

Caren Johnson
Fac/Permi/Col ID# 95-02 Date 9/21/12 Doc ID# DIN

VOLUME I OF II

**Groundwater and Surface Water
Assessment Monitoring Results Report
First Semi-Annual Event
(First Annual Comprehensive Event)**

**Watauga County Landfill
Watauga County, North Carolina
NCDEHNR Permit No. 95-02**

Prepared for:

Watauga County Board of Commissioners

and

North Carolina Department of Environment, Health and Natural Resources
Division of Solid Waste Management
Solid Waste Section

Prepared by:

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DAA Job No. 6520-21

January 12, 1996



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February 8, 1996

Mr. Mark Poindexter
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Solid Waste Section
North Carolina Department of Environment, Health and Natural Resources
P.O. Box 27687
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RE: Watauga County Landfill,
Fourth Quarter Assessment Monitoring Background Report,
DAA Job No. 6520-21

Dear Mr. Poindexter:

Please find enclosed a copy of the first comprehensive Semi-annual Assessment Monitoring Event (5th Assessment event) Report for the Watauga County Landfill for our review and comment. Summary tables for this event were sent to you on December 20, 1995, and summary discussions concerning the results of this event are included in the Remedial Investigation and Alternatives (RIA) Report, sent to you on January 12, 1996. The enclosed report presents in detail the findings of the first semi-annual Assessment Monitoring groundwater sampling event conducted on July 10-13, 1995 by Draper Aden Associates.

Volume I of the report discusses sampling procedures, analytical results, and overall conclusions of the first semi-annual event. Volume II, comprised of the nine separately bound sections, contains of all associated laboratory data.

The second semi-annual Assessment Monitoring Event is tentatively scheduled to be performed by Draper Aden Associates in January, 1996. The RIA Report contains proposed revisions to the Assessment Monitoring Program. Upon the approval of the NCDEHNR, the revisions outlined in the RIA Report (also discussed at the conclusion of the enclosed Semi-annual Assessment Monitoring Event Report) will be implemented with the second semi-annual assessment monitoring event (sixth assessment event). These proposed revisions are provided below for your convenience.

In summary, revisions to the assessment target parameter list involve the following:

- addition of four metal parameters;
Chromium, Cobalt, Nickel, and Vanadium, and
- deletion of two metal and one organic parameter;
Cadmium, Mercury and trans-1,3-Dichloropropene.

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Revisions to the network of core and boundary wells involve the following:

- addition of one monitoring well and one surface water sampling location further downgradient along the west drainage,
- upgrading of boundary monitoring well MW-15 to core status, and
- withdrawal of the non-impacted boundary monitoring wells (i.e. MW-4, MW-5, MW-13, MW-14, MW-16, and MW-18) from the routine compliance monitoring program. *reduced frequency*

If you should have any questions or comments concerning the enclosed report, or the proposed revisions to the Assessment Monitoring Program, please do not hesitate to contact me.

Sincerely,
DRAPER ADEN ASSOCIATES



Jeffrey E. Smith
Project Geologist

JES/rc

cc: Mr. James S. Ratchford, Watauga County Manager
Mr. Richard M. DiSalvo, Jr., P.E., Principal, DAA
Mr. William D. Newcomb, P.G., Groundwater Project Manager, DAA

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I. Introduction

This report presents the results of the first semi-annual sampling event (first *annual comprehensive* event) for Assessment Groundwater and Surface Water Monitoring at the Watauga County Landfill, NCDEHNR Permit No. 95-02, Watauga County, North Carolina, performed on July 10-13, 1995 by Draper Aden Associates. Assessment monitoring was performed in accordance with the Watauga County Landfill Assessment Plan (DAA, September 3, 1993), approved by the NCDEHNR on September 30, 1993. Appendix I of the Assessment Plan, The Groundwater and Surface Water Monitoring Program, details the schedule and procedures to be implemented for collecting groundwater and surface water samples, analyzing the samples for specified parameters, and evaluating and reporting the resultant water quality data.

Volume I of this report (herein) discusses sampling procedures, analytical results, and overall conclusions of the initial Assessment background sampling event. Volume II of the report (separate cover) contains copies of all associated laboratory data. Volume II of this report also contains Data Validation Forms summarizing the guidelines and results of the preliminary data validation procedures utilized for evaluating the data discussed in this report.

1.1. Groundwater Monitoring Well Network

Eighteen (18) groundwater monitoring wells comprise the assessment groundwater monitoring well network at the Watauga County Landfill. Monitoring well locations are shown on the Groundwater and Surface Water Monitoring Program site map (Figure 1).

In order to maximize the effectiveness and efficiency of the Groundwater Monitoring Program, the assessment well network is stratified into two groups of "core" and "boundary" wells. Core assessment wells are selected based on the well's ability to monitor and characterize migration of potential slugs of contaminants. Boundary assessment wells are selected based on the well's ability to monitor and characterize the limits of the horizontal and vertical extent of the contaminants.

The decision criteria utilized for the selection of core assessment wells is the exceedance of the groundwater protection standard for an individual parameter. The groundwater protection standard is based on an individual parameter's North Carolina Groundwater Quality Standard (NCS) or EPA Maximum Contaminant Level (MCL).

The decision criteria utilized for the classification of boundary wells in the assessment monitoring well network is the exceedance of the analytical method limit of detection as determined by the laboratory for parameters identified as target parameters in the core assessment monitoring wells. The presence of target parameters above the analytical method limit of detection shall be evaluated with respect to repeated sampling events prior to confirmation.

Eleven (11) of the eighteen (18) groundwater monitoring wells were installed in January and February of 1994. For the first quarter background event, four (4) of the previous seven (7) monitoring wells, MW-2, MW-3, MW-4, and MW-6, were denoted as core assessment wells based on the decision criteria and available data. The upgradient well MW-1 was also evaluated similarly for purposes of comparison. All other assessment monitoring wells were initially denoted as boundary assessment wells for this initial assessment background sampling event.

Based on the decision criteria and the analytical data obtained from the first quarter background event, the assessment monitoring well network was re-stratified for the following background monitoring events. Revisions to the network of core and boundary assessment wells resulted in the upgrading of six of the eleven recently installed monitoring wells to "core" status (MW-8, MW-9, MW-10, MW-11, MW-12, and MW-17).

Upon review of the analytical data obtained from all four (4) background events, two additional monitoring wells, MW-4 and MW-7, were also re-stratified for the following semi-annual monitoring events. MW-7 was upgraded to "core" status and MW-4 was downgraded to "boundary" status.

The resultant stratification of the assessment monitoring well network is as follows:

<u>CORE WELLS</u>	<u>BOUNDARY WELLS</u>
MW-1	MW-4
MW-2	MW-5
MW-3	MW-13
MW-6	MW-14
MW-7	MW-15
MW-8	MW-16
MW-9	MW-18
MW-10	
MW-11	
MW-12	
MW-17	

As outlined in the Assessment Monitoring schedule (Table 1, Appendix 1), both core and boundary assessment wells were analyzed for organic parameters using Low Level Risk Assessment (LLRA) screening methods (i.e. EPA SW-846 Methods 8011, 8021, 8081, 8151, 8260, 8270, 8310, and 9030) for the first annual comprehensive assessment monitoring event. Metal parameters were analyzed using CLP statements of work.

1.2 Surface Water Sampling

The goal of the surface water monitoring system at Watauga County Landfill is to provide representative surface water samples for assessing the potential impact of landfill runoff and leachate on the streams located downgradient of the waste disposal area. Five (5) surface water monitoring points, combined with the sampling of any observed leachate production, serve to provide this objective.

- (S-1) The last of the series of sediment ponds is sampled to provide a representative sample for assessing the quality of the surface water originating from the landfill before the water discharges into the stream.
- (S-2) The spring capture outfall located adjacent to the last of the series of sediment ponds is sampled to provide a representative sample for assessing the quality of the water originating from the spring capture system located beneath the fill area.
- (S-3) The stream is sampled at the landfill property boundary (approximately 600 feet below the last sediment pond) to provide a representative sample for assessing the water quality of the stream below the waste disposal area. No sampling location is available upstream of the waste disposal area since the stream originates immediately below the adjacent to the disposal area.
- (S-4) The stream located below the Bolick site is sampled approximately thirty (30) feet below the landfill property boundary to provide a representative sample for assessing the water quality of the surface water below the Bolick site. This sampling location is chosen instead of the sediment pond located on the Bolick site to provide a sample that is more representative of the potential influence of groundwater from the soil aquifer.
- (S-5) A seep, located below the waste disposal area and directly above the sediment pond, was observed flowing during the first quarter background event. This seep is sampled in addition to the four (4) originally proposed surface water sampling locations when observed flowing during routine surface water sampling events.

As outlined in the Assessment Monitoring schedule (Table 1, Appendix 1), surface water samples were analyzed using CLP statements of work for the first semi-annual assessment monitoring event.

In addition to these five surface water sampling locations, any leachate production observed during surface water sampling events is also sampled. A grid field screening inspection of the landfill was conducted concurrent with the first semi-annual event to verify the presence or absence of leachate production. No leachate production was observed. Observations resulting from the inspection is documented in the field notes (Appendix II).

1.3 Sampling and Analysis Schedule

Groundwater

During the first year of Assessment groundwater monitoring, four (4) quarterly sampling events were conducted on each groundwater monitoring well. Semi-annual sampling events will be conducted after the first year. The first semi-annual Assessment monitoring event (also the first *annual comprehensive* Assessment Monitoring event) was recently conducted on July 10-13, 1995 and is described herein. The groundwater Assessment monitoring schedule is outlined in Table 1.

The analytical scans performed on each monitoring well during the first year of assessment background groundwater monitoring were designed to analyze for all the target parameters detected and tentatively confirmed as a result of the initial comprehensive sampling event performed on the previously existing monitoring well network MW-1 through MW-7 on March 5, 1993. The initial March 5, 1993 sampling event was comprised of the complete EPA Appendix II List of Hazardous Inorganic and Organic Parameters (40 CFR, Part 258) currently required for Assessment Monitoring under the North Carolina Department of Environment, Health, and Natural Resources (NCDEHNR) requirements for Municipal Solid Waste Landfills (15A NAACO 13B Section .1600). A summary and evaluation of the results of the initial March 5, 1993 sampling event are contained in Appendix III of this report and detailed in Sections II and III of the Assessment Plan (DAA, September 3, 1993).

The Assessment Plan specifies that after completion of the four (4) quarterly Assessment background groundwater monitoring events and on an annual basis thereafter, the complete EPA Appendix II analysis will be repeated on the revised network of core plume assessment wells. The first annual comprehensive Assessment Monitoring event was recently conducted on July 10-13, 1995 and is described herein. If any additional parameters are detected, and verified through QA/QC validation as being present, that were not identified in prior Assessment monitoring events, amendments to the existing target parameter list will be evaluated and reviewed with the NCDEHNR. For amended target parameters, four (4) independent samples will be collected and analyzed for those additional parameters during the following four (4) semi-annual sampling events at all core and boundary assessment wells to establish background.

Groundwater monitoring events will also continue to be conducted on all wells on a semi-annual basis for the target parameters detected as a result of the complete EPA Appendix II analysis. Reevaluation of the site network and monitoring scheme will be conducted after review of the results of each sampling event.

The groundwater monitoring program follows a two-tiered analytical approach utilizing both EPA Contract Laboratory Program Statement of Work (CLP SOW) - Organic and Inorganic

analytical methods, and low level risk assessment (LLRA) screening by EPA-SW846 analytical methods. The CLP SOWs are utilized to generate high-level quality data with documented QA/QC protocols. The LLRA methods (EPA-SW-846) are utilized for risk assessment screening to preliminarily identify low levels of parameters that may be present. The groundwater analysis schedule, indicating methods designated for the core and boundary wells, is outlined in Table 1.

During the first year of Assessment Monitoring, analyses of the core assessment monitoring wells utilized CLP SOWs for all four (4) quarterly events. Organic analyses of the boundary assessment monitoring wells alternated between CLP and LLRA analytical methods for each quarterly event.

After the first year of quarterly background sampling events, the core assessment monitoring wells will continue to be monitored on a semi-annual basis. The parameter list for the first semi-annual core sampling event (described herein) includes all the assessment monitoring parameters included in the EPA Appendix II List of Hazardous Inorganic and Organic Parameters (40 CFR Part 258) utilizing LLRA analytical methods. The second semi-annual core sampling event will analyze for the target assessment monitoring parameters using CLP-SOWs.

After the first year of quarterly sampling events, boundary assessment wells will also be monitored on a semi-annual basis for the target parameter assessment monitoring parameters. Analysis of semi-annual boundary well monitoring events will continue to alternate between CLP and LLRA methods for each semi-annual event.

Surface Water

Surface water and leachate monitoring was conducted on a semi-annual basis during the first year of the Assessment Plan groundwater monitoring program and will continue semi-annually thereafter. The analytical scans that will be performed on the surface water and leachate samples will utilize CLP SOW and will be designed to analyze for all the target parameters detected as a result of the annual comprehensive Appendix II analysis. The surface water assessment monitoring schedule is outlined in Table 1.

II. GROUNDWATER AND SURFACE WATER SAMPLING FIELD PROCEDURES

Groundwater and surface water samples were collected according to the Watauga County Landfill Groundwater and Surface Water Monitoring Plan (DAA, September 3, 1993), to insure representative samples were collected, received by the laboratory and subject to analysis. Field notes, contained in Appendix II, document groundwater sample collection procedures.

2.1 Well Purging and Sample Collection

Dedicated stainless steel and TEFLON electrical submersible pumps were permanently installed in the new well network subsequent to the first event. Environmental Technicians from Draper Aden Associates used the dedicated pumps to purge and collect groundwater samples from the monitoring well network during the July 10-13, 1995 sampling event. All non-dedicated equipment was decontaminated between sampling of each monitoring well.

A minimum of three well volumes of groundwater, inclusive of water residing in the well casing and filter pack, were removed from each monitoring well prior to sample collection. A well volume was calculated from measurements of depth to water, and total well depth taken prior to purging. Stabilization of field analyses for pH and Specific Conductivity were used to verify that stagnant water within the well was removed during purging, and that groundwater representative of the near-aquifer was being sampled. Field notes recorded during each sampling event, contained in Appendix II, summarize and document well purging calculations and results.

The potentiometric surface inferred from static water level elevations obtained from nearby wells during the recent July sampling event is presented on the enclosed Groundwater and Surface Water Monitoring Program Site Map (Figure 1, Appendix I).

2.2 Field Meter Calibration

Measurements of pH and Specific Conductivity were analyzed at each well by completing multiple measurements in the field, at the time of groundwater purging. Although pH and Specific Conductivity are not assessment monitoring parameters, the measurements were used to ensure groundwater quality and stabilization.

A Corning Checkmate 90 pH/Conductivity/Temperature meter was used for the field measurement of pH, and conductivity. The meter was calibrated in the field using laboratory-grade buffers for pH, and KCl solution for Specific Conductivity. Field notes in Appendix II document field meter calibration methods for each sampling event.

2.3 Quality Control Blank Samples

Due to the use of dedicated purging and sampling equipment for each monitoring well, field blanks were not collected.

Trip Blanks were utilized as part of the assessment monitoring program. Trip Blanks were prepared by the analyzing laboratory to accompany the sample kits at all times. The Trip Blanks employed sample containers and volumes identical in physical and chemical integrity to the samples used for actual sample collection. The Trip Blank was analyzed for all parameters included in the sampling event. The Trip Blank served as a control on sample kit preparation, analysis in the laboratory, and sample kit transportation.

2.4 Sample Containers and Shipment

Groundwater samples were collected in U.S. EPA approved containers prepared and supplied by the analyzing laboratory. Where applicable, the analyzing laboratory prepared organic sample containers with hydrochloric acid (HCl) prior to sample collection. Total metal samples were preserved in the field using nitric acid supplied by the analyzing laboratory. All samples were placed on ice in a cooler at approximately 4°C immediately after collection. A chain of custody seal was placed on each sample and each cooler to verify samples were not disturbed during transport. The coolers were shipped to the analyzing laboratory by overnight courier service.

2.5 Chain of Custody Documentation

Chain of Custody documentation and analysis requests are contained within each laboratory report for each event. Laboratory analytical data sheets are found in Volume II.

Chain of Custody (COC) forms provided by the analyzing laboratory or developed by Draper Aden Associates were used to document the custody of the samples from the time they were collected in the field to the time the custody of the samples was relinquished by Draper Aden personnel. Relinquishing custody of the samples was accomplished by shipping through an overnight carrier service. The information recorded in the Chain of Custody included sampling location, sampling points, number of samples, type of sampling containers, sample preservation procedures, matrix spike samples, if any, blanks accompanying the samples, date and time of sample collection, and the date and time custody was relinquished. These COC forms were sent with the samples to the analyzing laboratory. Analysis request forms which included lists of parameters required to be analyzed for the different analytical methods to be used were also attached along with the COC forms. Draper Aden Associates also requested the analyzing laboratory to attach these COC documents with the certificate analysis supplied by them after analysis of samples was complete.

III. LABORATORY ANALYSIS AND DATA VALIDATION

3.1 List of Laboratories

Volatile organic analyses and Total Metal analyses by EPA Contract Laboratory Program (CLP) statements of work (SOW) were performed by Compuchem Environmental Corporation of Research Triangle Park, North Carolina.

Volatile and Semi-volatile organic analyses by EPA SW-846 Method 8260 and Method 8270, respectively, and sulfide analysis by SW-846 method 9030, were performed by ETS Analytical Services, Inc. of Roanoke, Virginia.

Volatile and semi-volatile organic analyses by EPA SW-846 Methods 8011, 8021, 8081, 8151, and 8310 were performed by CT&E Environmental Services, Inc. of Charleston, West Virginia.

3.2 Analytical Methods

All CLP analytical techniques used were in accordance with the procedures listed in the Contract Laboratory Program SOW Organics OLMO1.9 (3/90), Inorganics ILMO3.0.

All LLRA analytical techniques (SW-846) used were in accordance with the procedures listed in the U.S. EPA document Test Methods for Evaluating Solid Waste - Physical/Chemical Methods, SW-846 (latest edition).

3.3 Data Quality Objectives

Quality Assurance Objectives for Measurements

Data quality objectives (DQO) are established to ensure that the data collected throughout is sufficient and of adequate quality for the intended use. Overall data quality objectives included the following:

- Precision - A measurement of the reproducibility of measurements compared to their average value. Precision is measured by the use of splits, replicate samples, or co-located samples and field audit samples.
- Accuracy - This measures the bias in a measurement system by comparing a measured value to a true or standard value. Accuracy is measured by the use of standards, spiked samples, and field audit samples.

- Representativeness - This is the degree to which a sample represents the characteristic of the population being measured. Representativeness is controlled by defining sample collection protocols and adhering to them throughout the evaluation.
- Completeness - This is the ratio of validated data points to the total samples collected. Completeness is achieved through duplicate sampling and resampling, when necessary.
- Comparability - This is the confidence that one data set can be compared to another. Comparability is achieved through the use of standard methods to control the precision and accuracy of the data sets to be compared by use of field audit samples.

The CLP SOWs are utilized to generate a high level quality data with documented QA/QC protocols. The SW-846 methods are utilized to generate organic data for risk assessment to preliminary identify low levels of analytes that may be present. Estimated CLP SOW results, between the Instrument Detection Limit (IDL) and the Contract Required Detection Limit (CRDL) for Inorganics, and less than the Contract Required Quantitation Limit (CRQL) for Organics, are similarly provided for preliminary assessment purposes only. Estimated data is not intended for use in determining regulatory compliance issues.

Analytical Procedures

Analytical methods and detected parameters for the first semi-annual assessment monitoring event, described herein, are provided in Tables 2A-D and 3A-B (Summary Tables - Assessment Monitoring Results; Appendix I).

Internal Quality Control

i. **Field Quality Control** - Field Quality Control procedures are summarized in Section II of this report.

ii. **Analytical Quality Control** - Analytical Quality Control procedures for CLP analytical techniques are guided by adherence to Contract Laboratory Program (CLP) deliverables. All quality control data and records generated by the laboratory were examined by Draper Aden Associates for adherence to method requirements. A laboratory quality control report generally consists of the following components:

- spikes
- surrogate parameters
- chromatograms
- blanks
- instrument adjustment
- additional QC requirements (organic and inorganic)
- duplicates
- raw data
- calibration
- quantification

For this project, QC reports are provided with the target parameter analytical results for all sampling events.

IV. DATA VALIDATION

The CLP analyses for organic as well as inorganic parameters were performed in adherence to the relevant Contract Laboratory Program-Statement of Work (CLP-SOW). LLRA analyses for organic parameters were performed in adherence to relevant SW-846 method requirements and guidance. Results of the CLP-SOW analyses were summarized and reported by the analyzing laboratory in standard CLP reporting format. Draper Aden Associates conducted data validation of each data set. The results from each sampling event were evaluated in association with corresponding QA/QC information provided by the analyzing laboratory.

4.1 Laboratory Reporting Qualifiers

Two different types of qualifiers were associated with laboratory analyses and data validation: they were **laboratory reporting qualifiers** and **data validation qualifiers**.

The laboratory used **laboratory reporting qualifiers** to flag sample results with reference to relevant QA/QC criteria. Laboratory reporting qualifiers were unique to the analyzing laboratory and are defined in the laboratory data package presented in volume II of this report. The defined **organic** laboratory reporting qualifiers are not equivalent to the defined **inorganic** laboratory reporting qualifiers and review of the definitions is recommended. In addition to the laboratory reporting qualifiers defined in volume II, project specifications required the laboratory performing the analytical services to utilize the following additional data qualifiers and definitions:

Qualifiers

- D - Denotes the sample was diluted to obtain the result.
- S - Method of Standard Additions was utilized to obtain the result.
- E - Laboratory recoveries fell outside EPA control limits. Results are approximate concentrations.
- TI - The laboratory tentatively identified the parameter.

Definitions

- CRDL.** Contract Required Detection Limit (associated with CLP-inorganics only).
- IDL.** Instrument Detection Limit (Associated with CLP-inorganics only).
Inorganic Data qualified with a "U" refers to IDL.
- CRQL.** Contract Required Quantitation Limit (associated with CLP organics only).
Organic Data qualified with a "U", refer to CRQL.

4.2 Data Validation Qualifiers

Data validation was completed using guidance from the "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review", (Document 1) USEPA, February, 1993; and "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review - February 1994" (Document 2).

Data Validation was performed on the results presented in the laboratory analysis report, and the validated results were flagged, where required, using the appropriate national **data validation qualifiers** defined from the aforementioned CLP guidance documents. The data validation qualifiers were divided into two categories; **organic** data validation qualifiers and **inorganic** data validation qualifiers. The **data validation qualifiers** (as defined in Documents 1 and 2 above) are different from the **laboratory reporting qualifiers**. Definitions of the nationally recognized data validation qualifiers used by Draper Aden Associates in the validation process and for the reported results are presented below.

Organic Data Validation Qualifiers

- U - The parameter was analyzed for, but was not detected above the reported sample limit of quantitation (LOQ).
- J - The parameter was positively identified; the associated numerical value is the approximate concentration of the parameter in the sample.
- N - The analysis indicates the presence of an parameter for which there is presumptive evidence to make a "tentative identification".
- NJ - The analysis indicates the presence of an parameter that has been "tentatively identified" and the associated numerical value represents its approximate concentration.

- UJ - The parameter was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the parameter in the sample.
- R - The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the parameter cannot be verified.

Inorganic Data Validation Qualifiers

- U - The material was analyzed for, but was not detected above the level of the associated value. The associated value is the sample detection limit.
- J - The associated value is an estimated quantity.
- R - The data are unusable. (Note: Parameter may not be present)
- UJ - The material was analyzed for, but was not detected. The associated result is an estimate and may be inaccurate or imprecise.

4.3 Inorganic Data Review

Inorganic analyses for this Assessment monitoring event involved analyses for eighteen inorganic parameters (including 17 metal parameters), viz. antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, nickel, selenium, silver, thallium, tin, vanadium, zinc, and cyanide. All inorganic analyses for this monitoring event was performed by Compuchem Environmental Corporation, RTP, North Carolina. Analysis was performed on a total of eighteen groundwater samples collected from monitoring wells MW-1 through MW-18 (excluding MW-7), and five surface water samples, S-1 through S-5. Samples were divided into three sample delivery groups, as indicated below.

- DAASDG#1 (Compuchem SDG#10591M) - MW-1, MW-3, MW-6, MW-8, MW-10, MW-11, MW-13, MW-15 and MW-17
- DAASDG#2 (Compuchem SDG#10592M) - MW-2, MW-4, MW-5, MW-9, MW-12, MW-14, MW-16 and MW-18
- DAASDG#3 (Compuchem SDG#10593M) - S-1, S-2, S-3, S-4, S-5

Inductively Coupled Plasma (ICP), Graphite Furnace Atomic Absorption and Cold Vapor Atomic Absorption analysis were the major techniques on which the individual analytical methods for each of the metals were based, and analysis for cyanide was performed by Automated Colorimetric method (EPA 335.3). All analyses were performed in accordance with EPA Contract

Laboratory Program (CLP) Statement of Work ILMO3.0. All the above target metals were analyzed for their total concentrations. Designated QC samples for duplicate analyses and matrix spike analyses for each SDG above, were collected and supplied by DAA (MW1S and MW1D for SDG#1 and MW9S and MW9D for SDG#2).

Following data validation of the certificates of analysis for these three SDGs, the following discrepancies were noted.

