LCSD for COD were within the acceptance limits for accuracy and precision. The spike amount added and percent recoveries were all provided in the report.

Matrix Spike/Matrix Spike Duplicate (MS/MSDs): The primary laboratory was not requested to

perform MS/MSD's on any of the samples for COD and no evaluation of accuracy and precision based on matrix effects could be made.

Laboratory Duplicate: The primary laboratory did not report any laboratory duplicate results for COD.

7. Data comparison for BOD by Method 405.1.

There was one BOD determination. No BOD was detected by either laboratory. There was 100% overall agreement for this determination. No data discrepancy was noted.

7a. Batch QC Evaluation for the QA laboratory-AMRO.

Holding Times: The QA sample was analyzed within the method prescribed holding time.

Method Blanks: The method blank results for BOD showed no contamination above the laboratory's reporting limit.

Laboratory Control Samples (LCS/LCSDs): The QA laboratory reported that the LCS/LCSD recoveries for BOD were within the laboratory's acceptance limits for accuracy and precision at 95.9% and 94.2% recoveries, with a RPD of 1.78%. All of the spike levels, percent recoveries and QC limits were appropriately indicated in the QA laboratory's report.

Matrix Spike/Matrix Spike Duplicate (MS/MSDs): MS/MSD's are not applicable to BOD analysis. Refer to LCS/LCSD data for accuracy and precision verification.

Laboratory Duplicate: The QA laboratory did not report any laboratory duplicate results for BOD.

7b. Batch QC Evaluation for the Primary Laboratory-STL-VT.

Holding Times: The QA split sample SHM-96-5B was analyzed within the method prescribed holding times.

Method Blanks: All of the method blank results showed no contamination above the laboratory's reporting limit for BOD.

Laboratory Control Sample (LCS/LCSD's): The primary laboratory reported that all the LCS's for BOD were within the acceptance limits for accuracy and precision. The spike amount added and percent recoveries were all provided in the report.

Matrix Spike/Matrix Spike Duplicate (MS/MSDs): MS/MSD's are not applicable to BOD analysis and were not requested on the C-O-C. Refer to LCS for accuracy verification.

Laboratory Duplicate: The primary laboratory did not provide any laboratory duplicate results for BOD.

8. Data comparison for alkalinity by Method 310.1.

There was one alkalinity determination. Both laboratories detected alkalinity in the QA sample SHM-96-5B. There was 100% overall and quantitative agreement for this determination. No data discrepancy was noted.

8a. Batch QC Evaluation for the QA laboratory-AMRO.

Holding Times: The QA sample was analyzed within the method prescribed holding time.

Method Blanks: The method blank results for alkalinity showed no contamination above the laboratory's reporting limit.

Laboratory Control Sample (LCS): The QA laboratory reported that the LCS recovery for alkalinity was within the laboratory's acceptance limits of 80-120% at 98.9%. All of the spike levels, percent recoveries and QC limits were appropriately indicated in the QA laboratory's report.

Matrix Spike/Matrix Spike Duplicate (MS/MSDs): The QA laboratory reported that the MS/MSD's for alkalinity were within the laboratory's acceptance limits for accuracy (80-120%) and precision (20%RPD), at 97% and 95.7% recoveries with an RPD of 1.08%.

Laboratory Duplicate: The QA laboratory reported that the sample duplicate result for alkalinity was within the 20% RPD acceptance limit at 8.65%.

8b. Batch QC Evaluation for the Primary Laboratory-STL-VT.

Holding Times: The QA split sample SHM-96-5B was analyzed within the method prescribed holding times.

Method Blanks: All of the method blank results showed no contamination above the laboratory's reporting limit for alkalinity.

Laboratory Control Sample (LCS): The primary laboratory reported that the LCS for alkalinity was within the acceptance limits of 80-120%. The spike amount added, percent recoveries and QC limits were all provided in the report.

Matrix Spike/Matrix Spike Duplicate (MS/MSDs): The primary laboratory reported that the MS for alkalinity was recovered within the acceptance limits of 75-125% at 98.8%.

Laboratory Duplicate: The primary laboratory reported the laboratory duplicate results for sample SHL-19 were within the acceptance limits of 80-120% at 2.0% RPD.

9. Data comparison for hardness by calculation by Method 2340B.

There was one hardness determination. Both laboratories detected hardness in the QA sample SHM-96-5B. There was 100% overall and quantitative agreement for this determination and no data discrepancy was noted.

9a. Batch QC Evaluation for the QA laboratory-AMRO.

Holding Times: The QA sample was analyzed within the method prescribed holding time.

Method Blanks: The method blank results for hardness showed no contamination above the laboratory's reporting limit.

Laboratory Control Sample (LCS): The QA laboratory reported that the LCS recovery for hardness was within the laboratory's acceptance limits of (80-120%) at 99.4%. All of the spike levels, percent recoveries and QC limits were appropriately indicated in the QA laboratory's report.

Matrix Spike/Matrix Spike Duplicate (MS/MSDs): The QA laboratory did not report any MS/MSD results for hardness and accuracy and precision based on matrix effects could not be determined.

Laboratory Duplicate: The QA laboratory did not report any laboratory duplicate results for hardness.

9b. Batch QC Evaluation for the Primary Laboratory-STL-VT.