- 1) Serial dilution result for nickel was widely outside control limits.
- 2) Thallium was analyzed by method CLP-ICP with a detection limit (LOD) of 3.6 ug/l as opposed to being analyzed by DAA requested method, CLP-GFAA. Since the USEPA Maximum Contaminant Level for Thallium is 2 ug/l, DAA requested Thallium be reanalyzed by CLP-GFAA method in order to meet this LOD requirement.
- 3) Tin by method CLP-ICP was requested target parameter for all core wells. This was inadvertently missed out during analysis. Hence reanalysis of samples for Tin was requested.
- 4) EPA method 335.3 was used for analysis for Cyanide as opposed to the requested SW-846 methods 9010A or 9012. However, after an evaluation of the QC and method specifications for both EPA method 335.3 and SW-846 method 9012, the differences between these methods were noted to be minor and insignificant. After an evaluation of the sample results for cyanide, these differences were deemed to have no effect on the actual sample results for cyanide and hence the results were accepted from the reported method.
- 5) Results for core wells and boundary wells included parameters outside their respective target parameter lists. Compuchem was requested to revise and resubmit these data packages after effecting this requested change.

Based on the significant numbers of these above revisions, Compuchem was requested to effect all applicable revisions to the items listed above and submit new reports for Compuchem SDG#s 10591M and 10592M. Compuchem provided revised packages as requested, in separate reports for the two SDGs (Revisions dated September 21, 1995). However, from reviewing these revised packages, it was noted that results for iron were not provided for core wells. Following, DAA's request to provide corrections to this effect, Compuchem provided second revisions (as addendum to Revision 1), dated October 3, 1995. The data validation results provided herein are based on the revised final data packages for each sample delivery group.

The results of this data validation presented here are based upon a review of numerous QA/QC information as well as method performance criteria information including but not limited to, holding times, preservation procedures and standards, spike analysis on sample matrix

(including pre- and post-digestion spikes), laboratory control samples, blank samples analyses (method, trip, equipment, calibration and other blanks), duplicate sample analyses, duplicate spike analyses, replicate results information, dilution losses verification results, interference check sample results, and other relevant information.

CLP-ICP Method Inorganics Data Review

ICP analyses was performed on all samples, for barium, iron and cadmium, and for antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, nickel, selenium, silver, tin, vanadium, and zinc on core well samples (MW-1, MW-2, MW-3, MW-4, MW-6, MW-8, MW-9, MW-10, MW-11, MW-12, and MW-17). A brief discussion of the results of validation of ICP data is presented in the following paragraphs. All samples were received under the required preservation conditions, in the laboratory with the exception of the following samples: Samples MW-1 and Trip blank2 were received at pH=7. From an overall review all associated QC results (including duplicate sample result for MW-1 which was within duplicate results control limits), these sample results were deemed to be acceptable.

Review of data package for Compuchem SDG#10591M revealed the reported presence of barium in several calibration blanks and trip blank1, beryllium in several calibration blanks, preparation blank and trip blank1, cobalt in CCB1 and CCB3, and zinc in trip blank1. All sample results for beryllium, and zinc and result for MW-1 for cobalt were validated as "U", per validation criteria. As indicated herein above, the serial dilution analysis result for nickel, for this SDG, performed on sample MW-1 was outside control limits (Original result="U", serial dilution result 651 ug/l). However, reanalysis of serial dilution sample for nickel, provided results within control limits. No further action was deemed to be required.

The interference check sample (ICS-AB) was analyzed as required for all ICP target parameters except for antimony, arsenic and selenium. However, all field samples were reported "Undetect" at their respective detection limits, and hence no further validation was deemed to be required. All relevant ICS-AB recoveries recovered within control limits.

Reported presence of target parameters in blanks associated with analysis sequence for samples under Compuchem SDG#10592M included, Iron in preparation blank and certain calibration blanks, lead in preparation blank, zinc in preparation blank, trip blank 2 and a calibration blank, antimony, cobalt, beryllium and vanadium in some calibration blanks, copper in certain calibration blanks and trip blank2, and barium in trip blank2.

Review of data package for Compuchem SDG#10593M indicated that all relevant QC and method performance criteria were met for this analysis. Barium was reported in a few calibration blanks and preparation blank. However, no validation of sample results for barium based on these blank results was deemed to be required.

All other applicable QC and method specifications were verified to be met. All sample results unaffected by the above data validation process were recorded as reported by the laboratory or, if the reported value was less than the detection limit, validated and reported as "U".

Atomic Absorption - Graphite Furnace - Thallium analysis

As indicated above thallium was initially analyzed by CLP-ICP method, with a LOD of 3.6ug/l. However, following DAA's request, reanalysis results for thallium performed by CLP-GFAA were provided, with a LOD of 1ug/l. The CRDL for thallium is 10ug/l.

Review of calibration data indicated that the instrument was calibrated with the lowest standard of 10ug/l. However, from an overall review of results and associated QC, the linearity of the calibration curve may be effective at concentrations between the LOD and 10 ug/l. No validation was deemed to be required based on this observation.

Pre-digestion spike performed on sample MW-1 (for Compuchem SDG#10591M) recovered within control limits. However, the post-digestion spike for thallium on samples MW-1, MW-10, MW-11, MW-17, MW-3, MW-6 and MW-8 were outside control limits. These samples were deemed to require Method of Standard Additions (MSAs) analysis, which was not performed. Hence these sample results for thallium were validated as estimated and flagged with "J".

For Compuchem SDG#10592M, the pre-digestion spike performed on MW-9 was outside control limits. In addition, post-digestion spikes for MW-4, MW-9, and MW-12 were outside control limits. However, from an overall review of sample results for thallium with all associated QC, no validation was deemed to be required for sample results for thallium.

All other QC and method performance criteria were verified to be met. All sample results unaffected by this validation were recorded as reported by the laboratory or, if the detected value was less than the detection limit, validated and reported as "U".

Atomic Absorption - Cold Vapor - Mercury analysis

Cold Vapor Atomic Absorption was used to measure Mercury in all samples (All monitoring and surface waster samples from all three SDGs). A brief discussion of the results of validation of the Atomic Absorption data is presented in the following paragraph.

EPA-method 335.3 - Cyanide Analysis

Analysis for cyanide was performed on all core well samples which include MW-1, MW-2, MW-3, MW-4, MW-6, MW-8, MW-9, MW-11, MW-10, MW-12, and MW-17. As indicated

herein above, cyanide was requested to be analyzed by SW-846 method 9010A/9012. However, following an evaluation of the QC and method specifications for both EPA method 335.3 and SW-846 method 9012, the differences between these methods were noted to be minor and insignificant.

After an evaluation of the sample results for cyanide, these differences were deemed to have no effect on the actual sample results for cyanide and hence the results were accepted from the reported method.

All relevant calibration verification recoveries were within control limits. The matrix spike and duplicate sample analyses results met the required criteria. All blanks were free of cyanide contamination.

Finally all sample results unaffected by the data validation process, and less than the corresponding LOQs were validated and reported as "U".

4.4 Organic Data Review

CLP Volatile Organic Data Review

GC/MS organic data review was performed on volatile organic parameters analyzed using EPA CLP 3/90 Statement of Work (SOW) Document Number OLM01.9. The parameter list included dichlorodifluoromethane. Sample analysis was performed by CompuChem Environmental Corporation of Research Triangle Park, NC.

Evaluation of CompuChem's compliance with GC/MS CLP VOA protocol and validation of the results, included but was not limited to, review of the following items: sample holding times, sample preservation requirements, laboratory QA/QC performance checks, instrument calibration, blank analyses, surrogate spike recoveries, confirmation of detected parameters and matrix spike analyses results. Review of all transcriptions from raw sample data to sample summary sheets was performed. Specific representative calculations were also performed at random.

Samples were collected during the July 11, 1995 sampling event of Watauga County Landfill from surface water locations S-1, S-2, S-3, S-4, and S-5. Samples were received by CompuChem in good condition on July 13, 1995.

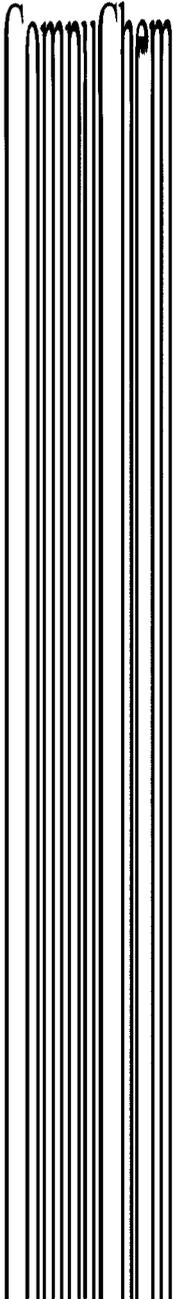
Overall, the analytical quality of the data for Watauga County Landfill and adherence to technical and reporting protocol was excellent. However, the last few pages of the report were missing from the certificate of analysis. A brief letter was sent to CompuChem requesting the missing data. All correspondence, and the replacement data, is located in Section 1.2 of Book 1, Volume II.

All method required initial and continuing calibration requirements were met. The percent deviation (%D) of dichlorodifluoromethane exceeded CLP performance criteria therefore all results for this parameter were qualified as estimated (J).

There was minimal methylene chloride contamination in the holding blank at 2 µg/L. CompuChem reported methylene chloride at low levels, less than 10 µg/L, in all samples. All methylene chloride results in all samples are considered laboratory contamination and were qualified accordingly, as per validation guidelines.

MS/MSD analyses were performed on S-5. All percent recovery (%R) and relative percent difference (%RPD) requirements were met. No evidence of matrix interference was found.

Numerous target parameters were detected, both above and below the CRQL, in these surface water samples as listed on the Analytical Data Set Notes. All reported parameters are confirmable. All sample results not previously noted as requiring qualification stand as reported by



All method required initial and continuing calibration requirements were met. The percent deviation (%D) of dichlorodifluoromethane exceeded CLP performance criteria therefore all results for this parameter were qualified as estimated (J).

There was minimal methylene chloride contamination in the holding blank at 2 µg/L. CompuChem reported methylene chloride at low levels, less than 10 µg/L, in all samples. All methylene chloride results in all samples are considered laboratory contamination and were qualified accordingly, as per validation guidelines.

MS/MSD analyses were performed on S-5. All percent recovery (%R) and relative percent difference (%RPD) requirements were met. No evidence of matrix interference was found.

Numerous target parameters were detected, both above and below the CRQL, in these surface water samples as listed on the Analytical Data Set Notes. All reported parameters are confirmable. All sample results not previously noted as requiring qualification stand as reported by CompuChem.

All blank, holding time, tuning criteria, surrogate recoveries, internal standard area, and internal standard retention time requirements were fulfilled.

All holding times, instrument calibration criteria, duplicate analyses, spiked sample recoveries, serial dilution results and blank sample analyses met the required criteria. All blanks were free of interferences. A comprehensive review of all relevant QC data indicates all analyses met the required QC and method specifications.

All sample results were recorded as reported by the laboratory or, if the detected value was less than the detection limit, validated and reported as "U".

SW-846 Method 8260 Volatile Data Review

GC/MS organic data review was performed on volatile organic parameters analyzed using USEPA SW-846 Method 8260. The parameter list included methylene chloride and vinyl chloride for confirmational analysis. To meet method quantitation limit requirements methylene chloride and vinyl chloride are analyzed using Method 8021. Method 8260 was performed by ETS Analytical Services of Roanoke, Virginia. ETS submitted results to Draper Aden Associates in a final Certificate of Analysis, including: Quality Assurance/Quality Control (QA/QC) documentation, instrument calibration data, internal standards results, raw chromatographic data printouts, and mass spectral results.

Evaluation of ETS's compliance with GC/MS Method 8260 and validation of the results encompassed review of the following items: sample holding times, sample preservation

requirements, laboratory QA/QC performance checks, instrument calibration, blank analyses, surrogate spike recoveries, and matrix spike analyses results. Review of all transcriptions from raw data to summary sheets was performed. Specific representative calculations were also performed at random.

ETS listed either 5 µg/L, 10 µg/L, 25 µg/L, or 50 µg/L for all 8260 parameter level of quantitation (LOQ) values. These values are supported by the "March 1995 VOA MDL Study" presented after the narrative in the certificate of analysis and are further supported by the first point of the calibration curve which was 10 µg/L or 50 µg/L.

Samples were collected during the July 10-13, 1995 sampling event of the Watauga County Landfill from monitoring wells MW-1, MW-2, MW-3, MW-4, MW-6, MW-7, MW-8, MW-9, MW-10, MW-11, MW-12 and MW-17. Samples were received in good condition, with custody seals intact and on ice by ETS on July 13, 1995. Samples from MW-1, MW-3, MW-6, MW-7, MW-8, MW-10, MW-11, and MW-17 were representative of the first sample delivery group (SDG-1) and samples from MW-2, MW-4, MW-9, and MW-12 represented the second sample delivery group (SDG-2). Samples were divided into two SDGs to meet contractual requirements.

Overall, the certificate of analysis for Watauga County Landfill was very complete in its presentation and the data was of acceptable quality, however, revisions were requested from ETS on November 9 and December 1, 1995 to finalize the deliverables package. As well, revisions were required to accurately reflect concentrations of parameters originally reported as non-detect by the laboratory. Separate aliquots for 8260 volatiles and acrolein/acrylonitrile were submitted and analyzed for each of the samples, with the exception of an acrolein/acrylonitrile sample for MW-7, due to insufficient water production from the monitoring well. Therefore, acrolein and acrylonitrile results for MW-7 are taken from the pH <2 aliquot analysis and required qualification as estimated. A separate 8260 analysis sample was necessary since the preservation requirement for both acrolein and acrylonitrile is pH 4-5 and all other volatile compounds require a pH < 2. Sample pH's for the acrylonitrile/acrolein aliquots were exceeded for the MW-8 and MW-11 samples resulting in qualification of the results for these two parameters in these two wells as estimated (J).

Two initial calibrations (ICAL) were analyzed with this sample batch. The ICALs were separated into two mixes due to the extensive parameter list in order to prevent chemical reactions. Both ICALS were analyzed on 7/14/95 and were designated 2VCAL (Mix 02) and 1VCAL (Mix 01). All samples were associated with both ICALS.

Both ICALS met SW-846 method criteria except for 1,1-dichloroethene %RSD=31.44. Draper Aden method performance criteria was exceeded for acetonitrile (%RSD = 30.67%) 1,1-dichloroethene (%RSD = 31.44%), acrolein (RRF=0.049) and isobutanol (%RSD = 35.03%). The only parameter results requiring qualification are 1,1-dichloroethene results greater than 100 ppb, which require qualification as estimated (J). This applies to the MW-2 sample only.

Six continuing calibrations (CCAL) were associated with this sample batch. All SW-846 method criteria and contractual requirements were met. Isobutanol %D=34.01 exceeded validation criteria requiring isobutanol results in MW-1, MW-3, MW-6, MW-7, MW-8, MW-11, MW-17 and MW-10 to be qualified as estimated (J).

All blank analysis criteria was met. Acetone contamination was present in all method blanks and both trip blanks (Trip Blank-1 and Trip Blank-2). Methylene chloride contamination was also present in all but one method blank and both trip blanks. Chloroform contamination was present in one method blank. Acetone and methylene chloride were also present in all groundwater sample as outlined in the Analytical Data Set Notes. Qualification of acetone and methylene chloride results was required as shown on the Analytical Data Set Notes.

No target parameters, other than laboratory contaminants acetone and methylene chloride, were detected in MW-1 and MW-4. Several target parameters were detected above and below the LOQs in the remaining 10 monitoring wells. Samples for MW-2, MW-6 and MW-10 were diluted 1:25, 1:5, and 1:5, respectively, due to concentrations of target parameters exceeding the upper linear calibration of 10-200 µg/L. Reanalysis of the diluted samples; MW-2DL, MW-6DL, and MW-10DL, was successfully completed. The sample LOQs were raised by 25X in MW-2DL for 1,1,1-trichloroethane, by 5X in MW-6DL for cis-1,2-dichloroethene and by 5X in MW-10DL for 1,1,1-trichloroethane. All validated results can be found in the Analytical Data Set Notes, after the Method 8260 Volatile Data Review.

A performance evaluation (PE) sample was submitted as MW-1A to ETS for volatile analysis by method 8260. ETS analyzed the MW-1A sample on 7/18/95 with the SDG-1 samples. ETS's reported results were within performance acceptance limits associated with the quality control standards certified by third party laboratory, Environmental Resource Associates (ERA) of Arvada, CO. Correspondence and certified results from ERA are included at the end of the Method 8260 volatile data review and Analytical Data Set Notes for review.

SW-846 Method 8270A Semi-Volatile Data Review

GC/MS organic data review was performed on semi-volatile organic parameters analyzed using USEPA SW-846 Method 8270A. Method 8270A was performed by ETS Analytical Services of Roanoke, Virginia. ETS submitted results to Draper Aden Associates in a final Certificate of Analysis, including: Quality Assurance/Quality Control (QA/QC) documentation, instrument calibration data, internal standards results, raw chromatographic data printouts, and mass spectral results.

Evaluation of ETS's compliance with GC/MS Method 8270A and validation of the results encompassed review of the following items: sample holding times, sample preservation

requirements, laboratory QA/QC performance checks, instrument calibration, blank analyses, surrogate spike recoveries, and matrix spike analyses results. Review of all transcriptions from raw sample data to sample summary sheets was performed. Specific representative calculations were also performed at random.

ETS listed either 10 µg/L or 20 µg/L for all 8270A parameter level of quantitation (LOQ) values except 1,4-benzenediamine listed at 100 µg/L and bis(2-ethylhexyl) phthalate at 6 µg/L. These values are supported by the "SVOA Precision and Accuracy Study March 1995" presented after the narrative in the certificate of analysis and are further supported by the first point of the calibration curve which is either 20 µg/ml or 50 µg/ml.

Samples were collected during the July 10-13, 1995 sampling event of the Watauga County Landfill from core monitoring wells MW-1, MW-2, MW-3, MW-4, MW-6, MW-7, MW-8, MW-9, MW-10, MW-11, MW-12, and MW-17. Samples were received in good condition, with custody seals intact and on ice by ETS on July 13, 1995. Samples from MW-1, MW-3, MW-6, MW-7, MW-8, MW-10, MW-11, and MW-17 were representative of the first sample delivery group (SDG-1) and samples from MW-2, MW-4, MW-9 and MW-12 represented the second sample delivery group (SDG-2). Samples were divided into two SDGs to meet contractual requirements.

Overall, the certificate of analysis for Watauga County Landfill was complete in its presentation and the data was of acceptable quality except for acid fraction results in MW-17 which were qualified as unusable (R) due to low surrogate recoveries which were confirmed as resulting from sample matrix interference. Revision 1 was submitted by ETS on September 25, 1995 to revise all Form I's and report a LOQ of 6 µg/L for the target parameter bis(2-ethylhexyl)phthalate. A second revision was requested by Draper Aden Associates to reflect the revised LOQ of bis(2-ethylhexyl)phthalate on page 11 of the March 1995 SV MDL study and to review and revise the LOQs of all target parameters for the MW-7 sample on pages 105-108. Due to limited sample volume, an initial volume of 200 ml, instead of 1000 ml, was extracted and concentrated to 1ml, thus the LOQs for all parameters in MW-7 should have been elevated by 5X.

All technical holding times for extraction and analysis were met for the original analyses. Temperature and preservation criteria were also met. Samples were collected on July 10-11, 1995 (SDG-1) and on July 12, 1995 (SDG-2) and were extracted on 7/14-15/95 (SDG-1) and 7/17/95 (SDG-2). Reextraction of the MW-17 sample (MW-17RE) was conducted on 7/20/95 due to low recovery of the acid surrogates. Reextraction of the MW-2 and MW-4 samples (MW-2RE and MW-4RE) was conducted on 7/20/95 due to bis(2 ethylhexyl)phthalate contamination. The MW-9 sample (MW-9RE) was also reextracted for low recoveries of the acid surrogates 2-fluorophenol and 2-chlorophenol-d₄. Holding times for all reextractions were exceeded (MW-17RE, MW-2RE, MW-4RE, MW-9RE). Reextraction analysis results for the acid surrogate recoveries in the MW-17RE and MW-9RE samples duplicated the original analyses results, thus indicating the presence of matrix interference in those samples. Matrix interference, however, was not evident in the MW-

9MS and MW-9MSD analyses. A review of extraction logs and data did not reveal an explanation for this. The MW-12 sample was reanalyzed (MW-12R) for exceeding %D criteria for di-n-octyl phthalate. Di-n-octyl phthalate results for MW-12 are from the reanalysis.

Seven initial calibrations (ICAL) were associated with these sample batches. Seven calibrations were necessary due to the extensive parameter list which were separated into seven mixes to prevent chemical reactions. O,O,O-triethylphosphorothioate exceeded DAA method performance criteria, however, no qualification of the data was deemed necessary. All other SW-846, DAA method performance and contractual requirements were met.

Sixteen continuing calibrations (CCAL) were associated with these sample batches. Parameters were separated into several mixes to prevent reactions. Several target parameters exceeded DAA method performance criteria for %D for the respective associated samples and required qualification as estimated (UJ) for these parameters. (See analytical data set notes).

All surrogate criteria was met for all samples except MW-9 and MW-17. All three acid surrogate recoveries for the MW-17 sample were below 10% as listed on the form II, page 62. Two acid surrogate recoveries for sample MW-9 were below QC limits but greater than 10%. Reextraction and reanalysis of these samples revealed very consistent results with the original analyses. Matrix interference was judged as the cause of the low recoveries of the acid surrogates. Holding times for the reextracted samples for MW-17 and MW-9 were exceeded. Due to acid surrogate recoveries less than 10%, in MW-17 the acid fraction results of the analysis are qualified as unusable (R). Due to low acid surrogate recoveries, although greater than 10%, in MW-9 the acid fraction results of the analysis are qualified as estimated. No matrix interference problems were found in the MW-9MS and MW-9MSD samples. Review of extraction and analytical logs do not reveal a possible explanation for this inconsistency. The following parameters are associated with the acid fraction and are affected by this validation: benzyl alcohol, 4-chloro-3-methyl phenol, 2-chlorophenol, 4-chlorophenol, 2-methylphenol, 3-methylphenol, 4-methylphenol, 2,4-dichlorophenol, 2,6-dichlorophenol, 2,4-dimethylphenol, 4,6-dinitro-2-methylphenol, 2,4-dinitrophenol, 2-nitrophenol, 4-nitrophenol, phenol, 2,3,4,6-tetrachlorophenol, 2,4,5-trichlorophenol and 2,4,6-trichlorophenol.

All blank analysis criteria were met. The target parameter bis(2-ethylhexyl)phthalate was detected above the LOQ in blank SBLK08 and was also detected in associated samples MW-2 and MW-4. The MW-2 and MW-4 samples were reextracted and reanalyzed, but revealed the absence of bis(2-ethylhexyl) phthalate. The presence of bis(2-ethylhexyl)phthalate was judged to be a random laboratory contaminant in the original analyses, since it was not detected in subsequent reanalyses. Bis(2-ethyl hexyl) phthalate results for MW-2 and MW-4 are from the reextraction and reanalyses runs and were estimated due to exceeding the 7 day holding time.

All instrument tuning, surrogate recoveries, internal standard area, internal standard retention time, and matrix spike/matrix spike duplicate requirements were met for all analyses.

No target parameters were detected above the respective laboratory LOQs in any of the twelve core wells: MW-1, MW-2, MW-3, MW-4, MW-6, MW-7, MW-8, MW-9, MW-10, MW-11, MW-12, and MW-17. Results for all parameters were validated as not detected above the LOQ ("U"), with the exceptions noted exceeding %D criteria, resulting in validation as not detected above the LOQ but estimated ("UJ") in numerous samples and exceeding surrogate recovery criteria resulting in validation of the acid fraction target parameters as unusable (R) in MW-17, and estimated (J) in MW-9.

SW-846 GC-Volatile Organic Data Review

Data validation was completed on laboratory analytical results generated from SW-846 Methods 8011, 8021, 8081, 8151, and 8310 for the July 10-13, 1995 first Semi-Annual Assessment Monitoring event at the Watauga County Landfill. The monitoring wells at the Watauga County Landfill are designated as either core or boundary monitoring wells. The core monitoring wells at the landfill are MW-1, MW-2, MW-3, MW-4, MW-6, MW-7, MW-8, MW-9, MW-10, MW-11, MW-12, and MW-17. The boundary monitoring wells are MW-5, MW-13, MW-14, MW-15, MW-16, and MW-18. Sample MW-1A (method 8021 only) was also submitted as a double blind Performance Evaluation Sample (PE) and treated as a core monitoring well. SW-846 Method 8011 was prescribed to analyze for ethylene dibromide (EDB) and 1,2-dibromo-3-chloropropane (DBCP) in the 12 core monitoring wells only. SW-846 Method 8021 was prescribed to analyze for the following 12 target parameters for the core and boundary wells: benzene, chloroethane, 1,1-dichloroethane, 1,1-dichloroethene, cis-1,2-dichloroethene, trans-1,3-dichloropropene, dichlorodifluoromethane, methylene chloride, tetrachloroethene, 1,1,1-trichloroethane, trichloroethene, and vinyl chloride. Five additional target parameters were analyzed for in the core well samples: bromoform, carbon tetrachloride, chloroform, 1,2-dichloroethane, and 1,2-dichloropropane, for a total of 17 parameters. SW-846 Method 8081 was prescribed to analyze for 20 pesticides and PCBs (7 Aroclors) for the core monitoring wells only. SW-846 Method 8151 was prescribed to analyze for 5 herbicides for the core monitoring wells only. SW-846 Method 8310 was prescribed to analyze for benzo[a]pyrene for the core monitoring wells only.

Samples collected from MW-1, MW-3, MW-6, MW-7, MW-8, MW-10, MW-11, MW-13, MW-15, MW-17 and PE sample MW-1A were representative of the first Sample Delivery Group (SDG-1) and samples from MW-2, MW-4, MW-5, MW-9, MW-12, MW-14, MW-16 and MW-18 were representative of the second Sample Delivery Group (SDG-2). Samples were divided into separate SDGs to meet contractual requirements.

GC analyses were performed by CT&E Environmental Services Inc. of Charleston, WV. CT&E analyzed for the aforementioned parameters following the prescribed methods. The

certificate of analysis prepared by CT&E laboratory included: extraction notes, instrument calibration data, raw chromatographic data printouts, Quality Assurance/Quality Control documentation, and tabulated results.

Validation for the laboratory's compliance with GC Methods 8011, 8021, 8081, 8151 and 8310 encompassed review of the following items: sample holding times, sample preservation requirements, sample extraction and purge procedures, laboratory QA/QC performance checks, instrument calibrations, blank analyses, surrogate spike analyses, and matrix spike analyses. Review of transcriptions from raw data to summary sheets and specific calculations were performed on random data points.

Method 8011 Review. Overall, the data set for Method 8011 was complete in its presentation and data was of acceptable quality. A single revision was required to obtain documentation to finalize the quality control deliverables package. The data set exhibited the analyst's ability to achieve the reported LOQ of 0.03 $\mu\text{g/L}$ for both target parameters as outlined by the precision and accuracy data presented by the laboratory. The first nonzero calibration standard was run at a concentration of 0.01 $\mu\text{g/L}$. Criteria for sample preservation and holding times were met. Method retention time criteria were met. Reagent / System / Trip Blank criteria were met. No matrix interference due to coelution with DBCM was found to exist. The laboratory employed a dual column (denoted Channel A and B) GC system to achieve method confirmational requirements. Channel A was used as the primary quantification column and channel B was used for confirmational purposes only. No DBCP was detected in the samples analyzed via channel A; therefore, review of channel B chromatographic information was not warranted. Channel A detected the presence of EDB in the sample from MW-2; however, the detection was unconfirmed by Channel B. The results from MW-2 were validated as undetected, "U". The matrix spike and duplicate analyses exhibited acceptable recoveries of 80-120%. No target parameters were detected above the LOQ in any of the 12 core monitoring wells, (MW-1, MW-2, MW-3, MW-4, MW-6, MW-7, MW-8, MW-9, MW-10, MW-11, MW-12, and MW-17). Results for target parameters not detected above the LOQs in the samples were validated as "U".

Method 8021 Review. Overall, the data set for Method 8021 was generally complete in its presentation and data was of acceptable quality. Draper Aden Associates requested two revisions (Nov. 9, 1995 and Dec. 1, 1995) to have CT&E address the matrix interference in the MW-9 MS and MW-9 MSD analyses, which caused several parameters to fail recovery criteria, and to address CT&E's failure to follow various technical requirements, which resulted in qualification of some of the data. Also requested, in Revision 2, a discussion of the non-detection of chloroethane, dichlorodifluoromethane, and 1,1-dichloroethane in several samples. Specific concerns discovered during data review, which were addressed in the revision requests, are discussed below. The data set exhibited the analyst's ability to achieve the reported LOQ of 2.0 $\mu\text{g/L}$ for all target parameters as outlined by the precision and accuracy data presented by the laboratory and was further supported by the first non-zero calibration standard at a concentration of 2.0 $\mu\text{g/L}$. Analysis for

benzene was conducted via a photoionization detector (PID) and all other parameters were analyzed for via the Hall Electrolytic Conductivity Detector (HECD).

Criteria for sample preservation, temperature, and holding times were met, with the exception of exceeded holding times for the analysis of several parameters which required sample dilution. Results for these parameters were estimated in samples MW-6, MW-8, MW-10, and MW-17. Method retention time criteria were met. Surrogate recoveries for all samples were within laboratory control limits of $100 \pm 20\%$. Blank analysis criteria were met and no target parameters were detected above the LOQ in any laboratory method blanks, Trip Blank-1, or Trip Blank-2.

All initial calibration criteria met SW-846 Method requirements. All continuing calibration criteria met SW-846 requirements with the exception of CCAL-2 on 7/22/95 in which the %Difference (%D) exceeded requirements for 1,2-dichloroethane and trichloroethene. Qualification of the results for these two compounds was required in the associated samples MW-15 and MW-17. Additionally, the CCAL on 7/26/95 failed %D criteria for dichlorodifluoromethane, resulting in qualification of the results for the compound in the associated samples listed in the table in Section E of the Method 8021 GC Volatile Data Review.

Matrix interference was evident in the matrix spike and matrix spike duplicate analyses of MW-9 as noted in CT&E's response to Revision 2. CT&E replied the matrix interference caused several parameters to fail recovery criteria and was also the cause of chloroethane being undetected.

CT&E stated the chloroethane response were "buried" by later coeluting peaks at high concentrations, rendering quantification of chloroethane impossible. As a result of the coelution, CT&E raised the LOQ for chloroethane based on the matrix interference level, from 2.0 ug/L to 5.0-20.0 ug/L depending on the sample, in the associated samples in SDG-2. Due to the raised LOQ, sample results less than these values were validated as ("U"). CT&E conducted confirmational GC/MS analysis by method 8260 for chloroethane, dichlorodifluoromethane and 1,1-dichloroethane, and reported preliminary results, which are consistent with 8260 results provided by ETS Analytical Services, Inc. of Roanoke, VA, for this event, and with past historical event GC/MS data. These values were reviewed strictly for confirmation purposes only, and were not validated.

Samples collected from MW-2, MW-3, MW-4, MW-6, MW-8, MW-9, MW-10, MW-12 and MW-17 were diluted as necessary for specific parameters due to elevated parameter concentrations which exceeded the linear calibration range of 2-40 ug/L. Analysis of the diluted samples was conducted, however, holding times were exceeded for the diluted samples MW-6, MW-8, MW-10, and MW-17. LOQs for all detected parameters of interest, in these samples, were raised accordingly based on the dilutions and estimated due to exceedance of holding times.

A double blind Performance Evaluation Sample (PE), sample identification MW-1A, was prepared by third party laboratory, Environmental Resource Associates (ERA) of Arvada, CO, for

Method 8021. CT&E analyzed for the extended target parameter list of 17 parameters. Validation of the PE results was not conducted by DAA, however, it should be noted that the MW-1A sample was associated with the failed CCAL on 7/22/95 along with the MW-15 and MW-17 samples and results for 1,2-dichloroethane and dichloroethene should be considered estimated. CT&E's analytical results and ERA's certified values and performance acceptance limits are included after the Analytical Data Set Notes tables for review.

Vinyl chloride was detected above the U.S. EPA MCL of 2 ug/L in the MW-3, MW-6, and MW-8 samples, however, further examination of the chromatograms and mass spectra revealed vinyl chloride coeluted with an unknown halogenated freon of mass 68. The coelution of these two compounds presented difficulty in estimating the true concentration of vinyl chloride when in the presence of the other compound. Supporting mass spectra obtained through a library search illustrated the detection of the mass 68 compound, having a significant ion abundance in relation to vinyl chloride's mass 62. Because of the presence of the coeluting compound the ability to accurately quantify the concentration of vinyl chloride may have been inhibited, and is a direct relationship to Method 8021 limitations. As a result of the method limitations and the coelution, the results for vinyl chloride in these samples were estimated as "J".

No Method 8021 target parameters were detected above the LOQ in core monitoring wells MW-1 and MW-4 or in boundary wells MW-5, MW-13, MW-14, MW-16, and MW-18. However, several target parameters were detected above and below the LOQ in core wells MW-2, MW-3, MW-6, MW-7, MW-8, MW-9, MW-10, MW-11, MW-12, and MW-17 and one parameter was detected above the LOQ in boundary well MW-15. All validated results are tabulated in the Analytical Data Set Notes after the Method 8021 GC Volatile Data Review.

The table lists all validated and qualified results for all parameters for all samples. Results for all target parameters not detected above the LOQs were validated as "U".

Method 8081 Review. Overall, the data set was complete in its presentation and data was of acceptable quality. The data set exhibited the analyst's ability to achieve the reported LOQs for the target parameters as outlined by the precision and accuracy data presented by the laboratory. The first nonzero calibration standard was at a concentration equal to or less than the reported LOQs. Criteria for sample preservation, storage temperature, and holding times were met. Five point calibration and continuing calibration criteria were achieved. Endrin breakdown was not observed by the laboratory. The laboratory employed a dual column (denoted Channel A and B) GC system to achieve method requirements. Channel B was used as the primary quantitation column and Channel A was for confirmation purposes. Channel A data was reviewed to disconfirm the presence of target parameters in samples MW-6 and MW-11, as presented in the addendum submitted by the laboratory. Extraction criteria was met by the laboratory and samples were concentrated by an approximate factor of 800 during preparation. Surrogate recoveries between 40-130% were achieved for all samples. No target parameters were identified above the LOQs in any

of the wells. Results for target parameters not detected above the LOQs in the samples were validated as "U".

Method 8151 Review. Overall, the data set for Method 8151 was complete in its presentation and data was of acceptable quality. The data set exhibited the analyst's ability to achieve the reported LOQs for the target parameters as outlined by the laboratory precision and accuracy statement. Criteria for sample preservation, holding times, and temperature requirements were met. Samples were extracted and concentrated by a factor of 100 as specified in Method 8151.

The laboratory employed a dual column (denoted Channel A and B) GC system to achieve confirmational requirements. Channel B was used as the primary quantitation column and channel A was used for confirmational purposes only. The five point method calibration criteria were met with the exception of 2,4,5-T, Dinoseb and pentachlorophenol. These parameters were not detected by the laboratory, therefore no corrective action or qualification was warranted. Method retention time criteria were met. Continuing calibration criteria was met.

Surrogate recovery limits of 40-120% were met for all samples. Method, extraction, and trip blank criteria were met. Matrix spikes recovery limits of 40-120% were achieved for all spiking parameters. No target parameters were reported by the laboratory as being detected in any sample. Channel A data was reviewed to disconfirm the presence of target parameters in samples MW-3, MW-4, MW-8, and MW-17, and an addendum was submitted by the laboratory. Results for target parameters not detected above the LOQ in the samples were validated as "U".

Method 8310 Review. Overall, the data set for Method 8310 was complete in its presentation and data was of acceptable quality. The data set exhibited the analyst's ability to achieve the reported LOQ of 1.0 µg/L for benzo[a]pyrene as outlined by the laboratory's precision and accuracy statement. A matrix spike and spike duplicate was performed at a concentration of 0.05 ug/L indicating that the data would support an LOQ equal to 0.05 ug/L, therefore, an LOQ of 0.05 ug/L was established for the data set. The first non-zero calibration standard was at a concentration equivalent to a 0.03 µg/L extracted sample concentration.

Criteria for samples preservation, holding times, and storage temperatures were met. Samples were extracted and concentrated following Method 8310 sample preparation protocol. Method retention time criteria were met. Surrogate recoveries for all samples were within laboratory control limits of 40% to 120%. Extraction blank analysis criteria were met and no benzo[a]pyrene was identified above the LOQ in the trip or laboratory control blank. Matrix spikes were performed and no indication of matrix interference was observed. The matrix spike and spike duplicate analyses exhibited acceptable recoveries between 40-140%. No benzo[a]pyrene was reported by the laboratory as being detected in any of the samples. Benzo[a]pyrene results not detected above the LOQ were validated as "U".

V. DISCUSSION OF ANALYTICAL RESULTS

Tables 2A-D (Assessment Target Parameter Analytical Results; Appendix I) provide a summary of the target parameter analytical results obtained from the first semi-annual sampling event (also the first *annual comprehensive* event). These results were validated in-house by Draper Aden Associates according to the discussion provided in Sections III and IV of this report. Tables 2A-D lists for each parameter, as applicable, a Maximum Contaminant Level (MCL) established by the USEPA and groundwater quality standards established by the state of North Carolina (NCS), the Instrument Detection Level (IDL) for CLP-Inorganic results, the Contract Required Quantitation Limit (CRQL) for CLP-Organic results, the Limit of Quantitation (LOQ) for LLRA-Organic results, and the analytical method.

Estimated analytical results for the target parameters are provided in Tables 2A-D for preliminary assessment purpose only. Estimated analytical data is not intended for use in determining regulatory compliance issues.

A summary of additional non-target parameter analytical results obtained from the first annual comprehensive sampling event is provided in Table 3A and 3B, for organic and metal parameters, respectively. Non-target parameter data is provided for preliminary assessment purpose only and is not intended for use in determining regulatory compliance issues.

5.1 Inorganic Analytical Results

i. Target Inorganic Parameters

The evaluation of existing inorganic data on twelve (12) metal parameters, collected prior to development of the Assessment Plan, indicated the tentative presence of four (4) metals at elevated concentrations in the groundwater beneath the Watauga County Landfill. Previous metal concentrations detected in the groundwater are generally low or are below analytical method quantitation limits. However, two metals, Cadmium and Iron, were historically observed at levels above those established by the EPA MCL and Secondary MCL, respectively. Barium, a common naturally occurring parameter, was also observed at relatively elevated levels, but below water quality standards. Mercury was also detected, although only once for each well in the six or more sampling and analysis events previously conducted.

The analytical results for the four target metal parameters, Barium, Cadmium, Iron, and Mercury, obtained from the first semi-annual assessment sampling event are summarized in Tables 2A and 2B and discussed below. A discussion of parameter distribution trends for each target parameter is presented in the following Section VI.

see next page
for ND metals
is detected
metals

The analytical results for fifteen (15) non-target metal parameters obtained from the first semi-annual assessment sampling event (also the first *annual comprehensive event*) are summarized in Table 3B and also discussed below. A discussion of parameter distribution trends for all detected non-target metal parameters is also presented in the following Section V.

The two metal target parameters, Barium and Iron, both common naturally occurring parameters, have been detected in all monitoring wells and surface water sampling locations, as a result of the previous background Assessment monitoring events (Table 5C). Although observed in all of the monitoring wells and surface water sampling locations, Barium was detected at levels below the EPA MCL and North Carolina groundwater standard of 2,000 µg/l as a result of all four background Assessment background monitoring events. Concentrations of Iron were often at levels significantly above associated water quality criteria. No Federal Primary Drinking Water Standard (EPA MCL) exists for Iron. Similar Barium and Iron concentrations were observed as a result of the first semi-annual assessment monitoring.

Review of Tables 2A and 2B indicates the first semi-annual total Cadmium and total Mercury CLP analysis resulted in the non-detection of Cadmium and Mercury in all eighteen (18) monitoring wells and five (5) surface water sampling locations sampled. Since Cadmium and Mercury were also not detected as a result of the initial four (4) background assessment monitoring analyses, Cadmium and Mercury will be removed from the existing target parameter list.

ii. Non-Target Inorganic Parameters

The comprehensive analysis of fifteen (15) non-target metal parameters resulted in the non-detection of the following eight (8) metals:

- Antimony
- Arsenic
- Beryllium
- Cyanide
- Selenium
- Silver
- Thallium and
- Tin

The following three (3) metals were only observed in one core monitoring well, MW-3, and at levels far below EPA MCL and North Carolina groundwater standards:

- Copper
- Lead
- Zinc

The remaining four (4) metals were observed in three (3) or more core monitoring wells, although also at levels far below EPA MCL and North Carolina groundwater standards.

- Chromium
- Cobalt
- Nickel
- Vanadium

These four (4) metals will be added to the existing target parameter list. Four (4) independent samples will be collected and analyzed for these four (4) metals during the following four (4) semi-annual sampling events at all core and boundary assessment wells to establish background.

Sulfide was also included in the first comprehensive events analysis. Sulfide was only observed in one core monitoring well, MW-4, and only detected in MW-4 at a concentration equal to the detection limit. Since no organic compounds or elevated metal levels have been previously detected in MW-4 (note: MW-4 was recently downgradient to boundary status, see Section I.), it is unlikely that the Sulfide detected in MW-4 is a related groundwater impact.

5.2 Organic Analytical Results

i. Target Organic Parameters

The evaluation of existing organic data, compiled prior and during development of the Assessment Plan, indicated the tentative presence of twelve (12) primary target organic parameters occurring in the groundwater beneath the Watauga County Landfill. The analytical results for the target organic parameters obtained from the first semi-annual assessment sampling event are summarized in Tables 2 A-D. The recent analytical results obtained from each target organic parameter is individually discussed below. A discussion of distribution trends for each target organic parameter is presented in the following Section VI.

1,1-Dichloroethane (1,1-DCA)

1,1-Dichloroethane (1,1-DCA) was detected at concentrations below the proposed North Carolina groundwater standard (NCS) of 700 µg/l in ten core groundwater monitoring wells (MW-2, MW-3, MW-6, MW-7, MW-8, MW-9, MW-10, MW-11, MW-12 and MW-17). No EPA MCL exists for 1,1-DCA. Concentrations of 1,1-DCA (detected both above and below the method CRQL) were also observed below the NCS at four surface water sampling locations (S-1, S-2, S-4, and S-5.)

Tetrachloroethene (PCE)

Tetrachloroethene (PCE) was detected at concentrations above the EPA MCL of 5 µg/l and above the North Carolina groundwater standard (NCS) of 0.7 µg/l in eight core groundwater monitoring wells (MW-2, MW-3, MW-6, MW-8, MW-10, MW-11, MW-12, and MW-17) and one surface water sampling location (S-4). Tetrachloroethene (PCE) was detected at concentrations equal to (SW-846 method 8021) and below (SW-846 method 8260) the EPA MCL of 5 µg/l and above the North Carolina groundwater standard (NCS) of 0.7 µg/l in one additional core groundwater monitoring well (MW-9). PCE was not detected in any of the boundary monitoring wells.

PCE was also detected at concentrations above the EPA MCL and NCS at one surface water sampling location (S-2). PCE was not detected at any other surface water sampling locations.

Trichloroethene (TCE)

Trichloroethene (TCE) was detected at concentrations above the EPA MCL of 5 µg/l and above the NCS of 2.8 µg/l in seven core groundwater monitoring wells (MW-3, MW-6, MW-8, MW-9, MW-11, MW-12, and MW-17). An estimated concentration for TCE (detected below the method LOQ) was observed below the EPA MCL and above the NCS in MW-11 utilizing SW-846 method 8260. An estimated concentration for TCE (detected below the method CRQL) was observed above the EPA MCL and above the NCS in one surface water sampling location (S-4) utilizing CLP methods. TCE was also estimated (detected below the method LOQ/CRQL) at concentrations below the EPA MCL and NCS in two additional core groundwater monitoring wells (MW-2 and MW-7) and one additional surface water sampling location (S-2). TCE was not detected in any of the boundary monitoring wells.

cis-1,1-Dichloroethene (cis-1,2-DCE)

As previously discussed in Section III, CLP-SOW analytical results (utilized with surface water samples only, for the first semi-annual event) for cis-1,2-Dichloroethane are reported as part of a total concentration of cis- and trans- isomers of the parameter.

Cis-1,2-Dichloroethene (cis-1,2-DCE) was detected at concentrations above the EPA MCL and North Carolina groundwater standard (NCS) of 70 µg/l in three core groundwater monitoring wells (MW-6, MW-8, and MW-17). Cis-1,2-DCE was also detected below the EPA MCL and NCS in five additional core monitoring wells (MW-3, MW-7, MW-9, MW-11, and MW-12). Total 1,2-DCE was observed (detected above the method CRQL) at a concentration below the EPA MCL and NCS at one surface water sampling location (S-4). Estimated concentrations for total 1,2-DCE (detected below the method CRQL) were observed below the EPA MCL and NCS at two additional surface water sampling locations (S-1 and S-2).

Dichlorodifluoromethane

Concentrations for Dichlorodifluoromethane (detected both above and below applicable method LOQs) were observed above the North Carolina groundwater standard (NCS) of 0.19 µg/l in seven core groundwater monitoring wells (MW-3, MW-6, MW-8, MW-9, MW-11, MW-12, and MW-17). An estimated concentration for Dichlorodifluoromethane (detected below the method CRQL) was also observed above the North Carolina groundwater standard (NCS) of 0.19 µg/l at one surface water sampling location (S-5). No EPA MCL exists for Dichlorodifluoromethane. Dichlorodifluoromethane was not detected at any other surface water sampling locations or in any of the boundary monitoring wells.

1,1,1-Trichloroethane (1,1,1-TCA)

1,1,1-Trichloroethane (1,1,1-TCA) was detected at concentrations above the EPA MCL and North Carolina groundwater standard (NCS) of 200 µg/l in two core monitoring wells (MW-2 and MW-10). 1,1,1-TCA was also detected below the EPA MCL and NCS in six additional core monitoring wells (MW-3, MW-8, MW-9, MW-11, MW-12, and MW-17) and one boundary groundwater monitoring well (MW-15).. Estimated concentrations of 1,1,1-TCA (below the method CRQL) were also observed below the EPA MCL and NCS at two surface water sampling locations (S-2 and S-4).

1,1-Dichloroethene (1,1-DCE)

1,1-Dichloroethene (1,1-DCE) was detected above the method LOQ at concentrations above the EPA MCL and NCS of 7 µg/l in two core groundwater monitoring wells (MW-2 and MW-10). . 1,1-DCE was also detected (observed both above and below applicable method LOQs) at concentrations below applicable water quality standards in six additional core wells (MW-3, MW-6, MW-8, MW-11, MW-12, and MW-17). 1,1-DCE was not detected in any of the boundary monitoring wells or surface water samples.

Benzene

Concentrations of Benzene were observed above the EPA MCL of 5 µg/l and above the NCS of 1 µg/l in two core groundwater monitoring wells (MW-6 and MW-8). Benzene was also detected below the EPA MCL but above the NCS in three additional core groundwater monitoring wells (MW-3, MW-7, AND MW-9). Benzene was not detected at any of the surface water sampling locations.

Vinyl Chloride

Concentrations of Vinyl Chloride (detected both above and below applicable LOQs) were observed at concentrations above the EPA MCL of 2 µg/l and above the North Carolina groundwater standard (NCS) of 0.015 µg/l in four core groundwater monitoring wells (MW-3, MW-6, MW-8, and MW-12). An estimated concentration of Vinyl Chloride (detected below the CLP method CRQL) was observed at concentrations above the EPA MCL of 2 µg/l and above the North Carolina groundwater standard (NCS) of 0.015 µg/l at one surface water sampling location (S-4). A low level concentration of Vinyl Chloride (detected below the method LOQ utilizing SW-846 method 8021) was also observed in one additional groundwater monitoring well (MW-17) at and estimated concentration below the EPA MCL but above the NCS.

Methylene Chloride

Methylene Chloride was observed above the EPA MCL and NCS of 5 µg/l in one core groundwater monitoring well (MW-9). Although not detected in any other groundwater monitoring wells utilizing SW-846 method 8260, Methylene Chloride was detected (observed both above and below the method LOQ) at concentrations below the EPA MCL and NCS in six additional core groundwater monitoring wells (MW-3, MW-6, MW-8, MW-11, MW-12, and MW-17) and two boundary groundwater monitoring wells (MW-13 AND MW-18) utilizing SW-846 method 8021. Methylene Chloride was not detected at any surface water sampling location.

Chloroethane

Chloroethane was detected in seven core groundwater monitoring wells (MW-3, MW-6, MW-7, MW-8, MW-9, MW-12, and MW-17) and at three surface water sampling locations (S-1, S-4, and S-5). No EPA MCL or North Carolina groundwater standard (NCS) exists for Chloroethane.

trans-1,3-Dichloropropene

Trans-1,3-Dichloropropene was not detected in any monitoring wells or surface water samples

ii. Non-Target Organic Parameters

The analytical results of additional detected non-target organic parameters are summarized in Table 3A. The analytical results obtained for non-target parameters, are provided to preliminary identify those parameters which may need to be continually monitored. If upon completion of background data collection, the presence of any non-target parameters are confirmed by repeated analysis, the parameter will be added to the Target Parameter list.

Additional non-target parameters were detected in seven monitoring wells and two surface water sampling locations. For the monitoring well analyses, six non-target parameters were detected utilizing SW-846 method 8260 and three non-target parameters were detected utilizing SW-846 method 8021. Two of the three non-target parameters detected by method 8021 were also detected by method 8260. For the surface water analyses, four non-target parameters were detected utilizing CLP SOPs. Detected non-target parameters and associated sampling points are presented below.

<u>Detected Non-target Parameter(s)</u>	<u>Monitoring Point(s)</u>
Trichlorotrifluoromethane and Bromomethane	MW-3
trans-1,2-Dichloroethene	MW-3, 6, 7, & MW-8
1,2-Dichloroethane	MW-3, 8, & MW-17
1,2-Dichloropropane	MW-3, 6, 7, & MW-8
1,4-Dichlorobenzene	MW-8
2-Butanone	MW-7, 8, 10, & S-2
o-Xylene	MW-9
m/p-Xylene	S-1
total Xylene	S-2
Toluene	S-2
Ethylbenzene	S-2

All but two of the detected non-target parameter concentrations were observed at levels below corresponding method LOQs and EPA MCLs. Estimated concentrations for two of the detected non-target parameters, 1,2-Dichloroethane and 1,2-Dichloropropane, were observed at levels above the NCS.