Holding Times: The QA split sample SHM-96-5B was analyzed within the method prescribed holding times.

Method Blanks: All of the method blank results showed no contamination above the laboratory's reporting limit for hardness.

Laboratory Control Samples (LCS/LCSD's): The primary laboratory did not report any LCS results for hardness. No evaluation of method performance (accuracy and precision) on an interference free matrix could be made.

Matrix Spike/Matrix Spike Duplicate (MS/MSDs): The primary laboratory did not report any MS/MSD results for hardness. No evaluation of accuracy and precision based on matrix effects could be made. The primary laboratory did not provide hardness results on the samples SHL-19MS and MSD which were requested on the chain-of-custody.

Laboratory Duplicate: The primary laboratory did not report any laboratory duplicate results for hardness for SHL-19. No QC limits for precision were provided.

10. Data comparison for TDS and TSS by Methods 160.1 and 160.2.

There was one total dissolved solids determination (TDS) and one total suspended solids (TSS) determination. Both laboratories reported detectable levels of TDS and TSS in the QA sample SHM-96-5B. There was 100% overall and quantitative agreement for the TDS determination and 100% overall and quantitative agreement for the TSS determination. No data discrepancies were noted for the TDS and TSS determinations.

10a. Batch QC Evaluation for the QA laboratory-AMRO.

Holding Times: The QA sample was analyzed within the method prescribed holding times.

Method Blanks: The method blank results for TDS and TSS showed no contamination above the laboratory's reporting limits.

Laboratory Control Sample (LCS): The QA laboratory reported that the LCS recoveries for TDS and TSS were within the laboratory's acceptance limits at 91.4% and 92%, respectively. All of the spike levels, percent recoveries and QC limits were appropriately indicated in the QA laboratory's report.

Matrix Spike/Matrix Spike Duplicate (MS/MSDs): MS/MSD's are not applicable for TDS and TSS.

Laboratory Duplicate: The QA laboratory reported that the TDS and TSS laboratory duplicates were within the laboratory's acceptance limits of 20% RPD at 10.4% and 13.3%, respectively.

10b. Batch QC Evaluation for the Primary Laboratory-STL-VT.

Holding Times: The QA split sample SHM-96-5B was analyzed within the method prescribed holding times.

Method Blanks: All of the method blank results showed no contamination above the laboratory's reporting limit for TDS and TSS.

Laboratory Control Sample (LCS/LCSD): The primary laboratory reported that all the LCS/LCSD's for TDS and TSS were within the acceptance limits of 80-120% for accuracy and precision. The spike amount added and percent recoveries were all provided in the report.

Matrix Spike/Matrix Sipke Duplicate (MS/MSDs): MS/MSD's are not applicable for TDS and TSS.

Laboratory Duplicate: The primary laboratory reported the duplicate sample results for SHL-19 were within the acceptance limits of 20% RPD for TDS at 2.0% RPD. No duplicate sample result for TSS was provided.

11. Data comparison for total organic carbon (TOC) by Method 9060.

There was one TOC determination. Both laboratories detected TOC in the QA sample SHM-96-5B. There was 100% overall and quantitative agreement for this determination. No data discrepancy was noted. The cooler was at the proper temperature when received at the sub-contracted laboratory, STL Pittsburgh, PA.

11a. Batch QC Evaluation for the QA laboratory-AMRO.

Holding Times: The QA sample was analyzed within the method prescribed holding time.

Method Blanks: The method blank results for TOC showed no contamination above the laboratory's reporting limit.

Laboratory Control Sample (LCS): The QA laboratory reported that the LCS recovery for TOC was within the laboratory's acceptance limits at 100%. All of the spike levels, percent recoveries and QC limits were appropriately indicated in the QA laboratory's report.

Matrix Spike/Matrix Spike Duplicate (MS/MSDs): The QA laboratory reported that the MS/MSD's for TOC were within the laboratory's acceptance limits for accuracy (75-125%) and precision (25%RPD), at 96% and 104% recoveries with an RPD of 1.9%.

Laboratory Duplicate: The QA laboratory did not report any laboratory duplicate results for TOC.

11b. Batch QC Evaluation for the Primary-Sub Laboratory-STL-Pittsburgh.

Holding Times: The QA split sample SHM-96-5B was analyzed within the method prescribed holding times.

Method Blanks: All of the method blank results showed no contamination above the laboratory's reporting limit for TOC.

Laboratory Control Samples (LCS/LCSD's): The primary laboratory reported that the LCS/LCSD's for TOC were within the acceptance limits for accuracy and precision. The spike amount added, percent recoveries and the QC limits were all provided in the report.

Matrix Spike/Matrix Sipke Duplicate (MS/MSDs): The primary laboratory did not report any MS/MSD results for TOC and no evaluation of accuracy or precision based on matrix effects could be made. Refer to the LCS/LCSD for accuracy and precision verification.

Laboratory Duplicate: The primary laboratory reported the duplicate sample results for SHL-19 were above the acceptance limits at 200% RPD. No QC limits for precision were provided.