As indicated in Table 6A (Cumulative Detected Non-target Organic Parameter Analytical Results), the presence of the non-target compounds detected in the first semi-annual sampling event are not confirmed by the non-target analytical results obtained from the previous background sampling events. Confirmation of the presence or absence of these non-target parameters and tentatively identified compounds will continue to be evaluated on the following semi-annual monitoring events.

VI. PARAMETER DISTRIBUTION TRENDS

6.1 Inorganic Analytical Results

Mercury (total)

The presence of Mercury in the groundwater at the site is not supported by the analytical results of all four assessment background monitoring events and the first comprehensive annual EPA Appendix II List sampling event. No concentrations of Mercury were observed above the IDL of 0.20 $\mu\text{g/l}$. Since Mercury is confirmed to be absent, it is proposed that Mercury be removed from the target parameter list.

Cadmium (total)

The presence of Cadmium in the groundwater at the site is not supported by the analytical results of all four assessment background monitoring events and the first comprehensive annual EPA Appendix II List sampling event. The recent comprehensive event detected no concentrations of Cadmium observed above the IDL of 0.5 $\mu\text{g/l}$. The only Cadmium detected in all four background events was detected in the low production well MW-7 (12.3 $\mu\text{g/L}$) on the fourth background sampling event. The three previous background sampling events resulted in the non-detection of Cadmium in MW-7.

Barium (total)

Barium distribution trends, indicated by the analytical results of the first comprehensive annual EPA Appendix II List sampling event, suggest a relationship between Barium distribution and proximity to both the waste disposal area and the west drainage. Although Barium was detected at every point sampled, half of the Barium detected in the groundwater at the site was reported at concentrations less than 100 $\mu\text{g/l}$. The EPA MCL and the NCS for Barium is 2000 $\mu\text{g/l}$.

Barium was observed above 100 $\mu\text{g/l}$ in nine monitoring wells. In three of the monitoring wells located near the waste disposal area (MW-5, MW-6 and MW-9), Barium was observed at concentrations above 400 $\mu\text{g/l}$. Barium was also observed at elevated levels above 100 $\mu\text{g/l}$ for MW-11 (199 $\mu\text{g/l}$), located below the Boone-Nissan septic field; for MW-2 (210 $\mu\text{g/l}$) and MW-10 (103 $\mu\text{g/l}$), located within the bedrock aquifer in the drainage below the waste disposal area; for MW-1 (125 $\mu\text{g/l}$), located adjacent and upgradient of the waste disposal area; and for MW-13 (116 $\mu\text{g/l}$), a boundary well located in the extreme NW portion of the site. MW-13 has not exhibited the confirmed presence of organic compounds to date.

Elevated concentrations of Barium above 250 µg/l were also detected in all the surface water monitoring locations; i.e. S-1 (502 µg/l), S-2 (592 µg/l), S-3 (277 µg/l), S-4 (861 µg/l), and S-5 (310 µg/l).

Iron (total)

Iron distribution trends, indicated by the analytical results of the first comprehensive annual EPA Appendix II List sampling event, also indicate a relationship between Iron distribution and proximity to the waste disposal area. The monitoring wells for which Iron was observed at the highest concentrations, MW-6 (7980 µg/L) and MW-3 (4480 µg/l), are located adjacent and west of the waste disposal area. Iron was also observed at elevated levels above 100 µg/l in MW-10 (508 µg/l), located in the drainage below the waste disposal area; MW-1 (646 µg/l), located adjacent and upgradient of the waste disposal area; and MW-8 (455 µg/l), located adjacent and west of the waste disposal area. An exception to this distribution trend, was the location where the third most elevated Iron concentrations was detected, i.e. monitoring well MW-13 (3960 µg/l), a boundary well located in the extreme NW portion of the site. MW-13 has not exhibited the confirmed presence of organic compounds to date.

Elevated concentrations of Iron above 1000 µg/l were also detected in all the surface water monitoring locations; i.e. S-1 (19,400 µg/l), S-2 (36,100 µg/l), S-3 (5740 µg/l), S-4 (1290 µg/l), and S-5 (87,900 µg/l).

6.2 Organic Analytical Results

i. Target Organic Parameters

1,1-Dichloroethane (1,1-DCA)

1,1-Dichloroethane (1,1-DCA) distribution trends, as indicated by the SW-846 Method 8260 analytical results, reveal 1,1-DCA was observed at elevated concentrations in more monitoring wells and occurs more pervasively throughout the site than any other target parameter. No established EPA MCL or NCS exists for 1,1-DCA.

1,1-DCA was observed at the highest concentrations (although below the proposed North Carolina groundwater quality standard of 700 µg/l) in the nested well pair, shallow MW-3 (160 µg/l) and deep well MW-17 (130 µg/l), located at the downgradient property boundary of the Bolick site. Elevated concentrations of 1,1-DCA were also observed between the landfill and the Bolick site at MW-6 (130 µg/l) and within the Bolick site at MW-8 (71 µg/l), and downgradient of the Bolick site at the nested well pair, shallow well MW-11 (26 µg/l) and deep well MW-12 (120 µg/l E).

Elevated concentrations of 1,1-DCA were also observed in the deep well MW-10 (55 µg/l), located below the waste disposal area, and the deep well MW-2 (94 µg/l), located in the drainage below the waste disposal area. 1,1-DCA was not detected in the shallow wells MW-4 and MW-16, located in the northern drainage basin below the landfill.

Elevated concentrations of 1,1-DCA were also observed at MW-9 (40 µg/l), located along the southern saddle above the landfill.

A lower level concentration of 1,1-DCA was observed at MW-7 (6.8 µg/l), located south of the Bolick site.

Tetrachloroethene (PCE)

Tetrachloroethene (PCE) distribution trends, as indicated by the SW-846 Method 8260 analytical results, show that with few exceptions, PCE was detected primarily along the west drainage basin adjacent to the landfill, located within and below the "Bolick" site.

PCE was detected at concentrations above the EPA MCL (5 µg/l) in the nested well pair located at the downgradient property boundary of the Bolick site; i.e. shallow well MW-3 (37 µg/l) and deep well MW-17 (30 µg/l). PCE was also detected downgradient of the Bolick site at concentrations above the EPA MCL in the nested well pair located below the Boone-Nissan septic field; i.e. shallow well MW-11 (8.1 µg/l) and the deep well MW-12 (31 µg/l). PCE was similarly detected above the EPA MCL in MW-8 (38 µg/l), located with the Bolick site, and in MW-6 (14 µg/l), located between the landfill and the Bolick site.

PCE was also detected at concentrations above the EPA MCL (5 µg/l) in the surface water sampling location situated in the west drainage, S-4 (11 µg/l).

Other PCE detections were observed at lower concentrations above the EPA MCL in MW-2 (9.9 µg/l) and in MW-10 (5.7 µg/l), located within the bedrock aquifer in the north drainage below the waste disposal area. PCE was not detected in the shallow soil wells, MW-4 and MW-16, located in the northern drainage basin below the landfill.

Trichloroethene (TCE)

Trichloroethene (TCE) distribution trends, as indicated by the SW-846 Method 8260 analytical results, are similar to PCE distribution trends. With one exception (MW-9), TCE was only detected along the west drainage basin adjacent to the landfill, located within and below the Bolick site.

TCE was detected at the highest concentration in monitoring well MW-6 (47 µg/l), located adjacent to the landfill, within the Bolick site. Elevated concentrations for TCE were also observed in the deeper well adjacent to MW-6, MW-8 (15 µg/L). Elevated concentrations for TCE were also observed in the nested well pair located at the downgradient property boundary of the Bolick site; i.e. shallow well MW-3 (16 µg/l) and deep well MW-17 (17 µg/l). TCE was also detected downgradient of the Bolick site in the nested well pair located below the Boone-Nissan septic field; i.e. deep well MW-12 (13 µg/l) and shallow well MW-11 (estimated at 3.1J µg/l). TCE was detected for the second time in MW-7 (estimated at 1.2 J µg/L), located immediately south of the Bolick site and adjacent and west of the disposal area.

TCE was also estimated at concentrations above the EPA MCL (5 µg/l) in the surface water sampling location situated in the west drainage, S-4 (8J µg/l).

The only TCE observed outside of the west drainage basin was detected in MW-9 (6 µg/l), located between the landfill and the Rocky Mountain Heights Subdivision, and the spring capture outfall, S-2, located in the north drainage below the disposal area (1J µg/l).

cis-1,2-Dichloroethene (cis-1,2-DCE)

Cis-1,2-Dichloroethene (cis-1,2-DCE) distribution trends, as indicated by the SW-846 Method 8260 analytical results, are similar to PCE, TCE, and Dichlorodifluoromethane distribution trends. With one exception (MW-9), cis-1,2-DCE was only detected along the west drainage basin adjacent to the landfill, located within and below the Bolick site.

Cis-1,2-DCE was observed at the highest concentrations (above the EPA MCL and NCS of 70 µg/l) in MW-6 (430 µg/l) and MW-8 (89 µg/l), located adjacent to the landfill and the Bolick site. Elevated concentrations of cis-1,2-DCE (below the EPA MCL and NCS) were also observed in the nested well pair located at the downgradient property boundary of the Bolick site i.e. shallow well MW-3 (50 µg/l) and deep well MW-17 (63 µg/l) and downgradient of the Bolick site at the nested well pair, shallow well MW-11 (7.6 µg/l) and deep well MW-12 (42 µg/l).

Lower level detections of cis-1,2-DCE were observed at the two monitoring wells, MW-7 (7.9 µg/l), located south of the Bolick site, and MW-9 (6.2 µg/l), located along the southern saddle above the landfill.

As previously discussed in Section III, surface water samples were analyzed utilizing CLP analytical methods. CLP-SOW analytical results for cis-1,2-Dichloroethene were reported as a total concentration of cis- and trans- isomers of the parameter. Total 1,2-Dichloroethene was detected at three surface water sampling locations; S-1 (estimated at 1J µg/l), S-2 (estimated at 3J µg/l), and S-4 (42 µg/l).

Dichlorodifluoromethane 1400

Dichlorodifluoromethane distribution trends, as indicated by the SW-846 Method 8260 analytical results, are similar to PCE, TCE, and cis-1,2-DCE distribution trends. Elevated concentrations of Dichlorodifluoromethane were observed in the west drainage in MW-3 at 7.2 µg/l and in MW-8 at 6.7 µg/l. Both of these estimated Dichlorodifluoromethane concentrations are above the North Carolina groundwater standard (NCS) of 0.19 µg/l. No EPA MCL exists for Dichlorodifluoromethane.

Lower estimated concentrations (below the method LOQ) of Dichlorodifluoromethane were also observed in four other monitoring wells located within the west drainage basin adjacent to the landfill; MW-6 (2.2J µg/l), MW-11 (1.7J µg/l), MW-12 (4.0J µg/l), and MW-17 (4.2J µg/l), and in MW-9 (2.8J µg/l), located between the landfill and the Rocky Mountain Heights Subdivision.

1,1,1-Trichloroethane (1,1,1-TCA) 200

1,1,1-Trichloroethane (1,1,1-TCA) distribution trends, as indicated by the SW-846 Method 8260 analytical results, show that 1,1,1-TCA, although occurring pervasive throughout the core of the site, was observed at the highest concentrations in the bedrock of the northern drainage basin below the landfill. 1,1,1-TCA was observed above the EPA MCL and NCS of 200 µg/l in the bedrock wells, MW-2 (1600 µg/l) and MW-10 (740 µg/l), located in the northern drainage below the landfill. 1,1,1-TCA was notable absent from the shallow soil wells, MW-4 and MW-16, located with the same drainage, adjacent to and downgradient, respectively, of MW-2.

1,1,1-TCA was also observed at lower concentrations, below the EPA MCL and NCS, in both the deep and shallow wells of the two nested pairs located in the west drainage basin; shallow MW-3 (21 µg/l) and deep MW-17 (7 µg/l), and shallow MW-11 (estimated at 4.8J µg/l) and deep MW-12 (16 µg/l), at and downgradient of the Bolick Site property boundary, respectively. An estimated concentration (below the LOQ) of 1,1,1-TCA was also observed in MW-8 (4.9J µg/l), located upgradient of these two nested pairs of wells in the west drainage basin.

1,1,1-TCA was additionally detected in MW-9 (9.8 µg/l), located adjacent to the Carroll property and detected (utilizing SW-846 Method 8021) in the boundary monitoring well MW-15 (2.7 µg/l), located adjacent to Rocky Branch.

1,1-Dichloroethene (1,1-DCE) 7

1,1-Dichloroethene (1,1-DCE) distribution trends, as indicated by the SW-846 Method 8260 analytical results, show that 1,1-DCE was observed at the highest concentrations in the bedrock of the northern drainage basin below the landfill. The highest concentrations for 1,1-DCE were observed in the deep bedrock well MW-2 (170 µg/l), located in northern drainage basin below

the landfill and in the bedrock well MW-10 (88 µg/l), located in the northern drainage directly below the fill areas. 1,1-DCE was not detected in the shallow soil wells, MW-4 and MW-16, located in the northern drainage basin below the landfill.

Monitoring wells located in the west drainage basin reveal either low level, estimated concentrations or the non-detection of 1,1-DCE. 1,1-DCE was observed below the method LOQ (estimated) for five monitoring wells located in the west drainage basin; MW-3 (3.7J µg/l), MW-6 (1.3J µg/l), MW-8 (4.1J µg/l), MW-12 (3.6J µg/l), and MW-17 (1.6J µg/l). 1,1-DCE was not detected in the shallow well MW-11, located adjacent to the deep well MW-12 in this west drainage basin.

Benzene |

Benzene distribution trends, as indicated by the SW-846 Method 8260 analytical results, suggest a relationship between Benzene distribution and proximity to both the waste disposal area and the west drainage.

Benzene was detected at concentrations above the EPA MCL (5 µg/l) and NCS (1 µg/l) in the nested well pair located adjacent and west of the disposal area., shallow well MW-6 (13 µg/l) and deep well MW-8 (5.5 µg/l). Estimated Benzene concentrations between the lower North Carolina groundwater quality standard (NCS) and the higher EPA MCL were observed randomly distributed about the site in three other core wells; MW-3 (2.6J µg/L), MW-7 (2.7J µg/L), and MW-9 (3.8J µg/L).

Vinyl Chloride 0.015

Vinyl Chloride distribution trends, indicated by the SW-846 Method 8260 analytical results indicate levels of Vinyl Chloride above the EPA MCL (2 µg/l) and NCS (0.015 µg/l) in the west drainage adjacent to the landfill in MW-6 (23 µg/l), located between the landfill and the Bolick site, and MW-8 (7.2 µg/l), located within the Bolick site. An estimated level of Vinyl Chloride was also detected above the NCS (0.015 µg/l) in MW-3 (3.1J µg/l), located in the west drainage at the downgradient property boundary of the Bolick site.

Methylene Chloride 5

Methylene Chloride distribution trends, as indicated by the SW-846 Method 8260 analytical results, show that Methylene Chloride was only observed at two disparate locations. The detection of Methylene Chloride at the highest concentration was observed in MW-9 (160 µg/l), located adjacent to the Carroll Residence, between the landfill and the Rocky Mountain Heights Subdivision. This Methylene Chloride concentration is well above the EPA MCL and North

Carolina groundwater standard (NCS) of 5 µg/l. The other lower level detection of Methylene Chloride was observed in MW-12 (5.9 µg/l).

Methylene Chloride distribution trends, as indicated by the SW-846 Method 8021 analytical results, reveal lower level detection of Methylene Chloride repeatedly observed along the west drainage basin adjacent to the landfill, located within and below the Bolick site. Methylene Chloride was observed below the EPA MCL and North Carolina groundwater standard (NCS) for six monitoring wells located in the west drainage basin; MW-3 (2.4 µg/l), MW-6 (1.2J µg/l), MW-8 (4.7 µg/l), MW-11 (2.9 µg/l), MW-12 (3.3 µg/l), and MW-17 (2.2 µg/l). Estimated concentrations of Methylene Chloride were also detected in the two nested boundary monitoring wells, MW-13 and MW-18, located further downgradient along the west drainage basin.

Chloroethane NS

Chloroethane distribution trends, as indicated by the SW-846 Method 8260 analytical results, indicate that Chloroethane was observed at the highest concentration in MW-9 (21 µg/l), located adjacent to the Carroll property, and well MW-7 (22 µg/l), located south of the Bolick site, adjacent to the disposal area.

Elevated concentrations of Chloroethane were also observed in five core monitoring wells located in the west drainage; shallow well MW-3 (8.7 µg/l), located adjacent to deep well MW-17 (estimated at 4.9 J µg/l), deep well MW-12 (6.4 µg/l), located adjacent to shallow well MW-11 (not detected), MW-6 (16 µg/l), located between the landfill and the Bolick site, and in MW-8 (9.3 µg/l), located within the Bolick site.

trans-1,3-Dichloropropene NS

The presence of trans-1,3-Dichloropropene in the groundwater at the site is not supported by the analytical results of the first comprehensive assessment monitoring event. Previous background organic analysis results indicated trans-1,3-Dichloropropene is not present in the groundwater beneath the site.

Since upon completion of background data collection and the first annual EPA Appendix II list sampling event (utilizing LLRA analytical methods), the absence of trans-1,3-Dichloropropene in the groundwater and surface waters at the site is confirmed, trans-1,3-Dichloropropene will be removed from the Target Parameter List.

ii. **Non-target Organic Parameters**

As previously discussed in Section IV.B.ii, additional non-target parameters were detected in seven monitoring wells and two surface water sampling locations (Table 3A, Appendix I). These

seven monitoring wells, MW-3, MW-6, MW-7, MW-8, MW-9, MW-10, and MW-17, are all core monitoring wells, preferentially located both adjacent to the waste disposal area and within the west drainage. Five non-target parameters were detected in two of these monitoring wells, MW-3 and MW-8, although all five parameters were observed at concentrations below the corresponding SW-846 method LOQ. The two surface water monitoring locations, S-1 and S-2, are monitoring points that also show impact by select target compounds. Four non-target parameters were detected in one of these surface water sampling locations, although again at concentrations below the corresponding CLP method CRQL.

Non-target parameter distribution trends will continue to be evaluated. These non-target compounds have not been repeatedly detected in these wells as a result of previous background analyses (Table 6A, Appendix I). The isolated detection of these non-target compounds in these wells is not indicative of a pervasive, persistent occurrence.

VII. POTABLE WELL SAMPLING AND ANALYSIS PROGRAM

The initial domestic and commercial use potable well sampling event was developed and conducted by Draper Aden Associates on March 5, 1993 at the direction of Watauga county and approval of State officials to protect public health and welfare. The ongoing potable water well sampling and analysis program is currently being jointly conducted by the Appalachian District Health Department (ADHD) and the North Carolina State Laboratory of Public Health.

The objective of the potable well sampling and analysis program is to investigate and evaluate the potential influence and associated risks of the landfill on neighboring groundwater resources. Potable well water samples collected by the ADHD are analyzed for volatile organic compounds by the State Laboratory utilizing EPA Method 502.2. Potable water well locations with accompanying sampled well reference number can be found on the Site Map (Figure 1). A summary of the analytical results of the potable well testing program collected to date are presented in Appendix IV.

The analytical results of the domestic and commercial use potable water well sampling and analysis program previously indicated that two (2) of the forty-one (41) sampled potable wells neighboring the landfill are significantly impacted by volatile organic compounds. These two (2) significant impacted wells are the Carroll residence (well reference no. 12) and the Nissan-Mazda Dealership well (well reference no. 4). The analytical results are from testing conducted in March 1993, and have been included in earlier reports.

At this time the cause or source of all the organics detected in the potable well sampling program cannot be determined. It should be noted that eight (8) of twenty-one (21) compounds detected in the Carroll residence potable well have not been detected in the landfill monitoring well network. The differences in parameter "fingerprints" in groundwater beneath these sites compared to "fingerprints" for landfill wells tends to indicate potential impacts resulting from activities specifically undertaken on these sites and/or immediately around the private well heads and/or components of the well systems.

Review of the analytical results from all the potable well sampling conducted recently, performed by the NC Department of Epidemiology, indicate that the sampled well waters are acceptable for all uses due to either non-detection or low level detection of organic analytes. The two (2) potable water wells previously identified as significantly impacted have been replaced by alternative water sources and have not been resampled during the past year. Individual potable well analytical results obtained recently are discussed below. Discussions of individual potable well analytical results obtained previously can be found in Section 2.10 of the Assessment Plan (dated Sept. 3, 1993), Section III of the Activity Report (dated June 29, 1994), and Section VII of the Third Quarter Background Monitoring Event Report (dated August 31, 1995).

7.1. April 26, 1995 Sampling Event

Three potable wells were resampled on April 26, 1995. Two of these three potable wells have previously shown trace and/or low level detections. These two potable wells included one residence located in the Rocky Mountain Heights Subdivision, immediately downgradient and strike from the Carroll residence and Southern Saddle (well reference no. 24), the BREMCO potable well (well reference no. 5), and one residence located approximately 1,200 feet northeast of the BREMCO business (well reference no. 15).

Blue Ridge Electric Membership Company, BREMCO(well reference no. 5)

Six (6) chlorinated volatile organic solvent compounds were detected in the April 26, 1995 resampling of the BREMCO potable well (1,1-Dichloroethane, 1,1-Dichloroethene, Cis-1,2-Dichloroethene, 1,1,1,-Trichloroethane, Trichloroethene, and Tetrachloroethene). The only compounds detected at quantifiable levels were 1,1-Dichloroethane (1,1-DCA), which was detected just above the detection limit of 1 ppb at 1.2 ppb, and 1,1-Dichloroethene (1,1-DCE), which was also detected just above the detection limit of 1 ppb at 1.1 ppb. No EPA Maximum Contaminant Level exists for 1,1-DCA. The EPA MCL for 1,1-DCE is 7 ppb. The other detected organic compounds were observed at unquantifiable levels below 1 ppb.

The same six (6) chlorinated volatile organic solvent compounds detected as a result of the recent sampling event have also been detected in previous sampling events conducted on the BREMCO potable well. Three of these compounds (1,1-Dichloroethane, 1,1,1-Trichloroethane, and Trichloroethene) had been detected in all four previous sampling events.

Ward Residence (well reference no. 24)

The April 26, 1995 resampling and analysis of the Ward residence potable well detected trace levels of Chloroform and Tetrachloroethene, and unquantifiable levels below 1 ppb of 1,1-Dichloroethane.

Prior to this sampling, five sampling events had been conducted on the Ward residence potable well. The combined analyses from the previous sampling events conducted on the Ward residence potable well had detected trace and/or unquantifiable levels below 1 ppb of five (5) chlorinated organic compounds (Carbon Tetrachloride, 1,1-Dichloroethane, 1,1,1-Trichloroethane, Trichloroethene, and Tetrachloroethene).

The initial Ward residence sampling event also detected Methylene Chloride at 3.2 ppb. the next five consecutive sampling events at the Ward residence resulted in the nondetection of Methylene Chloride. Methylene Chloride is also a known laboratory contaminant.

The third Ward residence sampling event also detected trace levels of chloroform. The other five sampling events conducted at the Ward residence had resulted in the nondetection of chloroform. Chloroform is a common transformation product result from the chlorination of well systems.

The fourth Ward residence sampling event resulted in no detected volatile organic compounds.

Chevrolet Dealership (well reference no. 7)

The Chevrolet Dealership's potable well was resampled on April 26, 1995 in response to NCDEHNR Solid Waste Section recommendations. Previous sampling of the Chevrolet Dealership's potable well resulted in no detected volatile organic compounds. The recent resampling detected tert-Butyl Metyl Ether at a concentration of 24.4 ppb. Tert-Butyl Metyl Ether has not been detected in any of the assessment monitoring wells to date. The presence of tert-Butyl Metyl Ether in the Chevrolet Dealership's potable well is likely due to activities and sources immediately surrounding the well head.

7.2 October 24, 1995 Sampling Event

Four potable wells were sampled on October 24, 1995. Three wells had been sampled previously. The resampled potable wells were resampled to further investigate trace and/or low level detections previously detected. These three resampled potable wells included two residences located in the Rocky Mountain Heights Subdivision, immediately downgradient and strike from the Carroll residence and Southern Saddle (well reference no. 24 and well reference no. 14), and the BREMCO potable well (well reference no. 5). One of these wells (well reference no. 24) was recently drilled deeper in order to provide needed water production. A residence located approximately 600 feet west of the BREMCO business (well reference no. 36) was also sampled for the first time on October 24, 1995. This residence had been previously unoccupied.

Blue Ridge Electric Membership Company, BREMCO(well reference no. 5)

Six (6) chlorinated volatile organic solvent compounds were detected in the October 24, 1995 sampling of the BREMCO potable well (1,1-Dichloroethane, 1,1-Dichloroethene, Cis-1,2-Dichloroethene, 1,1,1,-Trichloroethane, Trichloroethene, and Tetrachloroethene). The only compounds detected at quantifiable levels were 1,1-Dichloroethane (1,1-DCA), which was detected just above the detection limit of 1 ppb at 1.8 ppb, and 1,1-Dichloroethene (1,1-DCE), which was also detected just above the detection limit of 1 ppb at 1.7 ppb. No EPA Maximum Contaminant Level exists for 1,1-DCA. The EPA MCL for 1,1-DCE is 7 ppb. The other detected organic compounds were observed at unquantifiable levels below 1 ppb.

The same six (6) chlorinated volatile organic solvent compounds detected as a result of the recent sampling event have also been detected in previous sampling events conducted on the BREMCO potable well, and all of these six (6) compounds have been detected in the past three (3) sampling events. Three of these compounds (1,1-Dichloroethane, 1,1,1-Trichloroethane, and Trichloroethene) have been detected in all five previous sampling events.

Ward Residence (well reference no. 24)

The recent October 24, 1995 resampling and analysis of the Ward residence potable well detected trace levels of Chloroform and Tetrachloroethene, and unquantifiable levels below 1 ppb of 1,1-Dichloroethane.

Prior to this sampling, five sampling events had been conducted on the Ward residence potable well. The combined analyses from the previous sampling events conducted on the Ward residence potable well had detected trace and/or unquantifiable levels below 1 ppb of five (5) chlorinated organic compounds (Carbon Tetrachloride, 1,1-Dichloroethane, 1,1,1-Trichloroethane, Trichloroethene, and Tetrachloroethene).

The initial Ward residence sampling event also detected Methylene Chloride at 3.2 ppb. the next five consecutive sampling events at the Ward residence resulted in the nondetection of Methylene Chloride. Methylene Chloride is also a known laboratory contaminant.

The third Ward residence sampling event also detected trace levels of chloroform. The other five sampling events conducted at the Ward residence had resulted in the nondetection of chloroform. Chloroform is a common transformation product result from the chlorination of well systems.

The fourth Ward residence sampling event resulted in no detected volatile organic compounds.

Shared Well #2 (well reference no. 14)

Shared well #2 was recently drilled deeper in order to provide needed water production. Shared well #2 serves four residences. Resampling was performed to investigate the effect of drilling the well deeper on the concentrations of organic compounds found in this potable well.

Shared well #2 was originally sampled from the Cone residence on March 18, 1993. Resampling of shared well #2 conducted on March 30, 1994 and on January 12, 1995 and the recent resampling was performed on the adjacent Edwards residence.

The initial March 18, 1993 sampling detected only low levels of 1,4-Dichlorobenzene, which is a compound that has not been detected in the landfill monitoring well network.

The second March 30, 1994 sampling detected trace levels of Chloroform, which again is a common transformation product resulting from the chlorination of well systems, and also detected two (2) common chlorinated organic compounds (1,1-Dichloroethene and 1,1,1-Trichloroethane) at unquantifiable levels below 1 ppb.

The third January 12, 1995 sampling only detected 1,1-Dichloroethene at unquantifiable levels below 1 ppb.

The recent fourth resampling, performed on October 24, 1995, detected 1,1-Dichloroethane (not 1,1-Dichloroethene) at unquantifiable levels below 1 ppb, trace levels of Tetrachloroethene and 1,1,1-Trichloroethane, and Chloroform at 9 ppb. Chloroform is likely a transformation product resulting from the recent chlorination of the well system. A variety of additional compounds that do not appear related to the organic constituents found in the landfill's monitoring well network were also detected. These compounds include the following: Bromodichloromethane, Dibromochloromethane, 2-Chlorotoluene, 4-Chlorotoluene, Methyl Ethyl Ketone, and Tetrahydrofuran. The presence of these compounds are likely a byproduct resulting from the recent overdrilling of the well bore.

Bremco residence (well reference no. 36)

The water analysis of the Bremco residence well, located approximately 600 feet west of Blue Ridge Electric Membership Company, i.e. BREMCO (well reference no. 5), resulted in no detected volatile compounds.

7.3 Recommendations

In summary, the analytical results from the recent potable well sampling indicate that the recently sampled well waters are acceptable for all uses due to either nondetection or very low level detection of the organic analytes. At this time the cause or source of all the low level detected organics can not be determined.

Draper Aden Associates recommends that potable water well sampling program concentrate on sampling those few wells that have previously shown trace level detections of organics similar to those detected in the landfill groundwater monitoring well network. Duplicate sampling will indicate whether the organics detected are a persistent occurrence or uncommon event. Although alternate water supplies are currently provided, DAA also recommends continued periodic sampling of the (2) significantly impacted wells.

VIII. CONCLUSIONS

8.1 Parameter Distribution

The analytical results obtained from the first semi-annual assessment monitoring event (also the first *annual comprehensive event*) are similar to the results obtained from the previous background events. The analytical results continue to indicate that the detection of target parameters in the Watauga County Landfill monitoring network is primarily confined to those monitoring locations existing south of the proposed U.S. Route 421 Bypass (Figure 2; Appendix I).

The relocation of five (5) of the assessment monitoring wells (MW-12, MW-13, MW-14, MW-15, and MW-18), as originally proposed in the Assessment Plan (DAA, September 3, 1993), was necessary due to the proposed rerouting of U.S. Route 421. The construction right-of-way for the proposed bypass would have directly impacted the original locations for these five wells, likely requiring their premature abandonment. Four of these wells were relocated north of the proposed bypass (MW-13, MW-14, MW-15, and MW-18) and one well was relocated south of the proposed bypass (MW-12).

The first semi-annual analytical results indicate no elevated concentrations of target parameters in the four monitoring wells relocated north of the proposed bypass, although low level concentrations of 1,1,1-TCA in MW-15, and Methylene Chloride in the nested well pair, MW-13 and MW-18, were observed. Conversely, the recent analytical results reveal five target parameters detected above the method CRQL in MW-12, relocated south of the proposed bypass. The analytical results indicate the northern edge of the occurrence of assessment target parameters in the groundwater exists within the construction right-of-way for the proposed Route 421 bypass.

South of the proposed bypass, the detection of assessment target parameters was distributed between the saddle, located between the landfill and the Rocky Mountain Heights Subdivision, and the west and north drainages below the landfill.

In the west drainage, the detection of target parameters above groundwater standards was observed in both the soil and bedrock aquifer media, extending from the landfill to the proposed bypass. Organic analyses performed on the piezometer network on November 16-18, 1992, indicates the target parameters are confined to the trough of the west drainage. Seven target organic parameters were detected in the surface water sampling location in the west drainage. Three organic compounds were found above surface water standards at the surface water sampling location in the west drainage. The organic compounds and relative levels detected in the surface water sampling location in the west drainage are consistent with the those detected in adjacent groundwater monitoring wells, although at lower concentrations, and indicate that organic impacts to surface water are entirely due to local groundwater discharge at this location..

In the north drainage, the detection of target parameters above groundwater standards was confined to the bedrock aquifer medium. The levels of the target parameters detected in the two monitoring wells accessing the bedrock aquifer medium indicate the parameters have preferentially migrated to deeper fracture zones within the bedrock.

Several organic compounds detected in the monitoring well located along the saddle between the landfill and the Rocky Mountain Heights subdivision were observed at markedly different concentrations than the levels of the organic compounds detected in the remainder of the monitoring well network. In addition, several different organic compounds were detected along the saddle between the landfill and the Rocky Mountain Heights subdivision that were not detected in the remainder of the monitoring well network.

8.2 Target Parameter Summary

The detection of five target parameters, PCE, TCE, cis-1,2-DCE, Dichlorodifluoromethane, and Chloroethane, was primarily reported within the west drainage and southern saddle.

The detection of 1,1,1-TCA and 1,1-DCE was observed in both the west and the north drainages, although these parameters were observed at significantly higher elevated levels in the north drainage, particularly at the deep bedrock well MW-2. The detection of 1,1,1-TCA was also observed along the southern saddle.

The detection of 1,1-DCA was observed at elevated concentrations in more monitoring wells throughout the site than any other target parameter, although 1,1-DCA was observed at the highest concentrations in the west drainage.

Methylene Chloride was detected at a significantly higher concentration in MW-9, located along the southern saddle between the landfill and the Rocky Mountain Heights subdivision. Lower level concentrations of Methylene Chloride were detected along the west drainage.

Benzene was detected in five monitoring wells. Higher concentrations of Benzene are preferentially distributed adjacent to the disposal area. Lower estimated concentrations were found distributed further downgradient within the west drainage and in MW-9, located along the southern saddle between the landfill and the Rocky Mountain Heights subdivision.

Trans-1,3-Dichloropropene was not detected above or estimated below the method LOQ.

Vinyl Chloride was detected in three monitoring wells, all preferentially centrally located in the west drainage, adjacent to the waste disposal area.

8.3 Continuing Investigations

As a result of the four background and first semi-annual background sampling events, three areas are identified as not fully characterized by the existing monitoring network. The results obtained from the first semi-annual monitoring event are similar to the previous four background events and do not significantly alter the current assessment of these three areas. As described below, these three areas will continue to be evaluated during ongoing groundwater investigations.

West Drainage

As detailed in the Assessment Plan Activity Report (DAA, July 29, 1994), the west drainage adjacent to the landfill trends parallel to the orientation of two lineament sets observed at the site. Upper reaches of the west drainage trend parallel to mineral layering, lineation, and foliation in the host bedrock as well as parallel to the general northwest trending contact between the amphibolite/hornblende gneiss-mica schist and gneiss assemblages and the "mixed rocks" assemblage (N55°W). Upon reaching an area where the amphibolite/hornblende gneiss is not stratigraphically overlain by the mica schist and gneiss (inferred from drilling of MW-18 as well as the distribution of residual soil distributions depicted on the Watauga County Soil Survey), the drainage trends N10°E, parallel to bedrock fracture and joint lineations.

The original proposed locations for MW-13 and MW-18 were at the junction of the N55°W and N10°E lineament sets. MW-13 and MW-18 were relocated along the N10°E lineament set to account for the flow direction of the surface water drainage. Trace level detections observed in the BREMCO potable well (Potable Well Analysis Summary Table, Appendix IV) indicate the possibility that deeper groundwater flow within the bedrock may follow the N55°W lineament set. Therefore, the area between the proposed bypass and the BREMCO potable well is one area that will continue to be evaluated during ongoing groundwater investigations.

North Drainage

The recent analytical results indicate elevated levels above groundwater standards for the target parameters in the northern drainage below the landfill at the deep bedrock monitoring well, MW-2. Downgradient of this point the bedrock aquifer system enters the central watershed of Rocky Branch and is likely significantly diluted. Groundwater entering the Rocky Branch watershed from the northern drainage may be exhibiting lateral stratification. Rather than continuing to follow the northern drainage orientation, groundwater may flow N55°W, parallel to Rocky Branch, before reaching the apex of the watershed. Therefore, the area between the nested well pair, MW-14 and MW-15, and the Chevrolet Dealership will continue to be evaluated during ongoing groundwater investigations. The absence of volatile organic parameters detected at the Chevrolet Dealership's potable well suggests non-impact at the dealership's well location.

Southern Saddle

The analytical results obtained from the monitoring well installed along the saddle between the landfill and the Rocky Mountain Heights Subdivision (MW-9) indicates the organic parameters observed in Carroll residence potable well are not confined to the Carroll property. To examine potential flow pathways not currently investigated by the Residential and Business potable well sampling program (described in the Assessment Plan and Activity Report and summarized herein in Appendix IV), the area directly downgradient and south of the Carroll property will be evaluated for additional groundwater investigations. A residential well does not currently exist immediately downgradient of the Carroll property. To further investigate the parameter distributions across the saddle from the Carroll property, the area between the landfill and MW-9 will also be evaluated for additional groundwater investigations.

8.4 Closing

Second Semi-annual Assessment Background Monitoring Event

The second semi-annual assessment monitoring event (sixth assessment event) is tentatively scheduled to be performed by Draper Aden Associates in January, 1996. As indicated in the Assessment Monitoring schedule (Table 1, Appendix I), both core and boundary assessment wells will be analyzed utilizing CLP analytical methods for the second semi-annual assessment monitoring event. Surface water monitoring points will also be analyzed using CLP analytical methods.

Revisions to the network of core and boundary assessment wells for the first semi-annual assessment monitoring event involved in the upgrading of monitoring well MW-7 to "core" status and the downgrading of MW-4 to "boundary" status. As discussed in the Remedial Investigation and Alternatives (RIA) Report, it is proposed that the non-impacted boundary wells be withdrawn from the routine compliance monitoring program. It is proposed that these non-impacted wells remain operational to allow for future monitoring based on temporal contaminant distribution trends observed from subsequent monitoring events.

As discussed in Sections V and VI, revisions to the target inorganic parameter list involve adding four metal parameters; i.e. Chromium, Cobalt, Nickel, and Vanadium, and deleting two other metal parameters; i.e. Cadmium and Mercury. Chromium, Cobalt, Nickel, and Vanadium were observed in three (3) or more core monitoring wells, although also at levels far below EPA MCL and North Carolina groundwater standards, as a result of the first comprehensive annual EPA Appendix II List assessment sampling event. The presence of Cadmium and Mercury in the groundwater at the site is not supported by the analytical results of all four assessment background or the first semi-annual monitoring events.

As also discussed in Sections V and VI, revisions to the target organic parameter list involve deleting trans-1,3-Dichloropropene. Since upon completion of background data collection and the first annual EPA Appendix II list sampling event (utilizing LLRA analytical methods), the absence of trans-1,3-Dichloropropene in the groundwater and surface waters at the site is confirmed, trans-1,3-Dichloropropene will be removed from the Target Parameter List.

In summary, revisions to the assessment target parameter list involve the following:

- addition of four metal parameters;
Chromium, Cobalt, Nickel, and Vanadium, and
- deletion of two metal and one organic parameter;
Cadmium, Mercury and trans-1,3-Dichloropropene.

Revisions to the network of core and boundary wells involve the following:

- addition of one monitoring well and one surface water sampling location further downgradient along the west drainage,
- upgrading of boundary monitoring well MW-15 to core status, and
- withdrawal of the non-impacted boundary monitoring wells (i.e. MW-4, MW-5, MW-13, MW-14, MW-16, and MW-18) from the routine compliance monitoring program.

Upon the approval of the NCDEHNR, the revisions outlined above will be implemented with the second semi-annual assessment monitoring event (sixth assessment event), tentatively scheduled to be performed by Draper Aden Associates in January, 1996.

Residential and Business Potable Well Sampling Program

The initial domestic and commercial use potable well sampling event was developed and conducted by Draper Aden Associates on March 5, 1993 at the direction of Watauga County and approval of State official to protect public health and welfare. The ongoing potable water well sampling and analysis program is currently being jointly conducted by the Appalachian District Health Department (ADHD) and the North Carolina State Laboratory of Public Health.

The objective of the potable well sampling and analysis program is to investigate and evaluate the potential influence and associated risks of the landfill on neighboring groundwater resources. Potable well water samples collected by the ADHD are analyzed for volatile organic compounds by the State Laboratory utilizing EPA Method 502.2. Potable water well locations with accompanying sampled well reference number can be found on the Site Map (Figure 1). A summary of the analytical results of the potable well testing program collected to date are presented in Appendix IV.

The ongoing potable well sampling program will continue to concentrate on sampling those few wells that have previously shown trace level detections of organics similar to those detected in the landfill groundwater monitoring network. Duplicate sampling will indicate whether the organics detected are a persistent occurrence or common events. Although alternate water supplies are currently provided, the two significantly impacted wells, the Nissan-Mazda dealership well (well reference no. 4) and the Carroll residence well (well reference no 12) will also be periodically sampled.

The results of the potable well sampling program will assist ongoing groundwater investigations within areas not fully characterized by the existing monitoring well network. Appropriate additional groundwater investigations will be conducted upon consultation and approval from the NCDEHNR Solid Waste Section.

APPENDIX I

TABLES AND FIGURES

Table 1

**Watauga County Landfill
Groundwater and Surface Water
Assessment Monitoring Schedule**

GROUNDWATER MONITORING	1st Year Quarterly Sampling Event			2nd Year Semi-Annual Sampling Events		
"CORE" ASSESSMENT WELLS						
Assessment Monitoring Parameters (i.e. 40 CFR Part 258 Appendix II List)	-	-	-	-	Low Level Risk Assessment Screening Methods	-
Target Parameter Monitoring Parameters	CLP Methods	CLP Methods	CLP Methods	CLP Methods	-	GLP Methods
"BOUNDARY" ASSESSMENT WELLS						
Target Parameter Monitoring Parameters	LLRA Methods	CLP Methods	LLRA Methods	CLP Methods	LLRA Methods	CLP Methods
SURFACE WATER MONITORING						
Target Parameter Monitoring Parameters	CLP Methods	-	CLP Methods	-	CLP Methods	CLP Methods

CLP - EPA Contract Laboratory Program Methods
LLRA - Low Level Risk Assessment Screening Methods (EPA SW-846)

Watauga County Landfill
 Watauga County, North Carolina
 Upgradient Well: MW-1
 11/8/95

Table 2A
 First Semi-Annual Monitoring Event
 Assessment Target Parameter Analytical Results
 Core Groundwater Monitoring Wells - Inorganic and Organic Analyses
 Contract Laboratory Program (CLP) Statements of Work (SOW) - Metals (1)
 Low Level Risk Assessment - SW-846 Method (8260) Organics (2)

Parameters	Event	Results ug/L(ppb)										NCS (ug/L)	MCL (ug/L)										
		MW-1	MW-2	MW-3	MW-6	MW-7	MW-8	MW-9	MW-10	MW-11	MW-12			MW-17									
METALS, TOTAL																							
Barium, Total	7/10/95	125	210	J	94.5	499	-	70.6	612	103	199	110	79	2000	2000								
Iron, Total	7/10/95	646	9.7	U*	4480	7980	-	455	9.7	508	9.7	9.7	48.5	300*	300*								
Cadmium, Total	7/10/95	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	5.0	5.0								
Mercury, Total	7/10/95	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1.1	2.0								
ORGANICS																							
Benzene	7/10/95	5	U	5	U	2.6	J	13	2.7	J	3.5	3.8	J	5	U	1	5						
Chloroethane	7/10/95	5	U	5	U	8.7	16	9.3	22	9.3	5	5	U	5	U	4.9	J	-					
Dichlorodifluoromethane	7/10/95	5	U	5	U	7.2	2.2	J	5	U	6.7	2.8	J	5	U	1.7	J	4.2	J	0.19			
1,1-Dichloroethane	7/10/95	5	U	94	OK	160	130	6.8	6.8	40	55	26	130	700**	-	-	-	-	-				
1,1-Dichloroethene	7/10/95	5	U	170	J	3.7	J	1.3	5	U	4.1	5	U	8.1	5	U	3.6	J	1.6	J	7		
1,2-Dichloroethene(cis)	7/10/95	5	U	5	U	50	430	7.9	7.9	6.2	5	U	7.6	70	70	70	70	70	70	70	70		
trans-1,2-Dichloropropene	7/10/95	5	U	5	U	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5		
Methylene Chloride	7/10/95	5	U	5	U	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5		
Tetrachloroethene	7/10/95	5	U	5	U	3.7	14	5	5	U	3.1	3.6	J	8.1	5	U	5.9	U	5	U	5		
Trichloroethene	7/10/95	5	U	5	U	1.1	1.1	1.2	J	1.1	5	6	5	U	3.1	J	13	7	7	7	7		
1,1,1-Trichloroethane	7/10/95	5	U	1600	5	21	5	5	5	U	4.9	J	9.8	4.8	J	16	7	7	7	7	7		
Vinyl Chloride	7/10/95	5	U	5	U	3.1	1.23	5	5	U	7.7	5	U	5	U	5	U	5	U	5	U	0.015	2

Notes:
 NCS Denotes North Carolina Groundwater Quality Standard (T15A: 02L 0200)
 MCL Denotes EPA Maximum Contaminant Level (EPA 822-R-94-001)
 U Denotes not detected above Instrument Detection Level (IDL) for Inorganics and not detected above CRQL for Organics
 U* Denotes sample result is less than 5 times corresponding blank concentration (termed sample LOQ)
 J Denotes an estimated value
 CRQL Contract Required Quantification Limit
 Denotes a Secondary Maximum Contaminant Level (SMCL) for Total Iron
 Denotes a proposed NCS
 Denotes Not Available or Not Sampled
 Denotes parameter results that exceed U.S. EPA Maximum Contaminant Levels.
 (1) Metal parameters were analyzed in accordance with EPA Contract Laboratory Program (CLP) Statement of Work ILMO 3.0.
 CLP analytical methods utilize relevant Atomic Adsorption technique and Inductively Coupled Plasma (ICP) method for metal analysis
 (2) Organic parameters were analyzed in accordance with USEPA SW-846 Method 8260.

see table for PC for different values

Watauga County Landfill
 Watauga County, North Carolina
 Upgradient Well: MW-1
 11/8/95

Table 2B
 First Semi-Annual Monitoring Event
 Assessment Target Parameter Analytical Results
 Boundary Groundwater Monitoring Wells and Surface Water Sampling Locations - Inorganic and Organic Analyses
 Contract Laboratory Program (CLP) Statement of Work (SOW) (1) (2)

Parameters	Event	Results ug/L(ppb)														S-5	NCS (ug/L)	MCL (ug/L)
		MW-4	MW-5	MW-13	MW-14	MW-15	MW-16	MW-18	S-1	S-2	S-3	S-4						
METALS, TOTAL																		
Barium, Total	7/10/95	23.8	700	116	19.5	73.6	67	90	502	592	277	861	310	2000				
Iron, Total	7/10/95	9.7	U*	3960	9.7	U*	9.7	U*	19400	36100	5740	1290	87900	300*				
Cadmium, Total	7/10/95	0.5	U	0.5	U	0.5	U	0.5	U	4.2	U	4.2	U	5				
Mercury, Total	7/10/95	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1.1				
ORGANICS																		
Benzene	7/10/95	10	U	-	-	-	-	-	10	U	10	U	10	U	1	5		
Chloroethane	7/10/95	10	U	-	-	-	-	-	15	U	10	U	4	J	-	-		
Dichlorodifluoromethane	7/10/95	10	U	-	-	-	-	-	10	UJ	10	UJ	10	UJ	3	0.19		
1,1-Dichloroethane	7/10/95	10	U	-	-	-	-	-	6	J	20	U	41	2	J	700**		
1,1-Dichloroethene	7/10/95	10	U	-	-	-	-	-	10	U	10	U	10	U	7	7		
1,2-Dichloroethene(cis)	7/10/95	10	U	-	-	-	-	-	1	J	3	J	10	U	42	10		
trans-1,3-Dichloropropene	7/10/95	10	U	-	-	-	-	-	10	U	10	U	10	U	10	U		
Methylene Chloride	7/10/95	10	U	-	-	-	-	-	10	U	10	U	10	U	5	5		
Tetrachloroethene	7/10/95	10	U	-	-	-	-	-	10	U	10	U	10	U	10	U		
Trichloroethene	7/10/95	10	U	-	-	-	-	-	10	U	10	U	10	U	0.7	5		
1,1,1-Trichloroethane	7/10/95	10	U	-	-	-	-	-	10	U	1	J	10	U	8	10		
Vinyl Chloride	7/10/95	10	U	-	-	-	-	-	10	U	1	J	10	U	2	J		
	7/10/95	10	U	-	-	-	-	-	10	U	10	U	10	U	10	U		
	7/10/95	10	U	-	-	-	-	-	10	U	10	U	3	J	10	U		
	7/10/95	10	U	-	-	-	-	-	10	U	10	U	10	U	0.015	2		

Need to compare to SW (2B) standards.

Notes:
 NCS Denotes North Carolina Groundwater Quality Standard (TT15A: 02L .0200)
 MCL Denotes EPA Maximum Contaminant Level (EPA 822-R-94-001)
 CRQL Contract Required Quantification Limit
 U Denotes not detected above Instrument Detection Level (IDL) for Inorganics and not detected above CRQL for Organics
 U* Denotes sample result is less than 5 times corresponding blank concentration (termed sample LOQ)
 J Denotes an estimated value
 * Denotes a Secondary Maximum Contaminant Level (SMCL) for Total Iron
 ** Denotes a proposed NCS
 - Denotes Not Available or Not Sampled
 UJ Denotes parameter results that exceed U.S. EPA Maximum Contaminant Levels
 (1) Metal Parameters were analyzed in accordance with EPA Contract Laboratory Program (CLP) Statement of Work ILMO 3.0.
 CLP analytical methods utilize relevant Atomic Adsorption technique and Inductively Coupled Plasma (ICP) method for metal analysis.
 (2) Organic parameters for S1 through S5 were analyzed in accordance with USEPA CLP SOW OLMO1.9(3/90).
 For CLP analysis, 1,2-Dichloroethene was reported as total concentration rather than as cis-omer.
 Organic parameters for MW-4 were analyzed in accordance with SW-846 Method 8260.