12. References.

a. Data Reports for Shepley's Hill Landfill Long Term Monitoring, Devens, Massachusetts, prepared by the primary laboratory, Severn Trent Laboratories, Inc., 208 South Park Drive, Suite 1, Colchester, VT, 05446, were received 20 December 2002. The QA laboratory's data report, prepared by AMRO Environmental Laboratories Corporation, 111 Herrick Street, Merrimack, NH. 03054, were received 3 January 2003.

b. EM 200-1-6, Chemical Quality Assurance for Hazardous, Toxic and Radioactive Waste (HTRW) Projects, dated 10 October 1997.

c. Shell for Analytical Chemistry Requirements, Version 1.0, USACE, 2 November 1998.

APPENDIX A
KEY TO COMMENTS ON DATA COMPARISON TABLES

0 - Data agrees if any one of the following apply:

- both values are less than respective detection limit ($N < MDL$)
- $N_1 < MDL_1$ and $N_2 > MDL_2$ but $< MDL_1^*$
- both values are above respective detection limit ($N > MDL$) and difference between two values satisfies conditions below

For **all** analyses in a **water** matrix and for **metals** analysis in **soil**:
 $\leq 2X$ difference

For **all** other analyses:
 $\leq 4X$ difference

1 - Minor contamination by laboratory contaminant

2 - Not tested by both laboratories

3 - Minor data discrepancy, disagreement not serious, if any one of the following apply:

- $N_1 < MDL_1$ and $N_2 > MDL_2$ and the difference between values N_2^* does not exceed the upper limit (described below) defining a minor data discrepancy
- both values are above respective detection limit ($N > MDL^*$) and conditions described below apply to the difference between the two values

For **all** analyses in a **water** matrix and for **metals** analysis in **soil**:
 $2X < \text{difference} \leq 3X$

For **all** other analyses:
 $4X < \text{difference} \leq 5X$

4 - Major data discrepancy, disagreement serious, if any one of the following apply:

- $N_1 < MDL_1$ and $N_2 > MDL_2$ and the difference between values N_2 and MDL_1^* exceeds the limit (described below) defining a major data discrepancy
- both values are above respective detection limit ($N > MDL^*$) and conditions described below apply to the difference between the two values

For **all** analyses in a **water** matrix and for **metals** analysis in **soil**:
 $> 3X$ difference

For **all** other analyses:
>5X difference

MDL = Method Detection Limit

N = Analytical result

* - not all < values are MDLs. Values which are not MDLs will be noted.

Key to data qualifiers:

B - detected in method blank

DO - Diluted out

J - estimated value, above MDL but below practical quantitation limit

NA - Not analyzed

ND - Not detected

NR - Not reported

APPENDIX B

DATA COMPARISON TABLES

COMPARISON OF QA & CONTRACTOR RESULTS
PROJECT: SHEPLEY'S HILL LANDFILL, FALL 2002

Page 1 of 2

QA SAMPLE No.:	0210278-01A	CONTRACTORS SAMPLE No.:	508311
QA FIELD ID:	SHM-96-5B-QA	CONTRACTORS FIELD ID:	SHM-96-5B
QA ANALYSIS DATE:	11/5/02	CONTRACTOR'S ANALYSIS DATE:	11/5/02
QA LABORATORY:	AMRO	CONTRACTOR'S LABORATORY:	STL, VT
EXTRACTION METHOD:	5030B	EXTRACTION METHOD:	5030B
ANALYSIS METHOD:	8260B	ANALYSIS METHOD:	8260B

MATERIAL DESCRIPTION: WATER
DATE SAMPLED: 10/30/02
UNITS: ug/L

Target Analyte	AMRO QA LAB LRL	AMRO RESULTS QA LAB	STL-VT CONTRACTOR LRL	STL-VT RESULTS CONTRACTOR	COMPARISON CODE
Dichlorodifluoromethane	< 5.0		< 5.0		0
Chloromethane	< 5.0		< 5.0		0
Vinyl Chloride	< 2.0		< 5.0		0
Bromomethane	< 2.0		< 5.0		0
Chloroethane	< 5.0		< 5.0		0
Trichlorofluoromethane	< 2.0		< 5.0		0
Acrolein	NR		< 5.0		2
Freon TF	NR		< 5.0		2
1,1-Dichloroethene	< 1.0		< 5.0		0
Acetone	< 10		< 5.0		0
Methyl Iodide	NR		< 5.0		2
Carbon Disulfide	< 2.0		< 5.0		0
Allyl Chloride	NR		< 5.0		2
Methylene Chloride	< 5.0		< 5.0		0
Acrylonitrile	NR		< 5.0		2
trans-1,2-Dichloroethene	< 2.0		< 5.0		0
1,2-Dichloroethene (total)	NR		< 5.0		2
Methyl-t-Butyl Ether	< 2.0		< 5.0		0
1,1-Dichloroethane	< 2.0		< 5.0		0
Vinyl Acetate	NR		< 5.0		2
Chloroprene	NR		< 5.0		2
cis-1,2-Dichloroethene	< 2.0		< 5.0		0
2-Butanone	< 10		< 5.0		0
Proionitrile	NR		< 20		2
Methacrylonitrile	NR		< 5.0		2
Bromochloromethane	< 2.0		< 5.0		0
Tetrahydrofuran	NR		< 50		2
Chloroform	< 2.0		< 5.0		0
1,1,1-Trichloroethane	< 2.0		< 5.0		0
Carbon Tetrachloride	< 2.0		< 5.0		0
Isobutyl Alcohol	NR		< 250		2
Benzene	< 1.0		< 5.0		0
1,2-Dichloroethane	< 2.0		< 5.0		0
Trichloroethene	< 2.0		< 5.0		0
1,2-Dichloropropane	< 2.0		< 5.0		0
Methyl Methacrylate	NR		< 5.0		2
Dibromomethane	< 2.0		< 5.0		0
1,4-Dioxane	NR		< 250		2
Bromodichloromethane	< 2.0		< 5.0		0
2-Chloroethyl Vinyl Ether	NR		< 5.0		2
cis-1,3-Dichloropropene	< 1.0		< 5.0		0