Watauga County Landfill
 Watauga County, North Carolina
 Upgradient Well: MW-1
 12/11/95

Table 2C
 First Semi-Annual Monitoring Event
 Assessment Target Parameter Analytical Results
 Core Groundwater Monitoring Wells - Organic Analyses
 Low Level Risk Assessment SW846 Method 8021

Parameters	Event	Results ug/L(ppb)													NCS (ug/L)	MCL (ug/L)						
		MW-1	MW-2	MW-3	MW-6	MW-7	MW-8	MW-9	MW-10	MW-11	MW-12	MW-17										
ORGANICS																						
Benzene	7/10/9	2.0	U	2.0	U	2.3	14	2.2	6.2	4.0	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	1	5
Chloroethane	7/10/9	2.0	U	2.0	U	10	15	9.2	10	20	U	U	2.0	U	2.0	U	5.0	U	5.0	U	-	-
Dichlorodifluoromethane	7/10/9	2.0	UJ	2.0	UJ	6.9	2.0	2.0	16	2.0	UJ	UJ	2.0	UJ	2.0	UJ	5.7	J	5.3	J	0.19	-
1,1-Dichloroethane	7/10/9	2.0	U	81	100	130	100	4.8	60	36	J	J	58	J	22	100	102	J	700**	J	7	7
1,1-Dichloroethene	7/10/9	2.0	U	170	2.0	4.0	2.0	2.0	5.7	2.0	U	U	160	J	0.86	J	3.9	J	1.8	J	7	7
1,2-Dichloroethene(cis)	7/10/9	2.0	U	2.0	U	65	440	4.4	110	7.4	J	J	2.0	U	11	37	72	J	70	J	70	70
trans-1,3-Dichloropropene	7/10/9	2.0	U	2.0	U	2.0	2.0	2.0	2.0	2.0	U	U	2.0	U	2.0	U	2.0	U	2.0	U	-	-
Methylene Chloride	7/10/9	2.0	U	2.0	U	2.4	1.2	2.0	4.7	89	J	J	2.0	U	2.9	3.3	2.2	U	2.2	U	5	5
Tetrachloroethene	7/10/9	2.0	U	12	13	31	42	2.0	42	5.0	J	J	13	18	27	40	40	0.7	40	0.7	5	5
Trichloroethene	7/10/9	2.0	U	1.2	J	20	67	1.6	28	8.5	J	J	2.0	U	5.5	16	21	J	2.8	J	2.8	5
1,1,1-Trichloroethane	7/10/9	2.0	U	1600	2.0	26	2.0	2.0	6.0	12	990	5.9	17	17	7.8	200	200	200	200	200	200	200
Vinyl Chloride	7/10/9	2.0	U	2.0	J	2.9	12	2.0	11	2.0	U	2.0	2.0	U	2.0	0.94	0.94	J	0.015	J	0.015	2

Notes:
 NCS Denotes North Carolina Groundwater Quality Standard (T15A: 02L .0200)
 MCL Denotes EPA Maximum Contaminant Level (EPA 822-R-94-001)
 U Denotes not detected above Detection Level(IDL) for Inorganics and not detected above CRQL for Organics
 U* Denotes sample result is less than 5 times corresponding blank concentration (termed sample LOQ).
 J Denotes an estimated value
 CRQL Contract Required Quantification Limit
 ** Denotes a proposed NCS
 - Denotes Not Available or Not Sampled
 Shading denotes parameter results that exceed U.S. EPA Maximum Contaminant Levels.
 Organic parameters were analyzed in accordance with USEPA SW-846 Method 8021.

Values different than Table 2A

Watauga County Landfill
 Watauga County, North Carolina
 Upgradient Well: MW-1
 11/8/95

Table 2D
 First Semi-Annual Monitoring Event
 Assessment Target Parameter Analytical Results
 Boundary Groundwater Monitoring Wells - Organic Analyses
 Low Level Risk Assessment (LLRA) SW-846 Method 8021

Parameters	Event	Results ug/L(ppb)										NCS (ug/L)	MCL (ug/L)				
		MW-4	MW-5	MW-13	MW-14	MW-15	MW-16	MW-18									
ORGANICS																	
Benzene	7/10/95	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	1	5
Chloroethane	7/10/95	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	-	-
Dichlorodifluoromethane	7/10/95	2.0	U	2.0	UJ	2.0	UJ	2.0	U	2.0	U	2.0	UJ	2.0	UJ	0.19	-
1,1-Dichloroethane	7/10/95	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	700**	-
1,1-Dichloroethene	7/10/95	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	7	7
1,2-Dichloroethene(cis)	7/10/95	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	70	70
trans-1,3-Dichloropropene	7/10/95	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	-	-
Methylene Chloride	7/10/95	2.0	U	2.0	U	0.84	J	2.0	U	2.0	U	2.0	U	2.0	U	5	5
Tetrachloroethene	7/10/95	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	0.7	5
Trichloroethene	7/10/95	2.0	U	2.0	U	2.0	U	2.0	U	2.0	UJ	2.0	U	2.0	U	2.8	5
1,1,1-Trichloroethane	7/10/95	2.0	U	2.0	U	2.0	U	2.0	U	2.7	U	2.0	U	2.0	U	200	200
Vinyl Chloride	7/10/95	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	0.015	2

Notes:
 NCS Denotes North Carolina Groundwater Quality Standard (T15A: 02L .0200)
 MCL Denotes EPA Maximum Contaminant Level (EPA 822-R-94-001)
 CRQL Contract Required Quantification Limit
 U Denotes not detected above Instrument Detection Level(IDL) for Inorganics and not detected above CRQL for Organics
 U* Denotes sample result is less than 5 times corresponding blank concentration (termed sample LOQ).
 J Denotes an estimated value
 ** Denotes a proposed NCS
 - Denotes Not Available or Not Sampled
 Shading denotes parameter results that exceed U.S. EPA Maximum Contaminant Levels.
 Organic parameters were analyzed in accordance with SW-846 Method 8021.

Watauga County Landfill
Watauga County, North Carolina
Upgradient Well: MW-1
11/27/95

Table 3A
First Semi-Annual Assessment Monitoring Event
Detected Non-Target Organic Parameter Analytical Results

Parameter	Event	Method	Results ug/L (ppb)													NCS (ug/L)	MCL (ug/L)		
			MW-3	MW-6	MW-7	MW-8	MW-9	MW-10	MW-17	S-1	S-2								
Trichlorofluoromethane	7/10/95	8260	1.1 J	~	~	~	~	~	~	~	~	~	~	~	~	~	~	2,100	-
trans-1,2-Dichloroethene	7/10/95	8260	~	5.7	1.6 J	1.4 J	~	~	~	~	~	~	~	~	~	~	~	70	100
1,2-Dichloroethane	7/10/95	8260	1.8 J	~	~	~	~	~	~	~	~	~	~	~	~	~	~	0.30	-
	7/10/95	8021	1.8 J	~	~	0.89 J	~	~	~	~	~	~	~	~	~	~	~	0.30	-
Bromomethane	7/10/95	8260	2.4 J	~	~	~	~	~	~	~	~	~	~	~	~	~	~	-	-
1,2-Dichloropropane	7/10/95	8260	1.0 J	1.0 J	1.6 J	~	~	~	~	~	~	~	~	~	~	~	~	0.56	5
	7/10/95	8021	~	~	1.4 J	0.87 J	~	~	~	~	~	~	~	~	~	~	~	0.56	5
1,4-Dichlorobenzene	7/10/95	8260	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	-	-
	7/10/95	8260	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	-	-
2-Butanone	7/10/95	8260	~	~	15	4.9 J	~	~	~	~	~	~	~	~	3.1 J	~	~	-	-
	7/10/95	CLP	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	-	-
o-xylene	7/10/95	8260	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	530	10000
	7/10/95	CLP	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	530	10000
total xylene	7/10/95	CLP	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	530	10000
	7/10/95	CLP	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	1000	1000
toluene	7/10/95	CLP	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	29	700
	7/10/95	CLP	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	29	700

Notes:
NCS Denotes North Carolina Groundwater Quality Standard (T15A: 02L .0200)
MCL Denotes EPA Maximum Contaminant Level (EPA 822-R-94-001)
~ Denotes not detected above LOD/CRQL, as appropriate
- Denotes no applicable standard
J Denotes an estimated value
Shaded Denotes Parameter results that meet or exceed U.S. EPA Maximum Contaminant Levels
Organic parameters were analyzed in accordance with USEPA CLP SOW OLM01.9(3/90), SW-846 Method 8260 and/or 8021

Watauga County Landfill
Watauga County, North Carolina
Upgradient Well: MW-1
11/24/95

Table 3B
First Semi-Annual Assessment Monitoring Event
Non-Target Metal Parameter Analytical Results

Parameter	Event	Results ug/L(ppb)														NCS (ug/L)	MCL (ug/L)		
		MW-1	MW-2	MW-3	MW-4	MW-6	MW-8	MW-9	MW-10	MW-11	MW-12	MW-17							
Antimony	7/10/95	1.9	U	1.9	U	1.9	U	1.9	U	1.9	U	1.9	U	1.9	U	1.9	U	-	6
Arsenic	7/10/95	2.7	U	2.7	U	2.7	U	2.7	U	2.7	U	2.7	U	2.7	U	2.7	U	50	-
Beryllium	7/10/95	0.1	U*	0.1	U*	0.1	U*	0.1	U*	0.1	U*	0.1	U*	0.1	U*	0.1	U*	-	4
Chromium	7/10/95	1.4	U	5.5	U	0.7	U	1.5	U	6.3	U	0.7	U	0.7	U	0.7	U	50	100
Cobalt	7/10/95	0.5	U*	1.9	U	0.5	U	19.7	U	1.5	U	5.2	U	4.7	U	0.5	U	-	-
Copper	7/10/95	0.5	U	6.1	U	0.5	U*	0.5	U	0.5	U	0.5	U*	0.5	U*	0.5	U*	1000	1300
Cyanide	7/10/95	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	154	-
Lead	7/10/95	1.6	U	2	U	1.6	U	1.6	U	1.6	U	1.6	U	1.6	U	1.6	U	15	15
Nickel	7/10/95	2.4	U	2.4	U	2.4	U	7.6	U	2.9	U	2.4	U	2.4	U	2.4	U	100	100
Selenium	7/10/95	3.4	U	3.4	U	3.4	U	3.4	U	3.4	U	3.4	U	3.4	U	3.4	U	50	50
Silver	7/10/95	0.6	U	0.6	U	0.6	U	0.6	U	0.6	U	0.6	U	0.6	U	0.6	U	18	-
Tin	7/10/95	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	-	-
Thallium	7/10/95	1	UJ	1	UJ	1	UJ	1	UJ	1	UJ	1	UJ	1	UJ	1	UJ	-	2
Vanadium	7/10/95	1.5	U	10.6	U	1.3	U	0.74	U	3.8	U	1.9	U	0.6	U	0.88	U	-	-
Zinc	7/10/95	1.2	U*	23.8	U*	1.2	U*	1.2	U*	1.2	U*	1.2	U*	1.2	U*	1.2	U*	2100	-

Notes: NCS Denotes North Carolina Groundwater Quality Standard (T15A:02L.0200)
MCL Denotes EPA Maximum Contaminant Level (EPA 822-R-94-001)
U Denotes not detected above Instrument Detection Limit (IDL) for Inorganics (CLP SOW only)
U* Denotes sample result is less than 5 times corresponding blank concentration (termed sample LOQ).
J Denotes an estimated value
- Denotes not available or not sampled
Shaded denotes parameter results that exceed U.S. EPA Maximum Contaminant Levels.
CLP analytical methods utilize relevant Atomic Adsorption technique and Inductively Coupled Plasma(ICP) method ,
in accordance with EPA Contract Laboratory Program (CLP) Statement of Work ILMO 3.0 for metal analysis

Watauga County Landfill
 Watauga County, North Carolina
 Upgradient Well: MW-1

22-Nov-95

MW-1 \downarrow recharge
 MW-2 \downarrow discharge
 MW-3 \downarrow recharge
 MW-4 \downarrow discharge

TABLE 4A
 GROUNDWATER LEVEL DATA
 MONITORING WELLS

		REFERENCE ELEVATION								
		MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9
GROUND		3339.03	3184.24	3182.25	3150.00	3263.81	3262.55	3270.56	3235.39	3356.65
MEASURING POINT		3341.90	3152.94	3183.12	3152.52	3267.89	3268.04	3273.53	3239.77	3359.23

		STATIC WATER LEVEL								
		MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9
DATE										
6/20/94		38.00	7.88	18.43	13.48	NM	44.12	23.03	17.68	59.35
9/27/94		39.69	7.51	17.42	10.45	NM	43.99	30.73	17.38	57.79
2/6/95		37.57	5.58	16.20	8.18	50.39	42.85	45.88	15.41	59.54
4/11/95		37.94	6.46	16.85	9.22	48.95	42.81	49.11	16.05	59.30
7/10/95		41.20	6.60	17.43	8.94	50.29	43.73	48.98	17.42	80.17

		GROUNDWATER ELEVATION								
		MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9
DATE										
6/20/94		3303.80	3145.06	3164.89	3139.04	NM	3221.92	3250.50	3222.09	3299.88
9/27/94		3302.11	3145.43	3165.70	3142.07	NM	3222.05	3242.80	3222.39	3301.44
2/6/95		3304.23	3147.36	3166.92	3144.34	3217.30	3223.19	3227.65	3224.36	3298.69
4/11/95		3303.86	3146.48	3168.27	3143.30	3218.74	3223.23	3224.42	3223.72	3298.93
7/10/95		3300.60	3146.34	3165.89	3143.58	3217.40	3222.31	3224.55	3222.35	3279.06

		REFERENCE ELEVATION								
		MW-10	MW-11	MW-12	MW-13	MW-14	MW-15	MW-16	MW-17	MW-18
GROUND		3202.18	3146.25	3148.11	3117.39	3117	3117.15	3141.42	3181.14	3117.12
MEASURING POINT		3203.87	3147.07	3148.67	3119.72	3120	3120.65	3142.72	3183.62	3119.63

		STATIC WATER LEVEL								
		MW-10	MW-11	MW-12	MW-13	MW-14	MW-15	MW-16	MW-17	MW-18
DATE										
6/20/94		8.18	13.35	11.04	19.66	7.94	11.92	5.32	17.93	17.93
9/27/94		8.09	13.22	10.76	19.57	7.89	11.82	5.68	17.83	17.88
2/6/95		7.73	13.22	10.61	19.39	7.52	11.55	4.61	17.05	17.58
4/11/95		7.90	13.00	10.58	19.53	7.75	11.87	5.11	17.48	17.65
7/10/95		7.91	12.53	10.48	19.62	7.74	11.86	4.54	18.11	17.94

		GROUNDWATER ELEVATION								
		MW-10	MW-11	MW-12	MW-13	MW-14	MW-15	MW-16	MW-17	MW-18
DATE										
6/20/94		3195.69	3146.25	3148.11	3100.06	3112.06	3108.73	3137.40	3165.69	3101.70
9/27/94		3195.78	3146.38	3148.37	3100.15	3112.11	3108.83	3137.04	3165.79	3101.77
2/6/95		3196.14	3146.38	3148.54	3100.33	3112.48	3109.10	3138.11	3166.57	3102.05
4/11/95		3195.97	3146.80	3148.57	3100.19	3112.25	3108.78	3137.51	3166.14	3101.98
7/10/95		3195.96	3147.07	3148.67	3100.10	3112.26	3108.69	3138.18	3165.51	3101.69

1) ALL MEASUREMENTS IN FEET.
 2) ALL ELEVATIONS REFERENCE MEAN SEA LEVEL.
 3) MEASURING POINT (M.P.) IS FROM THE TOP OF WELL CASING.
 4) NM - NOT MEASURED

Watauga County Landfill
 Watauga County, North Carolina
 Upgradient Well: MW-1

22-Nov-95

TABLE 4B
 GROUNDWATER LEVEL DATA

REFERENCE ELEVATION							
	PZ-13	PZ-14	PZ-17	PZ-18	PZ-18A	PZ-22	PZ-23
GROUND	3195.05	3214.80	3217.62	3233.60	3233.95	3205.6	3221.74
MEASURING POINT	3198.33	3217.80	3220.79	3236.02	3236.86	3208.84	3225.27

STATIC WATER LEVEL							
DATE	12.75	17.26	14.47	16.80	17.30	14.29	24.68
6/20/94	12.29	16.64	14.06	16.47	17.77	13.99	23.50
9/27/94	10.71	13.66	12.88	13.66	13.60	12.86	22.44
2/6/95	12.39	15.82	13.79	15.39	15.92	13.25	23.26
4/11/95	13.07	18.47	15.24	16.41	16.49	14.15	23.71
7/10/95							

GROUNDWATER ELEVATION							
DATE	3185.58	3200.54	3206.32	3219.22	3219.56	3194.55	3200.59
6/20/94	3186.04	3201.16	3206.73	3219.55	3219.09	3194.85	3201.77
9/27/94	3187.62	3204.14	3207.91	3222.36	3223.26	3195.98	3202.83
2/6/95	3185.94	3201.98	3207.00	3220.63	3220.94	3195.59	3202.01
4/11/95	3185.26	3199.33	3205.55	3219.61	3220.37	3194.69	3201.56
7/10/95							

- 1) ALL MEASUREMENTS IN FEET.
- 2) ALL ELEVATIONS REFERENCE MEAN SEA LEVEL.
- 3) MEASURING POINT (M.P.) IS FROM THE TOP OF WELL CASING.

Watauga County Landfill
 Watauga County, North Carolina
 Upgradient Well: MW-1
 12/13/95

Table SA
 Background Assessment Organic Target Parameter Analytical Results
 Core Groundwater Monitoring Wells and
 Septic Field Wells

Parameter	Event	Results ug/l(ppb)																	MCL (ug/L)							
		MW-1	MW-2	MW-3	MW-6	MW-7	MW-8	MW-9	MW-10	MW-11	MW-12	MW-17	SFW-1	SFW-2	SFW-3	Analysis Type	NCS (ug/L)									
Benzene	RIEEL	10	120	U	0.42	J	0.72	J	5.30	U	5.30	U	5.30	U	5.30	U	5.30	U	5.30	U	5.30	U	CLPALRA	1	5	
	9/27/94	10	150	U	3	J	5	J	10	U	10	U	10	U	10	U	10	U	10	U	10	U	CLP	1	5	
	2/26/95	10	150	U	3	J	5	J	10	U	10	U	10	U	10	U	10	U	10	U	10	U	CLP	1	5	
	4/11/95	10	200	U	10	U	10	U	7.1	U	7.1	U	7.1	U	7.1	U	7.1	U	7.1	U	7.1	U	CLP	1	5	
	RIEEL	10	200	U	10	U	10	U	9.44	J	9.44	J	9.44	J	9.44	J	9.44	J	9.44	J	9.44	J	9.44	J	9.44	J
Chloroethane	RIEEL	10	170	U	7.23	J	7.23	J	19	U	19	U	19	U	19	U	19	U	19	U	19	U	CLPALRA	1	5	
	9/27/94	10	170	U	7	J	7	J	19	U	19	U	19	U	19	U	19	U	19	U	19	U	CLP	1	5	
	2/26/95	10	150	U	7	J	7	J	19	U	19	U	19	U	19	U	19	U	19	U	19	U	CLP	1	5	
	4/11/95	10	200	U	7	J	7	J	19	U	19	U	19	U	19	U	19	U	19	U	19	U	CLP	1	5	
	RIEEL	10	200	U	7	J	7	J	19	U	19	U	19	U	19	U	19	U	19	U	19	U	19	U	19	U
Dichlorodifluoromethane	RIEEL	10	120	U	48.84	U	2.28	J	13.92	J	13.92	J	13.92	J	13.92	J	13.92	J	13.92	J	13.92	J	13.92	J	13.92	J
	9/27/94	10	150	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
	2/26/95	10	150	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
	4/11/95	10	200	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
	RIEEL	10	200	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,1-Dichloroethane	RIEEL	10	75	U	10.42	J	35.33	J	13.63	J	13.63	J	13.63	J	13.63	J	13.63	J	13.63	J	13.63	J	13.63	J	13.63	J
	9/27/94	10	110	J	200	U	74	J	27	J	27	J	27	J	27	J	27	J	27	J	27	J	27	J	27	J
	2/26/95	10	160	U	140	U	84	J	84	J	84	J	84	J	84	J	84	J	84	J	84	J	84	J	84	J
	4/11/95	10	80	J	130	U	94	J	97	J	97	J	97	J	97	J	97	J	97	J	97	J	97	J	97	J
	RIEEL	10	100	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,1-Dichloroethene	RIEEL	10	170	U	8.75	U	0.30	J	9.75	U	9.75	U	9.75	U	9.75	U	9.75	U	9.75	U	9.75	U	9.75	U	9.75	U
	9/27/94	10	150	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
	2/26/95	10	150	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
	4/11/95	10	150	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
	RIEEL	10	170	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
cis 1,2-Dichloroethene(3)	RIEEL	10	120	U	0.97	J	24.90	J	0.95	U	0.95	U	0.95	U	0.95	U	0.95	U	0.95	U	0.95	U	0.95	U	0.95	U
	9/27/94	10	170	U	3	J	3	J	3	J	3	J	3	J	3	J	3	J	3	J	3	J	3	J	3	J
	2/26/95	10	150	U	54	J	54	J	54	J	54	J	54	J	54	J	54	J	54	J	54	J	54	J	54	J
	4/11/95	10	150	U	54	J	54	J	54	J	54	J	54	J	54	J	54	J	54	J	54	J	54	J	54	J
	RIEEL	10	170	U	61	J	61	J	61	J	61	J	61	J	61	J	61	J	61	J	61	J	61	J	61	J
trans-1,3-Dichloropropene	RIEEL	10	200	U	24.49	U	24.49	U	24.49	U	24.49	U	24.49	U	24.49	U	24.49	U	24.49	U	24.49	U	24.49	U	24.49	U
	9/27/94	10	170	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
	2/26/95	10	150	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
	4/11/95	10	200	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
	RIEEL	10	200	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Methylene Chloride	RIEEL	10	120	U	38.20	U	38.20	U	38.20	U	38.20	U	38.20	U	38.20	U	38.20	U	38.20	U	38.20	U	38.20	U	38.20	U
	9/27/94	10	150	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
	2/26/95	10	150	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
	4/11/95	10	200	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
	RIEEL	10	200	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Tetrachloroethene	RIEEL	10	120	U	0.88	J	7.65	J	1.30	J	1.30	J	1.30	J	1.30	J	1.30	J	1.30	J	1.30	J	1.30	J	1.30	J
	9/27/94	10	150	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
	2/26/95	10	150	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
	4/11/95	10	200	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
	RIEEL	10	200	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Trichloroethane	RIEEL	10	120	U	21.20	U	21.20	U	21.20	U	21.20	U	21.20	U	21.20	U	21.20	U	21.20	U	21.20	U	21.20	U	21.20	U
	9/27/94	10	150	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
	2/26/95	10	150	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
	4/11/95	10	200	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
	RIEEL	10	200	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,1,1-Trichloroethane	RIEEL	10	120	U	30.11	J	2.42	J	11.89	J	11.89	J	11.89	J	11.89	J	11.89	J	11.89	J	11.89	J	11.89	J	11.89	J
	9/27/94	10	150	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
	2/26/95	10	150	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
	4/11/95	10	200	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
	RIEEL	10	200	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Vinyl Chloride	RIEEL	10	120	U	6.60	U	6.60	U	6.60	U	6.60	U	6.60	U	6.60	U	6.60	U	6.60	U	6.60	U	6.60	U	6.60	U
	9/27/94	10	150	U	10	U	10																			

Table 5B
 Background Assessment Organic Target Parameter Analytical Results
 Boundary Groundwater Monitoring Wells and
 Surface Water Sampling Locations

Parameter	Event	MW-4	MW-5	MW-13	MW-14	MW-15	MW-16	MW-18	S1	S2	S3	S4	S5	L1	Mt. Spring	Analysis Type	NCS (ug/L)	MCL (ug/L)
Benzene	6/20/94	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP/LRA	1	6
	9/27/94	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP	1	6
	4/11/95	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP/LRA	1	6
	9/27/94	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP	1	6
Chloroethane	6/20/94	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP/LRA	1	3
	9/27/94	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP	1	3
	4/11/95	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP/LRA	1	3
	9/27/94	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP	1	3
Dichlorodifluoroethane	6/20/94	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP/LRA	0.19	-
	9/27/94	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP	0.19	-
	4/11/95	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP/LRA	0.19	-
	9/27/94	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP	0.19	-
1,1-Dichloroethane	6/20/94	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP/LRA	700**	-
	9/27/94	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP	700**	-
	4/11/95	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP/LRA	700**	-
	9/27/94	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP	700**	-
1,1-Dichloroethene	6/20/94	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP/LRA	7	7
	9/27/94	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP	7	7
	4/11/95	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP/LRA	7	7
	9/27/94	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP	7	7
cis-1,2-Dichloroethene(3)	6/20/94	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP/LRA	7	7
	9/27/94	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP	7	7
	4/11/95	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP/LRA	7	7
	9/27/94	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP	7	7
trans-1,2-Dichloroethene	6/20/94	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP/LRA	7	7
	9/27/94	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP	7	7
	4/11/95	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP/LRA	7	7
	9/27/94	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP	7	7
Methylene Chloride	6/20/94	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP/LRA	2	5
	9/27/94	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP	2	5
	4/11/95	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP/LRA	2	5
	9/27/94	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP	2	5
Tetrachloroethene	6/20/94	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP/LRA	0.7	2
	9/27/94	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP	0.7	2
	4/11/95	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP/LRA	0.7	2
	9/27/94	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP	0.7	2
Trichloroethene	6/20/94	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP/LRA	2.8	5
	9/27/94	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP	2.8	5
	4/11/95	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP/LRA	2.8	5
	9/27/94	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP	2.8	5
1,1,1-Trichloroethane	6/20/94	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP/LRA	200	200
	9/27/94	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP	200	200
	4/11/95	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP/LRA	200	200
	9/27/94	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP	200	200
Vinyl Chloride	6/20/94	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP/LRA	0.015	2
	9/27/94	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP	0.015	2
	4/11/95	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP/LRA	0.015	2
	9/27/94	U	U	U	U	U	U	U	U	U	U	U	U	U	U	CLP	0.015	2

NOTES:
 NCS Denotes North Carolina Groundwater Quality Standard (T15A: 02L: 0200)
 MCL Denotes EPA Maximum Contaminant Level (EPA 822-R-94-001)
 U Denotes not detected above Instrument Detection Level(IDL) for Inorganics and not detected above CROQL for Organics (CLP SOW Only).
 J Denotes an estimated value
 CROQL Contract Required Quantification Limit
 I Init
 S Shading - denotes parameter results that exceed U.S. EPA Maximum Contaminant Levels.
 H/Eteam/6520-21/Tab5B.xls

Note:
 1) CLP analytical methods utilize CLP Statement of Work OLMO1.9(3/90) for organic analysis
 2) LLRA analytical methods utilize EPA SW-846 Method #8021
 3) For CLP, 1,2-Dichloroethene was reported as total concentration; for LLRA concentration was reported for cis-isomer.
 4) For the 6/20/94 and 2/6/95 events, boundary monitoring well analyses were performed by using LLRA analytical methods and surface water sampling locations analyses were performed by using CLP analytical methods.

Watauga County Landfill
 Watauga County, North Carolina
 Upgradient Well: MW-1
 11/24/95

Table 5C
 Background Assessment Metal Target Parameter Analytical Results
 Core Groundwater Monitoring Wells and Septic Field Monitoring Wells

Parameter	Event	Results ug/(ppb)																	MCL (ug/L)
		MW-1	MW-2	MW-3	MW-4	MW-6	MW-8	MW-9	MW-10	MW-11	MW-12	MW-17	SFW-1	SFW-2	SFW-3	Analysis Type	NCS (ug/L)		
Barium, Total	6/20/94	203	199	123	242	652	281	710	109	117	101	117	-	-	-	CLP	2000		
	9/27/94	149	204	119	23.5	502	86.9	632	113	153	101	90.4	-	-	-	CLP	2000		
	2/06/95	157	192	109	27.2	418	70.4	615	94.8	176	104	87.2	-	-	-	CLP	2000		
	4/11/95	143	212	82	23.2	477	65	628	93.1	295	97.7	77.3	1050	J	143	CLP	2000		
	6/20/94	409	24.4	U	24.4	24900	16100	J	7060	5460	J	3220	-	-	-	CLP	2000		
Iron, Total	9/27/94	1390	140	9320	71.8	9170	418	42	3100	3.8	149	-	-	-	-	CLP	300		
	2/06/95	2830	46	6610	552	5930	368	735	2240	296	260	-	-	-	-	CLP	300		
	4/11/95	2490	J	3600	J	8300	J	149	J	157	U	63.7	J	56600	J	CLP	300		
	6/20/94	6.0	4.5	U	4.5	U	4.5	U	4.5	U	4.5	U	-	-	-	CLP	300		
	9/27/94	4.3	U	4.6	U	4.3	U	4.6	U	4.6	U	4.6	U	-	-	CLP	300		
Cadmium, Total	6/20/94	0.5	U	4.4	U	4.4	U	4.4	U	4.4	U	4.4	U	4.4	U	CLP	5		
	2/06/95	0.5	U	4.4	U	4.4	U	4.4	U	4.4	U	4.4	U	4.4	U	CLP	5		
	4/11/95	0.3	U	4.4	U	4.4	U	4.4	U	4.4	U	4.4	U	4.4	U	CLP	5		
	6/20/94	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	-	-	CLP	1.1		
	9/27/94	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	-	-	CLP	1.1		
Mercury, Total	2/06/95	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	CLP	1.1		
	4/11/95	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	CLP	1.1		
	6/20/94	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	-	-	CLP	1.1		
	9/27/94	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	-	-	CLP	1.1		
	4/11/95	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	-	-	CLP	1.1		

Boundary Groundwater Monitoring Wells and Surface Water Sampling Locations

Parameter	Event	Results ug/(ppb)																	MCL (ug/L)
		MW-5	MW-7	MW-13	MW-14	MW-15	MW-16	MW-18	S1	S2	S3	S4	S5	L1	M Spring	Analysis Type	NCS (ug/L)		
Barium, Total	6/20/94	-	439	542	18.4	94.9	66.8	73.6	133	755	366	94.1	197	-	-	CLP	2000		
	9/27/94	-	698	597	17.4	79	70.6	78.7	-	-	-	-	-	-	-	CLP	2000		
	2/06/95	710	743	79.4	16.3	82.3	72.5	67.9	86.8	J	350	J	82.5	J	5.5	CLP	2000		
	4/11/95	591	436	54.4	16.4	78.4	70.3	83	J	-	-	-	472	J	2240	CLP	2000		
	6/20/94	-	15200	283	100	2110	78.6	24.4	11300	30800	8600	1040	26400	-	-	CLP	2000		
Iron, Total	9/27/94	-	19200	450	3.8	554	117	12.2	-	-	-	-	-	-	-	CLP	300		
	2/06/95	475	26400	2370	61.3	975	490	61.3	13200	J	8790	J	90300	J	31.4	CLP	300		
	4/11/95	15.7	U	131	J	40.8	U	40.8	U	40.8	U	4.5	U	4.5	U	CLP	300		
	6/20/94	-	4.5	U	4.5	U	4.5	U	4.5	U	4.5	U	4.5	U	-	CLP	5		
	9/27/94	-	4.3	U	4.3	U	4.4	U	4.4	U	4.4	U	4.4	U	4.3	U	CLP	5	
Cadmium, Total	2/06/95	4.4	U	4.4	U	4.4	U	4.4	U	4.4	U	4.4	U	4.4	U	CLP	5		
	4/11/95	0.3	U	4.4	U	4.4	U	4.4	U	4.4	U	4.4	U	4.4	U	CLP	5		
	6/20/94	-	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	-	CLP	5		
	9/27/94	-	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	CLP	1.1	
	4/11/95	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	CLP	1.1		

Notes:
 NCS Denotes North Carolina Groundwater Quality Standard (TI15A: 02L 0200)
 MCL Denotes EPA Maximum Contaminant Level (EPA 822-R-94-001)
 U Denotes not detected above Instrument Detection Limit(IDL) for Inorganics(CLP SOW only)
 J Denotes an estimated value
 ** Denotes a Secondary Maximum Contaminant Level (SMCL) for Total Iron
 - Denotes a proposed NCS
 - Denotes Not Available or Not Sampled
 - Denotes parameter results that exceed U.S. EPA Maximum Contaminant Levels.
 - Denotes analytical methods utilize relevant Atomic Adsorption technique and Inductively Coupled Plasma (ICP) method, in accordance with EPA Contract Laboratory Program (CLP) Statement of Work ILMO 3.0 for metal analysis.

Watauga County Landfill
 Watauga County, North Carolina
 Upgradient Well: MW-1
 12/07/95

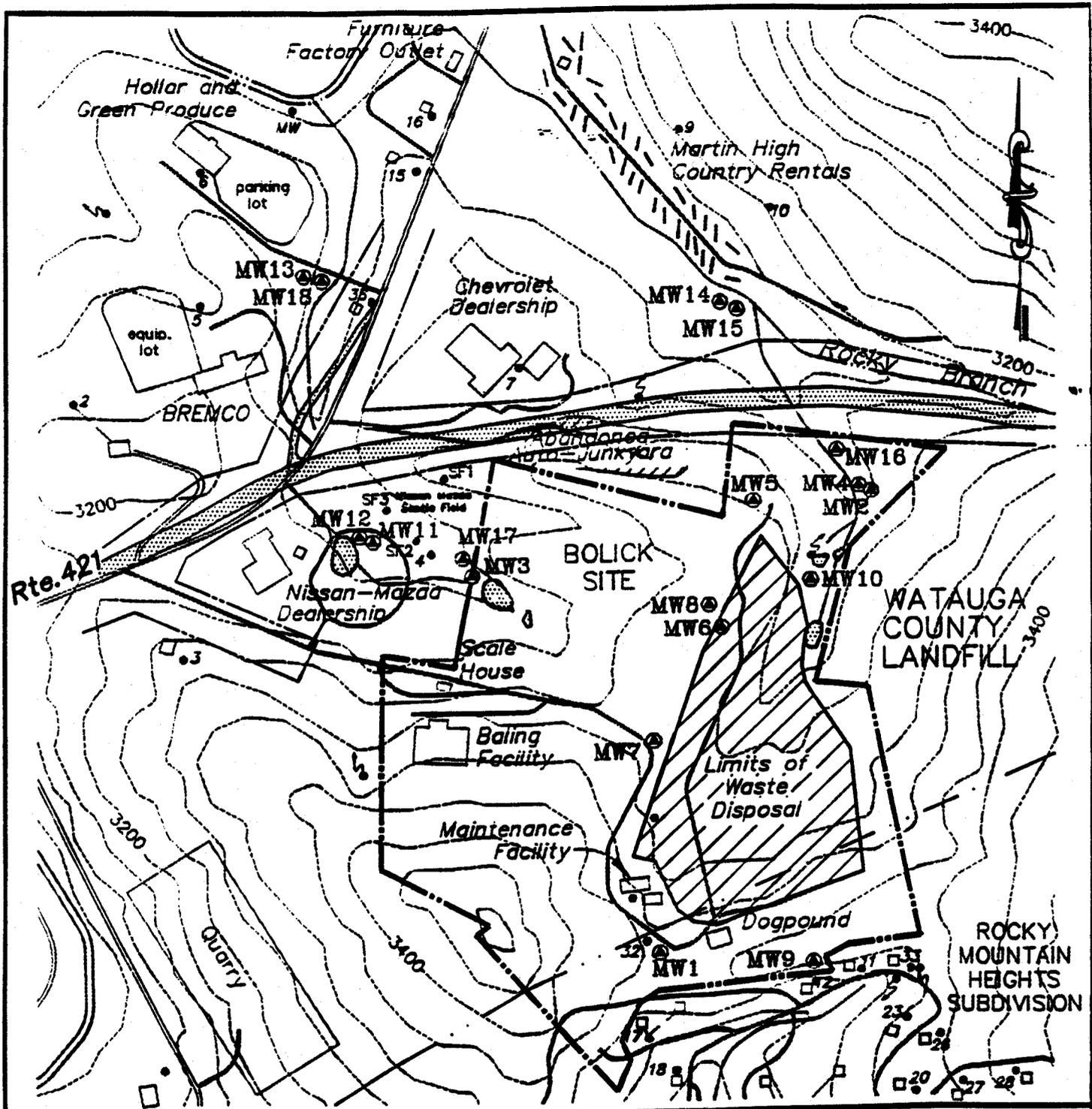
Table 6A
 Cumulative Detected Non-Target Organic Parameter Analytical Results
 Contract Laboratory Program (CLP) Statement of Work (SOW) - Organics

Parameter	Event	Results ug/L(ppb)													MCL (ug/L)		
		MW-1	MW-3	MW-4	MW-7	MW-8	MW-9	MW-10	MW-11	MW-12	MW-17	S1	S2	NCS (ug/L)			
Acetone	6/20/94	61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	700
	9/27/94	-	-	-	-	-	-	-	-	-	-	40	-	-	-	-	700
	4/11/95	-	-	-	15	J	-	-	-	-	-	-	-	-	-	-	700
2-Butanone	9/27/94	-	-	-	19	-	-	-	-	-	-	-	-	-	-	-	-
	7/10/95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4/11/95	-	-	2	J	-	-	-	-	-	-	-	-	-	-	-	-
Carbon Tetrachloride	4/11/95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4/11/95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4/11/95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloropropane	2/6/95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4/11/95	-	-	1	J	-	-	-	-	-	-	-	-	-	-	-	0.3
	4/11/95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.56
2-methyl-2-pentanone	6/20/94	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.56
	6/20/94	2	J	-	-	-	-	-	-	-	-	-	-	-	-	-	0.56
	6/20/94	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
Ethylbenzene	6/20/94	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
	7/10/95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4/11/95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	6/20/94	2	J	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	7/10/95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4/11/95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Xylene (total)	6/20/94	64	-	-	-	-	-	-	-	-	-	-	-	-	-	-	29
	7/10/95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	700
	4/11/95	-	-	2	J	-	-	-	-	-	-	-	-	-	-	-	29
m,p Xylene	6/20/94	64	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1000
	7/10/95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1000
	4/11/95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1000

Tentatively Identified Compounds

Parameter	Event	Results ug/L(ppb)												
		MW-6	MW-9	MW-11	MW-16	MW-17	MW-18							
Hexane	4/11/95	-	-	-	-	-	-							
	4/11/95	-	200	NJ	7	NJ	-							
Dichlorobromethane	4/11/95	-	-	-	-	-	-							
	4/11/95	-	-	6	NJ	-	-							
Unknown Alkane	4/11/95	-	-	-	-	-	-							
	4/11/95	-	-	9	NJ	-	-							
Unknown Cycloalkane	4/11/95	-	-	-	-	-	-							
	4/11/95	-	-	12	NJ	-	-							
Unknown Hydrocarbon	4/11/95	-	-	-	-	-	-							
	4/11/95	-	-	28	NJ	-	-							
Unknown Unsaturated Hydrocarbon	4/11/95	-	-	-	-	-	-							
	7/10/95	-	-	10	NJ	10	NJ							
Unknown Ketone	4/11/95	-	-	-	-	-	-							
	4/11/95	-	-	5	NJ	7	NJ							
Unknown Ketone	4/11/95	-	-	-	-	-	-							
	7/10/95	-	-	13	NJ	18	NJ							
Unknown Ketone	4/11/95	-	-	-	-	-	-							
	7/10/95	-	-	7	NJ	9	NJ							
Unknown Ketone	4/11/95	-	-	-	-	-	-							
	7/10/95	-	-	8	NJ	8	NJ							

Notes:
 NCS Denotes North Carolina Groundwater Quality Standard (T15A: 02L .0200)
 MCL Denotes EPA Maximum Contaminant Level (EPA 822-R-94-001)
 - Denotes Not Detected
 - Denotes Not Available
 J Denotes an estimated value
 N Denotes tentatively identified
 Organic parameters were analyzed in accordance with USEPA CLP SOW OLM01.9 (3/90).



3200 Existing Ground
 Proposed Right-of-Way
 Existing Ground
 Proposed Right-of-Way

STANDARD FIELD PROTOCOL - INITIAL ACTIVITIES

Project Watauga County Landfill Permit #95-02 Date 7-9-95
 Sampling Sequence see below Weather/Temperature see field notes
 Samplers Jeff Park / Len DiJoia
 Static Water Level measurement equipment Soline + D4 Environmental
 procedure Immersion

Well evacuation equipment Dedicated Grundfos pump for all wells except MWs 5, 7
 procedure pumping at acceptable flow rates based on recharge rates. (MW's 5 and 7 purged by PE disposable bailers).

Sample withdrawal equipment same as above
 procedure same as above - sampled at rate of < 100 ml/minute

Sample filtration equipment none required.
 procedure _____

Types of sample containers and method of preservation used for required analysis (in order of sequence of filling containers)

CD metals (white plastic 1L - HNO₃), CLP 9010A (white plastic - NaOH)
8011/8021 (clear glass - 40ml - HCl), 8081/8151/8310 (1L amber glass - no preservative), 8260/8260 acryl/acro (40 ml clear glass - HCl), 8270A (1L amber glass - no preservative)
4030 (500ml white plastic - Zn Acetate) - See field notes for sequence of filling containers

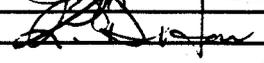
Internal temperature of shipping containers at outset of sampling
room temperature

Temperature equipment Corning Checkmate probe
 calibration procedure intake
 measurement procedure immersion

pH equipment Corning Checkmate probe
 calibration procedure 7.00 and 4.00 or 7.00 and 10.00 buffers (depending on well)
 measurement procedure immersion B/Baxter solutions

Conductivity equipment Corning Checkmate probe
 calibration procedure air/1408.8 µS Ricca Chemical Co. conductivity std.
 measurement procedure cal. in air / then in 1 dose 8 µS std.

Conductivity calibration measurements/time see field notes

Sampler signatures (date/time)  / 7-9-95 1800
 / 7-9-95 1800

Sampling sequence: - MW-1, MW-6, MW-3, MW-7 (partial), MW-8 (7-10-95)
 - MW-13, MW-11, MW-10, MW-17, MW-15, S-3, S-1, S-2, S-5, S-4, MW-7 (partial) (7-11-95)
 - MW-9, MW-12, MW-16, MW-14, MW-2, MW-4 (7-12-95)
 - MW-18, MW-5 (7-13-95)

ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit #95-02

Well # MW-1 date 7-10-95 time 1125

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 41.20' (in feet)
 Total depth of well = TD = 76.65' (in feet)
 Water column length = $L_c(\text{ft.}) = (TD-DTW) =$ 35.45' (in feet)

Volume of water in well casing = $V_{c(\text{gal.})} = L_c(\text{ft.}) * 0.653 \text{ gal/ft.}$
 = 23.15 gallon

Volume of water in filter pack = $V_{f(\text{gal.})} =$
 $= [L_c(\text{ft.}), \text{ Not to exceed 37 feet }] * 0.522 \text{ gal/ft.}$
 = 18.50 gallon

Unit Well Volume = V_w (Gallons) = $(V_c + V_f)$ = 41.65 gallon
 Minimum Purge Volume (Gallons) = $3 * V_w$ = 125 gallon

Description of water before purging clear - no odor

Measurements collected during purging:

1140 began purging at 4.0 gpm

+19
minutes

Time	Temperature	pH	mV	Conductivity	Pumping Rate	# gallon
1. 1141	14.1°C	5.97	46	93.2 uS	4.0 gpm	4.0
2. 1152	13.4°C	6.61	26	111.4 uS	4.0 gpm	48.0
3. 1202	13.5°C	6.45	30	98.1 uS	4.0 gpm	88.0
4. 1212	13.5°C	6.42	28	94.5 uS	4.0 gpm	128.0

Total volume of water purged + 130 gallon
 Description of water after purging clear - no odor

Measurements collected after purging:

pH Calibration: 4.00 and 7.00

Final four (4) replicate measurements of:

	Temperature	pH	mV	Conductivity	Time
1.	16.1°C	6.41	28	92.3 uS	1230
2.	16.1°C	6.42	28	96.6 uS	1232
3.	16.3°C	6.51	26	94.0 uS	1236
4.	16.0°C	6.40	28	94.8 uS	1238

Misc. Field Observations sampled at 1230

Sampler signatures (date/time) [Signature] 7/10-95 1300
[Signature] 7-10-95 1300

ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit #95-02

Well # MW-2 date 7-12-95 time 1610

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 6.60' (in feet)
 Total depth of well = TD = 177.50 (in feet)
 Water column length = $L_{c(ft.)} = (TD-DTW) =$ 170.90 (in feet)

Volume of water in well casing = $V_{c(gal.)} = L_{c(ft.)} * 0.163 \text{ gal/ft.}$
 = 27.86 gal.

Volume of water in filter pack = $V_{f(gal.)} =$
 = $[L_{c(ft.)}, \text{ Not to exceed } 17.0 \text{ ft.}] * 0.522 \text{ gal/ft.}$
 = 3.37 gal

Unit Well Volume = V_w (Gallons) = $(V_c + V_f)$ = 36.7 gal

Minimum Purge Volume (Gallons) = $3 * V_w$ = 110.1 gal

Description of water before purging clear - no odor

Measurements collected during purging:

1615 began purging at 4.0 gpm

+44
minutes

Time	Temperature	pH	mV	Conductivity	Pumping Rate	± gallons
1. <u>1616</u>	<u>13.9°C</u>	<u>8.35</u>	<u>-</u>	<u>279 μS</u>	<u>4.0 gpm</u>	<u>4</u>
2. <u>1625</u>	<u>14.4°C</u>	<u>7.99</u>	<u>-53</u>	<u>280 μS</u>	<u>4.0 gpm</u>	<u>40</u>
3. <u>1634</u>	<u>15.1°C</u>	<u>7.01</u>	<u>-53</u>	<u>277 μS</u>	<u>4.0 gpm</u>	<u>76</u>
4. <u>1643</u>	<u>15.3°C</u>	<u>7.87</u>	<u>-47</u>	<u>267 μS</u>	<u>4.0 gpm</u>	<u>112</u>

Total volume of water purged +112 gallons

Description of water after purging clear - no odor

Measurements collected after purging:

pH Calibration: 7.00 and 10.01

Final four (4) replicate measurements of:

	Temperature	pH	mV	Conductivity	Time
1.	<u>14.2°C</u>	<u>7.67</u>	<u>40</u>	<u>272 μS</u>	<u>1700</u>
2.	<u>15.4°C</u>	<u>7.82</u>	<u>-46</u>	<u>265 μS</u>	<u>1705</u>
3.	<u>15.1°C</u>	<u>7.98</u>	<u>-53</u>	<u>276 μS</u>	<u>1710</u>
4.	<u>15.6°C</u>	<u>7.80</u>	<u>-44</u>	<u>268 μS</u>	<u>1715</u>

Misc. Field Observations 1730 sampled

Sampler signatures (date/time) [Signature] 7-12-95 1545
[Signature] 7-12-95 1545

ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit #95-02

Well # MW-3 date 7-10-95 time 1455

Condition of well GOOD

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 17.43 (in feet)
 Total depth of well = TD = 39.60 (in feet)
 Water column length = $L_c(\text{ft.}) = (TD-DTW) =$ 22.17 (in feet)

Volume of water in well casing = $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$
 = 3.61 gal

Volume of water in filter pack = $V_f(\text{gal.}) =$
 $= [L_c(\text{ft.}), \text{ Not to exceed } 12.0 \text{ ft.}] * 0.522 \text{ gal/ft.}$
 = 6.26 gal

Unit Well Volume = V_w (Gallons) = $(V_c + V_f)$ = 9.87 gal
 Minimum Purge Volume (Gallons) = $3 * V_w$ = 29.6 gal

Description of water before purging Slightly silty

Measurements collected during purging:

1504 began purging at 2.0 gpm

Time	Temperature	pH	mV	Conductivity	Pumping Rate	# gallons
1. 1505	15.5°C	6.02	43	204 $\mu\text{S/cm}$	2 gpm	2.0
2. 1509	14.7°C	6.07	43	204 $\mu\text{S/cm}$	2 gpm	10 Silty H.
3. 1514	15.0°C	6.54	27	196.2 $\mu\text{S/cm}$	2 gpm	20
4. 1519	15.0°C	6.51	28	201 $\mu\text{S/cm}$	2 gpm	30

Total volume of water purged 30 gallons
 Description of water after purging F30 GAL

Measurements collected after purging:

pH Calibration: 4:7

Final four (4) replicate measurements of:

	Temperature	pH	Conductivity	Time	mV
1.	17.7°C	6.59	198 $\mu\text{S/cm}$	25	
2.	16.8°C	6.53	200 $\mu\text{S/cm}$	28	
3.	16.7°C	6.66	196 "	23	
4.	16.2°C	6.57	196 "	36	

Misc. Field Observations Sampling 1530

Sampler signatures (date/time) [Signature] 7-10-95 1600
[Signature] 7-10-95 1600

ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit #95-02

Well # MW-4 date 7-12-95 time 1745

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 8.94 (in feet)
 Total depth of well = TD = 29.40 (in feet)
 Water column length = $L_c(\text{ft.}) = (TD-DTW) =$ 20.46 (in feet)

Volume of water in well casing = $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$
 = 3.33 gal.

Volume of water in filter pack = $V_f(\text{gal.}) =$
 $= [L_c(\text{ft.}), \text{ Not to exceed } 11.0 \text{ ft.}] * 0.522 \text{ gal/ft.}$
 = 5.74 gal

Unit Well Volume = V_w (Gallons) = $(V_c + V_f)$ = 9.07 gal
 Minimum Purge Volume (Gallons) = $3 * V_w$ = 27.2 gal.