SEE APPENDIX A FOR KEY TO COMMENTS

NR=NOT REPORTED

J=Estimated value greater than one half the reporting limit.

B=Analyte was detected in method blank.

COMPARISON OF QA & CONTRACTOR RESULTS
PROJECT: SHEPLEY'S HILL LANDFILL, FALL 2002

Page 2 of 2

QA SAMPLE No.:	0210278-01A	CONTRACTORS SAMPLE No.:	508311
QA FIELD ID:	SHM-96-5B-QA	CONTRACTORS FIELD ID:	SHM-96-5B
QA ANALYSIS DATE:	11/5/02	CONTRACTOR'S ANALYSIS DATE:	11/5/02
QA LABORATORY:	AMRO	CONTRACTOR'S LABORATORY:	STL, VT
EXTRACTION METHOD:	5030B	EXTRACTION METHOD:	5030B
ANALYSIS METHOD:	8260B	ANALYSIS METHOD:	8260B

MATERIAL DESCRIPTION: **WATER**
 DATE SAMPLED: **10/30/02**
 UNITS: **ug/L**

Target Analyte	AMRO QA LAB LRL	AMRO RESULTS QA LAB	STL-VT CONTRACTOR LRL	STL-VT RESULTS CONTRACTOR	COMPARISON CODE
4-Methyl-2-pentanone	< 10		< 5.0		0
Toluene	< 2.0		< 5.0		0
trans-1,3-Dichloropropene	< 1.0		< 5.0		0
Ethyl Methacrylate	NR		< 5.0		2
1,1,2-Trichloroethane	< 2.0		< 5.0		0
Tetrachloroethene	< 2.0		< 5.0		0
2-Hexanone	< 10		< 5.0		0
Dibromochloromethane	< 2.0		< 5.0		0
1,2-Dibromoethane	< 2.0		< 5.0		0
Chlorobenzene	< 2.0		< 5.0		0
1,1,1,2-Tetrachloroethane	< 2.0		< 5.0		0
Ethylbenzene	< 2.0		< 5.0		0
Xylene (m,p)	< 2.0		< 5.0		0
Xylene (total)	< 2.0		< 5.0		0
Xylene (o)	< 2.0		< 5.0		0
Styrene	< 2.0		< 5.0		0
Bromoform	< 2.0		< 5.0		0
Isopropylbenzene	< 2.0		< 5.0		0
cis-1,4-Dichloro-2-butene	NR		< 5.0		2
1,1,2,2-Tetrachloroethane	< 2.0		< 5.0		0
1,2,3-Trichloropropane	< 2.0		< 5.0		0
trans-1,4-Dichloro-2-butene	NR		< 5.0		2
1,3-Dichlorobenzene	< 2.0		< 5.0		0
1,4-Dichlorobenzene	< 2.0		< 5.0		0
1,2-Dichlorobenzene	< 2.0		< 5.0		0
1,2-Dibromo-3-Chloropropane	< 5.0		< 5.0		0
1,2,4-Trichlorobenzene	< 2.0		< 5.0		0
Hexachlorobutadiene	< 2.0		< 5.0		0
Naphthalene	< 5.0		< 5.0		0
2,2-Dichloropropane	< 2.0		< 5.0		0
1,1-Dichloropropene	< 2.0		< 5.0		0
1,3-Dichloropropane	< 2.0		< 5.0		0
Bromobenzene	< 2.0		< 5.0		0
n-Propylbenzene	< 2.0		< 5.0		0
2-Chlorotoluene	< 2.0		< 5.0		0
4-Chlorotoluene	< 2.0		< 5.0		0
1,3,5-Trimethylbenzene	< 2.0		< 5.0		0
tert-Butylbenzene	< 2.0		< 5.0		0
1,2,4-Trimethylbenzene	< 2.0		< 5.0		0
sec-Butylbenzene	< 2.0		< 5.0		0
4-Isopropyltoluene	< 2.0		< 5.0		0
n-Butylbenzene	< 2.0		< 5.0		0
1,2,3-Trichlorobenzene	< 2.0		< 5.0		0

SURROGATE RECOVERIES (%)	QA	PRIMARY
Dibromofluoromethane (85-120)	93.3	Toluene-d8 (88-110) 108
1,2-Dichloroethane-d4 (80-124)	94.7	1,2-Dichloroethane-d4 (72-141) 108
Toulene-d8 (88-109)	90.8	Bromofluorobenzene (72-122) 105
4-Bromofluorobenzene (77-117)	85.8	1,2-Dichlorobenzene-d4 (69-124) 106

SEE APPENDIX A FOR KEY TO COMMENTS

NR=NOT REPORTED

J=Estimated value greater than one half the reporting limit.

B=Analyte was detected in method blank.

* = Surrogates outside of acceptable limits

COMPARISON OF QA & CONTRACTOR RESULTS
PROJECT: SHEPLEY'S HILL LANDFILL, FALL 2002

QA SAMPLE No.:	0210278-01	CONTRACTORS SAMPLE No.:	508311
QA FIELD ID:	SHM-96-5B-QA	CONTRACTORS FIELD ID:	SHM-96-5B
QA ANALYSIS DATE:	11/5/02	CONTRACTOR'S ANALYSIS DATE:	11/1/02
QA LABORATORY:	AMRO	CONTRACTOR'S LABORATORY:	STL, VT
EXTRACTION METHOD:	3010A	EXTRACTION METHOD:	3010A
ANALYSIS METHOD:	6010B,Hg-7470A	ANALYSIS METHOD:	6010, Hg-7470
MATERIAL DESCRIPTION: WATER			
DATE SAMPLED: 10/30/02			
UNITS: ug/L			

COMPARISON									
Target Analyte	AMRO	AMRO	STL-VT	STL-VT	CODE				
	QA LAB	QA LAB	CONTRACTOR	CONTRACTOR	Dup-				
	LRL	RESULTS	LRL	RESULTS	RPD's				
Aluminum	< 200	200 U	16.1 U	200 B	19.0 B	NC	0		
Antimony	< 20	20 U	3.5 U	20 B	3.5 U	NC	0		
Arsenic	< 5.0 (SW7060A)	2400 U	3.2 U	1970 B	1960	0.51	0		
Barium	< 200	50 U	9.2 U	45.6 B	45.6 B	0	0		
Beryllium	< 5.0	5.0 U	0.20 U	0.20 U	0.20 U	NC	0		
Cadmium	< 5.0	5.0 U	0.30 U	0.30 U	0.30 U	NC	0		
Calcium	< 2500	102000	155 U	102000	102000	0	0		
Chromium	< 10	10 U	4.6 U	4.6 U	4.6 U	NC	0		
Colbolt	< 50	10 U	2.2 U	12.4 B	12.4 B	0.81	0		
Copper	< 25	50 U	1.8 U	5.8 B	1.8 U	NC	0		
Iron	< 100	1800	22.6 U	18700	18700	0	0		
Lead	< 5.0 (SW7421)	5000 U	1.2 U	3100 B	1.1 U	NC	0		
Magnesium	< 2500	15000	218 U	14600	14500	0.69	0		
Manganese	< 15	12000	2.5 U	13000	12800	1.55	0		
Mercury	< 0.20 (SW7470A)	0.20 U	0.10 U (11-6-02)	0.10 U	0.10 U	NC	0		
Nickel	< 40	10 U	13.5 U	13.5 U	13.5 U	NC	0		
Potassium	< 2500	3300	275 U	9580	8760	0	0		
Selenium	< 5.0 (SW7740)	20 U	3.9 U	6.3	6.0	2.47	0		
Silver	< 7.0	3.7 U	1.4 U	1.4 U	1.4 U	NC	0		
Sodium	< 2500	35000	539 U	36200	35800	1.11	0		
Thallium	< 5.0 (SW7841)	5.0 U	3.0 U	3.0 U	3.0 U	NC	0		
Vanadium	< 50	50 U	2.8 U	2.8 U	2.8 U	NC	0		
Zinc	< 20	12.4	6.9 U	8.9 B	7.3 B	NC	0		

SEE APPENDIX A FOR KEY TO COMMENTS

NR=NOT REPORTED

U= Not Detected at the Reporting Limit

B= Less than the Contract Required Detection Limit (CRDL),
but greater than the Instrument Detection Limit (IDL).

J= Analyte detected below quantitation limit.

COMPARISON OF QA & CONTRACTOR RESULTS
PROJECT: SHEPLEY'S HILL LANDFILL, FALL 2002

QA SAMPLE No.:	0210278-01	CONTRACTORS SAMPLE No.:	508311
QA FIELD ID:	SHM-96-5B-QA	CONTRACTORS FIELD ID:	SHM-96-5B
QA ANALYSIS DATE:	11/6/02	CONTRACTOR'S ANALYSIS DATE:	NR
QA LABORATORY:	AMRO	CONTRACTOR'S LABORATORY:	STL, VT
EXTRACTION METHOD:	NA	EXTRACTION METHOD:	NA
ANALYSIS METHOD:	9010B	ANALYSIS METHOD:	335.4

MATERIAL DESCRIPTION: **WATER**
DATE SAMPLED: **10/30/02**
UNITS: **mg/L**

Target Analyte	AMRO QA LAB LRL	AMRO RESULTS QA LAB	STL-VT CONTRACTOR LRL	STL-VT RESULTS CONTRACTOR	COMPARISON CODE
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Cyanide (CN)	< 0.020		< 0.010		0
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SEE APPENDIX A FOR KEY TO COMMENTS
NR=NOT REPORTED

*Note: Cyanide sample was adjusted for pH to >12 until it was received at the lab.
U= Not detected at or above the Reporting Limit

COMPARISON OF QA & CONTRACTOR RESULTS
PROJECT: SHEPLEY'S HILL LANDFILL, FALL 2002

QA SAMPLE No.:	0210278-01	CONTRACTORS SAMPLE No.:	508311
QA FIELD ID:	SHM-96-5B-QA	CONTRACTORS FIELD ID:	SHM-96-5B
QA ANALYSIS DATE:	See Below	CONTRACTOR'S ANALYSIS DATE:	10/31/02
QA LABORATORY:	AMRO	CONTRACTOR'S LABORATORY:	STL, VT
EXTRACTION METHOD:	NA	EXTRACTION METHOD:	NA
ANALYSIS METHOD:	300.0	ANALYSIS METHOD:	300.0

MATERIAL DESCRIPTION: WATER
DATE SAMPLED: 10/30/02
UNITS: mg/L

Target Analyte	AMRO QA LAB	AMRO RESULTS QA LAB	STL-VT CONTRACTOR LRL	STL-VT RESULTS CONTRACTOR	COMPARISON CODE
Chloride, CL	(11-1-02) < 2.5		< 0.20		0
Nitrate, as N	(10-31-02) < 0.20		< 0.20		0
Othophosphate, as P	(11-1-02) < 0.10		< 0.20		0
Sulfate, SO4	(11-1-02) < 5.0		< 0.20		0

SEE APPENDIX A FOR KEY TO COMPARISON CODES
NR= NOT REPORTED
U= Not detected at or above the Reporting Limit
J= Estimated value, below the Reporting Limit
LRL= Laboratory Reporting Limit

COMPARISON OF QA & CONTRACTOR RESULTS
PROJECT: SHEPLEY'S HILL LANDFILL, FALL 2002

QA SAMPLE No.:	0210278-01	CONTRACTORS SAMPLE No.:	508311
QA FIELD ID:	SHM-96-5B-QA	CONTRACTORS FIELD ID:	SHM-96-5B
QA ANALYSIS DATE:	11/13/02	CONTRACTOR'S ANALYSIS DATE:	11/4/02
QA LABORATORY:	AMRO	CONTRACTOR'S LABORATORY:	STL, VT
EXTRACTION METHOD:	NA	EXTRACTION METHOD:	NA
ANALYSIS METHOD:	410.4	ANALYSIS METHOD:	410.1

MATERIAL DESCRIPTION: **WATER**
DATE SAMPLED: **10/30/02**
UNITS: **mg/L**

Target Analyte	AMRO QA LAB LRL	AMRO RESULTS QA LAB	STL-VT CONTRACTOR LRL	STL-VT RESULTS CONTRACTOR	COMPARISON CODE
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Chemical Oxygen Demand (COD)	< 50		< 5.0		0
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SEE APPENDIX A FOR KEY TO COMMENTS
NR=NOT REPORTED
U= Not detected at or above the Reporting Limit

COMPARISON OF QA & CONTRACTOR RESULTS
PROJECT: SHEPLEY'S HILL LANDFILL, FALL 2002

QA SAMPLE No.:	0210278-01	CONTRACTORS SAMPLE No.:	508311
QA FIELD ID:	SHM-96-5B-QA	CONTRACTORS FIELD ID:	SHM-96-5B
QA ANALYSIS DATE:	11/1/02	CONTRACTOR'S ANALYSIS DATE:	11/1/02
QA LABORATORY:	AMRO	CONTRACTOR'S LABORATORY:	STL, VT
EXTRACTION METHOD:	NA	EXTRACTION METHOD:	NA
ANALYSIS METHOD:	405.1	ANALYSIS METHOD:	405.1
MATERIAL DESCRIPTION:		WATER	
DATE SAMPLED:		10/30/02	
UNITS:		mg/L	
Target Analyte	AMRO	AMRO	STL-VT
	QA LAB	RESULTS	CONTRACTOR
	LRL	QA LAB	LRL
			STL-VT
			RESULTS
			CONTRACTOR
			COMPARISON
			CODE
Biological Oxygen Demand (5 Day)	< 2.0	2.0	< 0.20
			0
SEE APPENDIX A FOR KEY TO COMMENTS			
NR=NOT REPORTED			
U= Not detected at or above the Reporting Limit			

COMPARISON OF QA & CONTRACTOR RESULTS
PROJECT: SHEPLEY'S HILL LANDFILL, FALL 2002

QA SAMPLE No.:	0210278-01	CONTRACTORS SAMPLE No.:	508311
QA FIELD ID:	SHM-96-5B-QA	CONTRACTORS FIELD ID:	SHM-96-5B
QA ANALYSIS DATE:	11/5/02	CONTRACTOR'S ANALYSIS DATE:	11/11/02
QA LABORATORY:	AMRO	CONTRACTOR'S LABORATORY:	STL, VT
EXTRACTION METHOD:	NA	EXTRACTION METHOD:	NA
ANALYSIS METHOD:	310.2	ANALYSIS METHOD:	310.1

MATERIAL DESCRIPTION: **WATER**
DATE SAMPLED: **10/30/02**
UNITS: **mg/L**

Target Analyte	AMRO	AMRO	STL-VT	STL-VT	
	QA LAB	RESULTS	CONTRACTOR	RESULTS	COMPARISON
	LRL	QA LAB	LRL	CONTRACTOR	CODE

Total Alkalinity as CaCO3	< 10	331	< 1.0	307	0
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SEE APPENDIX A FOR KEY TO COMMENTS
NR=NOT REPORTED

COMPARISON OF QA & CONTRACTOR RESULTS
PROJECT: SHEPLEY'S HILL LANDFILL, FALL 2002

QA SAMPLE No.:	0210278-01	CONTRACTORS SAMPLE No.:	508311
QA FIELD ID:	SHM-96-5B-QA	CONTRACTORS FIELD ID:	SHM-96-5B
QA ANALYSIS DATE:	11/5/02	CONTRACTOR'S ANALYSIS DATE:	11/21/02
QA LABORATORY:	AMRO	CONTRACTOR'S LABORATORY:	STL, VT
EXTRACTION METHOD:	NA	EXTRACTION METHOD:	NA
ANALYSIS METHOD:	2340B	ANALYSIS METHOD:	2340B
MATERIAL DESCRIPTION:		WATER	
DATE SAMPLED:		10/30/02	
UNITS:		mg/L	

Target Analyte	AMRO QA LAB LRL	AMRO RESULTS QA LAB	STL-VT CONTRACTOR LRL	STL-VT RESULTS CONTRACTOR	COMPARISON CODE
Total Hardness as CaCO3*	< 33	NR	< 1.3	NR	0

SEE APPENDIX A FOR KEY TO COMMENTS
NR=NOT REPORTED

*Note: Hardness as calculated by the separate determinations of calcium and magnesium,
expressed as mg equivalent CaCO3/L by Method 2340B.

COMPARISON OF QA & CONTRACTOR RESULTS
PROJECT: SHEPLEY'S HILL LANDFILL, FALL 2002

QA SAMPLE No.:	0210278-01	CONTRACTORS SAMPLE No.:	508311
QA FIELD ID:	SHM-96-5B-QA	CONTRACTORS FIELD ID:	SHM-96-5B
QA ANALYSIS DATE:	11/1/02	CONTRACTOR'S ANALYSIS DATE:	11-5+4-02
QA LABORATORY:	AMRO	CONTRACTOR'S LABORATORY:	STL, VT
EXTRACTION METHOD:	NA	EXTRACTION METHOD:	NA
ANALYSIS METHOD:	160.1 and 160.2	ANALYSIS METHOD:	160.1 and 160.2

MATERIAL DESCRIPTION: **WATER**
DATE SAMPLED: **10/30/02**
UNITS: **mg/L**

Target Analyte	AMRO QA LAB LRL	AMRO RESULTS QA LAB	STL-VT CONTRACTOR LRL	STL-VT RESULTS CONTRACTOR	COMPARISON	
					RPD	CODE
Total Dissolved Solids (TDS by 160.1)	< 10	NR	< 5.0	NR	8.80%	0
Total Suspended Solids (TSS by 160.2)	< 4.0	NR	< 0.50	NR	50.80%	0

SEE APPENDIX A FOR KEY TO COMMENTS
NR=NOT REPORTED
LRL=Laboratory Reporting Limit

COMPARISON OF QA & CONTRACTOR RESULTS
PROJECT: SHEPLEY'S HILL LANDFILL, FALL 2002

QA SAMPLE No.:	C2K010332-001	CONTRACTORS SAMPLE No.:	508311
QA FIELD ID:	SHM-96-5B-QA	CONTRACTORS FIELD ID:	SHM-96-5B
QA ANALYSIS DATE:	11/7/02	CONTRACTOR'S ANALYSIS DATE:	11/21/02
QA LABORATORY:	STL-Pittsburgh (subcontracted)	CONTRACTOR'S LABORATORY:	STL, VT
EXTRACTION METHOD:	NA	EXTRACTION METHOD:	NA
ANALYSIS METHOD:	9060.0	ANALYSIS METHOD:	9060.0
MATERIAL DESCRIPTION:		WATER	
DATE SAMPLED:		10/30/02	
UNITS:		mg/L	
Target Analyte	AMRO QA LAB LRL	AMRO RESULTS QA LAB	STL-VT CONTRACTOR LRL
			STL-VT RESULTS CONTRACTOR
			COMPARISON RPD CODE
Total Organic Carbon (TOC)	< 1.0		< 1.0
			7.14% 0
SEE APPENDIX A FOR KEY TO COMMENTS			
NR=NOT REPORTED			

APPENDIX C

SAMPLE RECEIPT & CUSTODY DOCUMENTATION

qc/qcmemos/forms/samplerec Rev.18 06/00

QA

Amro # 02 10278

[illegible]

CASE NARRATIVE

Amro Environmental Laboratories
Shepley's Hill

STL Lot #: C2K010332

Sample Receiving:

STL Pittsburgh received one sample on November 1, 2002. The cooler temperature was within the proper temperature range.

General Chemistry:

There were no problems associated with the analysis.

Project No.: _____		Project Name: <u>SHEPLEY'S HILL</u>		Project Manager: _____		Samplers (Signature): <u>CC</u>		AMRO Project No.: <u>0210278</u>								
		Project State: <u>MA</u>														
Sample ID	Date/Time Sampled	Matrix A= Air S= Soil GW= Ground W. WW= Waste W. DW= Drinking W. O= Oil Other= Specify	Total # of Cont. & Size	Comp	Grab	Analysis Required									Remarks	
<u>OLD SHM-96-</u> <u>5B-QA</u>	<u>10/30/02</u> <u>@ 1141</u>	<u>AQ</u>	<u>3-40m/l</u>		<u>✓</u>	<u>TDC 9060</u>										
Preservative: Cl-HCl, MeOH, N-HNO3, S-H2SO4, Na-NaOH, O- Other						<u>5</u>										
Container Type: P- Plastic, G-Glass, V-Vial, T- Teflon, O-Other						<u>✓</u>										
Send Results To:		FAX No.:		Seal Intact?		P.O. No:		GW-1*		GW-2		GW-3				
<u>AMRO ENVIRONMENTAL</u>		<u>603-429-8496</u>		<u>Yes</u> <u>No</u> <u>N/A</u>												
<u>111 Hertick St.</u>																
<u>Merrimack, NH 03054</u>																
Relinquished By:		Date/ Time		Received By		Results Needed By:		MCP Level Needed:		*May require additional cost		PRIORITY TURNAROUND TIME AUTHORIZATION				
<u>Giacobbe Aludardi</u>		<u>10/31/02</u>		<u>[Signature]</u>		<u>STD</u>						Before submitting samples for expedited TAT, you must have requested in advance and received a coded AUTHORIZATION NUMBER.				
												Samples arriving after 12:00 noon will be tracked and billed as received on the following day.				
												AUTHORIZATION No. _____ BY: _____				
Please print clearly, legibly and completely. Samples can not be logged in and the turnaround time clock will not start until any ambiguities are resolved.				NOTES: Preservatives, Special reporting limits, Known Contamination, etc;				AMRO policy requires notification in writing to the laboratory in cases where the samples were collected from highly contaminated sites.								
				<u>Hg-80 y.</u>												
White: Lab Copy		Yellow: Accompanies Report		Pink: Client Copy		SHEET /		OF /								

APPENDIX F

GROUNDWATER ANALYTICAL DATA

3.5 inch diskette (not included in all reports)

APPENDIX G

REFERENCES

REFERENCES

- Stone & Webster Environmental Technology & Services, 1996. *Long Term Monitoring and Maintenance Plan, Shepley's Hill Landfill*, Fort Devens, Massachusetts. Prepared for the U.S. Army Corps of Engineers, New England Division. March.
- Stone & Webster Environmental Technology & Services, 1997. *Shepley's Hill Landfill, Annual Report 1996*, Devens, Massachusetts. Prepared for the U.S. Army Corps of Engineers, New England Division. April.
- Stone & Webster Environmental Technology & Services, 1998. *Final Five Year Review, Shepley's Hill Landfill, Long Term Monitoring*, Devens, Massachusetts. Prepared for the U.S. Army Corps of Engineers, New England District. August.
- Harding Lawson Associates, 1999. *Final Work Plan – Supplemental Groundwater Investigation at Shepley's Hill Landfill*, Devens Reserve Forces Training Area, Devens, Massachusetts. Prepared for the U.S. Army Corps of Engineers, New England District. February.
- Harding ESE, A MACTEC Company, 2002. *Revised Draft Shepley's Hill Landfill Supplemental Groundwater Investigation*, Devens Reserve Forces Training Area, Devens, Massachusetts. Prepared for the U.S. Army Corps of Engineers, New England District. February.
- U.S. Army Corps of Engineers, New England District (CENAE), 2002. *Semi-Annual Groundwater Analytical Data Report, Spring 2002*, Shepley's Hill Landfill, Long Term Monitoring, Devens, Massachusetts. August.
- U.S. Army Corps of Engineers, New England District (CENAE), 2002. *2001 Annual Report*, Shepley's Hill Landfill, Long Term Monitoring and Maintenance, Devens, Massachusetts. April.
- U.S. Army Corps of Engineers, New England District (CENAE), 2003. *Draft Cap Drainage Report*, Shepley's Hill Landfill, Devens RFTA, Ayer, Massachusetts. January.
- U.S. Environmental Protection Agency (USEPA) Region 1, 1996. *Low Stress (low flow) Purging and Sampling Procedure for the Collection of Ground Water Samples From Monitoring Wells*, SOP #: GW 0001, Revision 2. July 30.
- ABB Environmental Services, Inc. (ABB-ES), 1993. *Final Remedial Investigation Addendum Report*, Fort Devens Feasibility Study for Group 1A Sites. Prepared for the U.S. Army Environmental Center, Aberdeen Proving Ground, Maryland. Portland, Maine. December.
- ABB Environmental Services, Inc. (ABB-ES), 1995a. *Final Feasibility Study, Shepley's Hill Landfill Operable Unit*, Fort Devens Feasibility Study for Group 1A Sites. Prepared for the U.S. Army Environmental Center, Aberdeen Proving Ground, Maryland. Portland, Maine. September.
- ABB Environmental Services, Inc. (ABB-ES), 1995b. *Record of Decision, Shepley's Hill Landfill Operable Unit*, Fort Devens Feasibility Study for Group 1A Sites. Prepared for the U.S. Army Environmental Center, Aberdeen Proving Ground, Maryland. Portland, Maine. September.