Description of water before purging clear - no odor

Measurements collected during purging:

1747 began purging at 2.0 gpm

*+7
minutes*

Time	Temperature	pH	mV	Conductivity	Pumping Rate	# gallons
1. <u>1748</u>	<u>14.5°C</u>	<u>6.40</u>	<u>32</u>	<u>66.3 uS</u>	<u>2.0 gpm</u>	<u>2.0</u>
2. <u>1752</u>	<u>13.5°C</u>	<u>6.49</u>	<u>27</u>	<u>48.7 uS</u>	<u>2.0 gpm</u>	<u>10.0</u>
3. <u>1757</u>	<u>14.0°C</u>	<u>6.70</u>	<u>17</u>	<u>50.4 uS</u>	<u>2.0 gpm</u>	<u>20.0</u>
4. <u>1802</u>	<u>14.4°C</u>	<u>6.87</u>	<u>11</u>	<u>48. uS</u>	<u>2.0 gpm</u>	<u>30.0</u>

Total volume of water purged + 30 gal
 Description of water after purging clear - no odor

Measurements collected after purging:

pH Calibration: 7.00 and 4.00

Final four (4) replicate measurements of:

	Temperature	pH	mV	Conductivity	Time
1.	<u>15.2°C</u>	<u>6.67</u>	<u>20</u>	<u>47.3 uS</u>	<u>1808</u>
2.	<u>14.1°C</u>	<u>6.60</u>	<u>21</u>	<u>50.3 uS</u>	<u>1809</u>
3.	<u>13.6°C</u>	<u>6.62</u>	<u>21</u>	<u>50.4 uS</u>	<u>1810</u>
4.	<u>13.3°C</u>	<u>6.61</u>	<u>21</u>	<u>50.2 uS</u>	<u>1811</u>

Misc. Field Observations 1815 sampled

Sampler signatures (date/time) [Signature] 7-12-95 1830
[Signature] 7-12-95 1830

ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit #95-02

Well # MW-5 date 7-13-95 time 0900

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 50.29' (in feet)
 Total depth of well = TD = 73.00 (in feet)
 Water column length = $L_c(ft.) = (TD-DTW) =$ 22.71 (in feet)

Volume of water in well casing = $V_c(gal.) = L_c(ft.) * 0.163 gal/ft.$
 = 3.7 gallons

Volume of water in filter pack = $V_f(gal.) =$
 $= [L_c(ft.), \text{ Not to exceed } 12.0 \text{ ft.}] * 0.624 gal/ft.$
 = _____

Unit Well Volume = V_w (Gallons) = $(V_c + V_f)$ = 3.7 gallon

Minimum Purge Volume (Gallons) = $3 * V_w$ = 11.1 gallon
(44 bails)

Description of water before purging clear-no odor

Measurements collected during purging:

0906 began bailing

Time	Temperature	pH	Conductivity	# bails	Pumping Rate	= gallon
1. <u>0906</u>	<u>15.6°C</u>	_____	<u>360 μS</u>	<u>1</u>	<u>1</u>	<u>0.25</u>
2. <u>0917</u>	<u>16.9°C</u>	_____	<u>387 μS</u>	<u>15</u>	<u>15</u>	<u>3.75</u>
3. <u>0932</u>	<u>15.9°C</u>	_____	<u>353 μS</u>	<u>30</u>	<u>30</u>	<u>7.50</u>
4. <u>0944</u>	_____	_____	<u>356 μS</u>	<u>45</u>	<u>45</u>	<u>11.25</u>

Total volume of water purged + 45 bails (11.25 gallons)

Description of water after purging clear-no odor

Measurements collected after purging:

pH Calibration: _____ * pH meter malfunction

Final four (4) replicate measurements of:

	Temperature	pH	Conductivity	Time
1.	_____	_____	_____	_____
2.	_____	_____	_____	_____
3.	_____	_____	_____	_____
4.	_____	_____	_____	_____

Misc. Field Observations pH meter malfunction - sampled at 0950

Sampler signatures (date/time) [Signature] 7-13-95 1000
[Signature] 7-13-95 1000

ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit #95-02

Well # MW-6 date 7-10-95 time 1330

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 43.73 (in feet)

Total depth of well = TD = 58.00 (in feet)

Water column length = $L_{c(ft.)} = (TD-DTW) =$ 14.27 (in feet)

Volume of water in well casing = $V_{c(gal.)} = L_{c(ft.)} * 0.163 \text{ gal/ft.}$
 = 2.33 gal

Volume of water in filter pack = $V_{f(gal.)} =$
 $= [L_{c(ft.)}, \text{ Not to exceed } 12.0 \text{ ft.}] * 0.624 \text{ gal/ft.}$
 = 7.5 gal

Unit Well Volume = V_w (Gallons) = $(V_c + V_f)$ = 9.8 gal

Minimum Purge Volume (Gallons) = $3 * V_w$ = 29.4 gal

Description of water before purging CLEAR

Measurements collected during purging:

(3:47) began purging at 0.25 gpm

Time	Temperature	pH	Conductivity	Pumping Rate	ML
1. <u>3:47</u>	<u>18.2°C</u>	<u>5.90</u>	<u>428 $\mu S/cm$</u>	<u>0.25 GPM</u>	<u>50</u>
2. <u>3:50</u>	<u>18.2°C</u>	<u>6.00</u>	<u>437 $\mu S/cm$</u>	<u>0.25 GPM</u>	<u>49</u>
3. <u>3:56</u>	<u>18.1°C</u>	<u>6.98</u>	<u>439 $\mu S/cm$</u>	<u>0.25 GPM</u>	<u>50</u>
4. _____	_____	_____	_____	<u>DRY</u>	_____

Total volume of water purged 2.5 Gal

Description of water after purging CLEAR

Measurements collected after purging:

pH Calibration: 4.7

Final four (4) replicate measurements of:

	Temperature	pH	Conductivity	Time	ML
1.	<u>20.4°C</u>	<u>6.26</u>	<u>434 $\mu S/cm$</u>	_____	<u>31</u>
2.	<u>17.6°C</u>	<u>6.46</u>	<u>486 $\mu S/cm$</u>	_____	<u>31</u>
3.	<u>17.6°C</u>	<u>6.47</u>	<u>404 $\mu S/cm$</u>	_____	<u>33</u>
4.	<u>17.6°C</u>	<u>6.45</u>	<u>408 $\mu S/cm$</u>	_____	<u>33</u>

Misc. Field Observations SAMPLED 1430 AFTER RECHARGE

Sampler signatures (date/time) [Signature] 7-10-95 1500

[Signature] 7-10-95 1500

ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit #95-02

Well # MW-7 date 7-9-95 time 1805

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 48.98 (in feet)
 Total depth of well = TD = 50.00 (in feet)
 Water column length = $L_c(\text{ft.}) = (TD-DTW) =$ 1.02 (in feet)

Volume of water in well casing = $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$
 = .03

Volume of water in filter pack = $V_f(\text{gal.}) =$
 $= [L_c(\text{ft.}), \text{ Not to exceed 12.0 ft.}] * 0.624 \text{ gal/ft.}$
 = .64

Unit Well Volume = V_w (Gallons) = $(V_c + V_f)$ = .66
 Minimum Purge Volume (Gallons) = $3 * V_w$ = 2.0

Description of water before purging Clear

Measurements collected during purging:

Time	Temperature	pH	Conductivity	Pumping Rate	MY
1. <u>1821</u>	<u>15.8 °C</u>	<u>6.83</u>	<u>850 $\mu\text{S/cm}$</u>	<u>1st Bail</u>	<u>6MV</u>
2. <u>1827</u>	<u>16.3 °C</u>	<u>6.98</u>	<u>810 $\mu\text{S/cm}$</u>	<u>3rd Bail</u>	<u>2MV</u>
3. <u>1830</u>	<u>16.1 °C</u>	<u>6.99</u>	<u>821 $\mu\text{S/cm}$</u>	<u>5 Bail</u>	<u>1MV (1/2 Full)</u>
4. <u>1834</u>	<u>16.2 °C</u>	<u>7.08</u>	<u>897 $\mu\text{S/cm}$</u>	<u>6 Bail</u>	<u>0MV (~4" Full of H₂O)</u>

Total volume of water purged ~ 1.5 GAL
 Description of water after purging VERY SLIGHTLY SILTY

Measurements collected after purging:

pH Calibration: 4.7

Final four (4) replicate measurements of:

	Temperature	pH	Conductivity	Time
1.	_____	_____	_____	_____
2.	_____	_____	_____	_____
3.	_____	_____	_____	_____
4.	_____	_____	_____	_____

Misc. Field Observations Sampled at 1620

Sampler signatures (date/time) [Signature] 7-10-95 1645
[Signature] 7-10-95 1645

ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit #95-02

Well # MW-8

date 7-10-95

time 09:50

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 17.42 (in feet)

Total depth of well = TD = 67.00 (in feet)

Water column length = $L_c(\text{ft.}) = (TD - DTW) = \underline{49.58}$ (in feet)

Volume of water in well casing = $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$
 = 8.08 gallons

Volume of water in filter pack = $V_f(\text{gal.}) =$
 $= [L_c(\text{ft.}), \text{ Not to exceed } 12.0 \text{ ft.}] * 0.522 \text{ gal/ft.}$
 = 6.26 gallons

Unit Well Volume = V_w (Gallons) = $(V_c + V_f) = \underline{14.34 \text{ gallons}}$

Minimum Purge Volume (Gallons) = $3 * V_w = \underline{43.0 \text{ gallons}}$

Description of water before purging clear - no odor

Measurements collected during purging:

1626 began purging at 0.50 gpm

Time	Temperature	pH	mV	Conductivity	Pumping Rate	# gallons
1. 1021	15.5°C	6.56	24	841 μ S	0.50 gpm	0.50
2. 1024	14.8°C	6.43	31	632 μ S	0.50 gpm	2.00
3. 1029	16.2°C	6.66	21	594 μ S	0.50 gpm	4.50
4. 1034	16.4°C	6.83	14	609 μ S	0.50 gpm	7.00
5. 1038	15.9°C	6.83	10	628 μ S	1.00 gpm	11.00

Total volume of water purged + 13 gallons

Description of water after purging clear - no odor

Measurements collected after purging:

pH Calibration: 4.00 and 7.00

Final four (4) replicate measurements of:

	Temperature	pH	mV	Conductivity	Time
1.	18.8°C	6.60	19	672 μ S	1638
2.	18.5°C	6.69	16	635 μ S	1641
3.	18.5°C	6.66	16	642 μ S	1643
4.	18.3°C	6.71	15	627 μ S	1645

Misc. Field Observations sampled at 1645

Sampler signatures (date/time) [Signature] 7-10-95 1700
[Signature] 7-10-95 1700

1041 well after 14.0 gal

ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit #95-02

Well # MW-9

date 7-12-95

time 0740

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 20.17 (in feet)

Total depth of well = TD = 86.40 (in feet)

Water column length = $L_c(ft.) = (TD-DTW) = \underline{6.23}$ (in feet)

Volume of water in well casing = $V_c(gal.) = L_c(ft.) * 0.163 \text{ gal/ft.}$
 = 1.0 gal.

Volume of water in filter pack = $V_f(gal.) =$
 $= [L_c(ft.), \text{ Not to exceed } 12.0 \text{ ft.}] * 0.522 \text{ gal/ft.}$
 = 3.25 gal

Unit Well Volume = V_w (Gallons) = $(V_c + V_f) = \underline{4.25 \text{ gal}}$

Minimum Purge Volume (Gallons) = $3 * V_w = \underline{12.75 \text{ gal}}$

Description of water before purging clear - no odor

Measurements collected during purging:

0750 began purging at 0.75 gpm

+ 22
minutes

Time	Temperature	pH	mV	Conductivity	Pumping Rate	# gallons
1. 0752	13.9°C	5.92	53	485 μ S	0.75 gpm	1.5
2. 0756	14.4°C	6.06	49	505 μ S	0.75 gpm	4.5
3. 0802	15.3°C	6.09	52	477 μ S	0.75 gpm	9.0
4. 0808	15.3°C	6.20	48	467 μ S	0.75 gpm	13.5

Total volume of water purged + 16 gallons

Description of water after purging clear - no odor

Measurements collected after purging:

pH Calibration: 7.00 & 4.00

Final four (4) replicate measurements of:

	Temperature	pH	mV	Conductivity	Time
1.	15.6°C	6.19	48	460 μ S	0824
2.	15.7°C	6.21	48	453 μ S	0826
3.	15.6°C	6.16	50	471 μ S	0829
4.	15.9°C	6.23	47	466 μ S	0831

Misc. Field Observations Sampled at 0845

Sampler signatures (date/time) [Signature] 7-12-95 0900

[Signature] 7-12-95 0900

ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit #95-02

Well # MW-10 date 7-10-95 time 1048

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 7.91' (in feet)
 Total depth of well = TD = 70.03 (in feet)
 Water column length = $L_c(ft.) = (TD-DTW) =$ 62.12 (in feet)

Volume of water in well casing = $V_c(gal.) = L_c(ft.) * 0.163 gal/ft.$
 = 10.13 gallons

Volume of water in filter pack = $V_f(gal.) =$
 $= [L_c(ft.), \text{ Not to exceed } 12.0 \text{ ft.}] * 0.522 gal/ft.$
 = 6.26 gallons

Unit Well Volume = V_w (Gallons) = $(V_c + V_f) =$ 16.39 gallons
 Minimum Purge Volume (Gallons) = $3 * V_w =$ 49.2 gallons

Description of water before purging clear - no odor

Measurements collected during purging:

1054 began purging at 0.75 gpm

Time	Temperature	pH	mV	Conductivity	Pumping Rate	# gallons
1. 1055	13.2°C	7.54	-25	246 μS	0.75 gpm	0.75
2. 1100	14.5°C	7.47	-27	215 μS	0.75 gpm	4.50
3. 1105	15.0°C	7.41	-21	142 μS	0.75 gpm	8.25
4. 1110	15.9°C	7.46	-23	143 μS	0.75 gpm	12.00
5. 1114	16.6°C	7.37	-15	141.9 μS	0.75 gpm	15.00

Total volume of water purged + 17 gallons
 Description of water after purging clear - no odor

1116
well drn
after
16.50
gallons

Measurements collected after purging:

pH Calibration: 7.04 and 10.15

Final four (4) replicate measurements of:

Taken on 7-11-95

	Temperature	pH	Conductivity	MV Time
1.	17.6°C	7.35	133.5 $\mu S/cm$	-20
2.	17.4	7.21	167.7	-10
3.	18.0	7.26	132.7 $\mu S/cm$	-11
4.	16.9	7.14	132.9 $\mu S/cm$	-7

Misc. Field Observations SAMPLED 7-11-95 @ 1030

Sampler signatures (date/time) [Signature] 7-10-95 1100
[Signature] 7-10-95 1100

ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit #95-02

Well # MW-11 date 7-11-95 time 0850

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 12.53 (in feet)

Total depth of well = TD = 25.80 (in feet)

Water column length = $L_c(\text{ft.}) = (TD-DTW) = \underline{13.27}$ (in feet)

Volume of water in well casing = $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$
 = 2.16 gallons

Volume of water in filter pack = $V_f(\text{gal.}) =$
 $= [L_c(\text{ft.}), \text{ Not to exceed } 12.0 \text{ ft.}] * 1.045 \text{ gal/ft.}$
 = 12.54 gallons

Unit Well Volume = V_w (Gallons) = $(V_c + V_f) = \underline{14.7 \text{ gallon}}$

Minimum Purge Volume (Gallons) = $3 * V_w = \underline{44.1 \text{ gallons}}$

Description of water before purging clear - no odor

Measurements collected during purging:

0857 began purging at 3 gpm

*+7
minutes*

Time	Temperature	pH	mV	Conductivity	Pumping Rate	# gallons
1. <u>0858</u>	<u>15°C</u>	<u>6.14</u>	<u>45</u>	<u>202 uS</u>	<u>3 gpm</u>	<u>3</u>
2. <u>0902</u>	<u>15.2°C</u>	<u>6.18</u>	<u>42</u>	<u>200 uS</u>	<u>3 gpm</u>	<u>15</u>
3. <u>0907</u>	<u>16.2°C</u>	<u>6.33</u>	<u>33</u>	<u>193.3 uS</u>	<u>3 gpm</u>	<u>30</u>
4. <u>0912</u>	<u>15.9°C</u>	<u>6.72</u>	<u>20</u>	<u>194.9 uS</u>	<u>3 gpm</u>	<u>45</u>

Total volume of water purged + 48 gallons

Description of water after purging clear - no odor

Measurements collected after purging:

pH Calibration: 7.00 & 4.00

Final four (4) replicate measurements of:

	Temperature	pH	mV	Conductivity	Time
1.	<u>20.5°C</u>	<u>6.57</u>	<u>27</u>	<u>201 uS</u>	<u>0931</u>
2.	<u>20.7°C</u>	<u>6.43</u>	<u>30</u>	<u>198 uS</u>	<u>0933</u>
3.	<u>19.8°C</u>	<u>6.46</u>	<u>30</u>	<u>197.1 uS</u>	<u>0934</u>
4.	<u>19.9°C</u>	<u>6.43</u>	<u>30</u>	<u>195.4 uS</u>	<u>0936</u>

Misc. Field Observations sampled at 0932

Sampler signatures (date/time) [Signature] 7-11-95 1000
[Signature] 7-11-95 1000

ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit #95-02

Well # MW-12 date 7-12-95 time 0910

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 10.48' (in feet)
 Total depth of well = TD = 72.75 (in feet)
 Water column length = $L_c(\text{ft.}) = (TD-DTW) = \underline{62.27}$ (in feet)

Volume of water in well casing = $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$
 = 10.15 gal.

Volume of water in filter pack = $V_f(\text{gal.}) = [L_c(\text{ft.}), \text{ Not to exceed } 12.0 \text{ ft.}] * 0.522 \text{ gal/ft.}$
 = 6.26 gal

Unit Well Volume = V_w (Gallons) = $(V_c + V_f) = \underline{16.41 \text{ gal}}$
 Minimum Purge Volume (Gallons) = $3 * V_w = \underline{49.2 \text{ gallons}}$

Description of water before purging clear - no odor

Measurements collected during purging:

0915 began purging at 3.0 gpm

+ 18 minutes

Time	Temperature	pH	mV	Conductivity	Pumping Rate	# gallons
1. 0916	12.8°C	6.29	35	201.5	3.0 gpm	3
2. 0920	14.2°C	6.54	24	189.5	3.0 gpm	15
3. 0925	15.2°C	6.63	19	190.0	3.0 gpm	30
4. 0930	15.7°C	6.76	13	187.9	3.0 gpm	45

Total volume of water purged + 51 gallons
 Description of water after purging clear - no odor

Measurements collected after purging:

pH Calibration: 7.00 and 4.00

Final four (4) replicate measurements of:

	Temperature	pH	mV	Conductivity	Time
1.	17.1°C	6.81	12	188.9	0940
2.	15.5°C	6.81	12	188.7	0941
3.	17.0°C	6.89	8	186.0	0943
4.	16.2°C	6.85	9	186.3	0944

Misc. Field Observations sampled at 1000

Sampler signatures (date/time) [Signature] 7-12-95 1015
[Signature] 7-12-95 1015

ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit #95-02

Well # MW-13 date 7-11-95 time 0720

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 19.62 (in feet)
 Total depth of well = TD = 31.65 (in feet)
 Water column length = $L_c(\text{ft.}) = (TD - DTW) = \underline{12.03}$ (in feet)

Volume of water in well casing = $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$
 = 1.96 gallons

Volume of water in filter pack = $V_f(\text{gal.}) =$
 $= [L_c(\text{ft.}), \text{ Not to exceed } 12.0 \text{ ft.}] * 1.045 \text{ gal/ft.}$
 = 12.54 gallons

Unit Well Volume = V_w (Gallons) = $(V_c + V_f) = \underline{14.5 \text{ gallons}}$
 Minimum Purge Volume (Gallons) = $3 * V_w = \underline{43.5 \text{ gallons}}$

Description of water before purging Clear

Measurements collected during purging:

STARTED Purge @ 0735

Time	Temperature	pH	Conductivity	Pumping Rate	MV	Gals
1. 0735	13.5 °C	5.62	29.6 uS/cm	5 GPM	74	.5
2. 0740	13.6 "	5.87	29.3 uS/cm	5 GPM	65	2.5
3. 0746	14.2 "	5.91	26.7 uS/cm	5 GPM	32	5.5
4. 0800	14.2 °C	6.04	39.1 uS/cm	5 GPM	32	12.5

Total volume of water purged + 14 Gals (WATER DEW)
 Description of water after purging Clear

Measurements collected after purging:

pH Calibration: 4.7

Final four (4) replicate measurements of:

	Temperature	pH	Conductivity	MV Time
1.	14.8 °C	6.06	39.4 uS/cm	38
2.	14.2 °C	5.91	30.4 uS/cm	66
3.	13.8 °C	5.95	32.0 uS/cm	60
4.	13.7 °C	5.92	32.2 uS/cm	57

Misc. Field Observations SAMPLED @ 0820

Sampler signatures (date/time) [Signature] / 7-11-95 0845
[Signature] / 7-11-95 0845

ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit #95-02

Well # MW-14 date 7-12-95 time 1440

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 7.74' (in feet)
 Total depth of well = TD = 71.00 (in feet)
 Water column length = $L_c(\text{ft.}) = (TD-DTW) = \underline{63.26}$ (in feet)

Volume of water in well casing = $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$
 = 10.31 gal

Volume of water in filter pack = $V_f(\text{gal.}) =$
 = [$L_c(\text{ft.})$, Not to exceed 12.0 ft.] * 1.567 gal/ft.
 = 18.8 gal

Unit Well Volume = V_w (Gallons) = ($V_c + V_f$) = 29.1 gal.
 Minimum Purge Volume (Gallons) = $3 * V_w = \underline{87.3 gal.}$

Description of water before purging Clear - no odor

Measurements collected during purging:

1446 began purging at 1.5 gpm

Time	Temperature	pH	MV Conductivity	Pumping Rate	# gallons
1. 1448	16.4 °C	6.45	101.2 uS/cm	1.5 gpm	3.0
2. 1458	16.6 "	6.77	85.0 "	1.5 GPM	18.0
3. 1508	16.8 "	6.72	78.9 "	1.5 GPM	33.0
4. 1518	16.7 "	6.78	81.1 uS/cm	1.5 GPM	48.0
5. 1530	15.5	6.90	78.0 uS/cm	1.5 GPM	66.0

Total volume of water purged 66.0 gal.

Description of water after purging Clear
 6.1543 15.9 6.85 7 73.0 uS/cm 1.5 87

Measurements collected after purging:

pH Calibration: 4.7

Final four (4) replicate measurements of:

	Temperature	pH	MV	Conductivity	Time
1.	17 °C	6.85	10	77.8 uS/cm	1555
2.	15.8	6.81	10	78.1 uS/cm	1557
3.	16.3	6.82	10	77.3 uS/cm	1601
4.	15.8	6.81	11	77.6 "	1602

Misc. Field Observations Sand @ 1600

Sampler signatures (date/time) [Signature] 7-12-95 1615
[Signature] 7-12-95 1615

ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit #95-02

Well # MW-15 date 7-11-95 time 1245

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 11.96 (in feet)
 Total depth of well = TD = 178.00 (in feet)
 Water column length = $L_c(\text{ft.}) = (TD-DTW) = \underline{166.04}$ (in feet)

Volume of water in well casing = $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$
 = 27 gallons

Volume of water in filter pack = $V_f(\text{gal.}) =$
 = [$L_c(\text{ft.})$, Not to exceed 13.0 ft.] * 1.522 gal/ft.
 = 20 gallons

Unit Well Volume = V_w (Gallons) = ($V_c + V_f$) = 47 gallons
 Minimum Purge Volume (Gallons) = $3 * V_w = \underline{141 \text{ gallons}}$

Description of water before purging clear - no odor

Measurements collected during purging:

1254 began purging at 1.5 gpm

Time	Temperature	pH	MV	Conductivity	Pumping Rate	# gallons
1. 1256	14.7°C	8.28	-69	154.7 μS	1.5 gpm	3.0
2. 1302	16.9°C	8.27	-67	150.9 μS	1.5 gpm	12.0
3. 1310	16.5°C	8.21	-65	150.6 μS	1.5 gpm	24.0
4. 1319	17.5°C	8.36	-68	155.2 μS	1.5 gpm	38.0

1324 dry at 45 gallons
 Total volume of water purged + 47 gallons
 Description of water after purging clear - no odor

Measurements collected after purging:

pH Calibration: 7.00 and 10.01

Final four (4) replicate measurements of:

	Temperature	pH	MV	Conductivity	Time
1.	17.3°C	8.24	-65	157.4 μS	1340
2.	17.7°C	8.36	-68	151.0 μS	1341
3.	17.1°C	8.24	-65	153.4 μS	1343
4.	17.0°C	8.21	-65	157.4 μS	1344

Misc. Field Observations sampled at 345

Sampler signatures (date/time) [Signature] 7-11-95 1400
[Signature] 7-11-95 1400

ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit #95-02

Well # MW-16

date 7-12-95

time 1400

Condition of well GOOD

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 4.54 (in feet)

Total depth of well = TD = 26.80 (in feet)

Water column length = $L_{c(ft.)} = (TD-DTW) = \underline{22.26}$ (in feet)

Volume of water in well casing = $V_{c(gal.)} = L_{c(ft.)} * 0.163 \text{ gal/ft.}$
 = 3.6

Volume of water in filter pack = $V_{f(gal.)} =$
 $= [L_{c(ft.)}, \text{ Not to exceed } 12.0 \text{ ft.}] * 0.522 \text{ gal/ft.}$
 = 6.3

Unit Well Volume = V_w (Gallons) = $(V_c + V_f) = \underline{9.9}$
 Minimum Purge Volume (Gallons) = $3 * V_w = \underline{30 \text{ GALS}}$

Description of water before purging CLEAR/NO ODOR

Measurements collected during purging:

1400 - STARTED PURGE

*15 MIN PURGE
7 MIN DRAIN*

Time	Temperature	pH	Conductivity	Pumping Rate	MV	GALS
1. <u>1403</u>	<u>15.6 °C</u>	<u>6.31</u>	<u>193.9 uS/cm</u>	<u>2 GPM</u>	<u>33</u>	<u>6</u>
2. <u>1408</u>	<u>14.2 "</u>	<u>6.57</u>	<u>186.2 "</u>	<u>2 GPM</u>	<u>22</u>	<u>16</u>
3. <u>1413</u>	<u>14.1 "</u>	<u>6.66</u>	<u>187.4 "</u>	<u>2 GPM</u>	<u>20</u>	<u>26</u>
4. <u>1417</u>	<u>14.8 "</u>	<u>6.70</u>	<u>186.6 "</u>	<u>"</u>	<u>16</u>	<u>34</u>

Total volume of water purged + 34 GALS

Description of water after purging CLEAR

Measurements collected after purging:

pH Calibration: 7.4

Final four (4) replicate measurements of:

	Temperature	pH	Conductivity	Time	MV
1.	<u>15.8 °C</u>	<u>6.81</u>	<u>194.3 uS/cm</u>	<u>1422</u>	<u>10</u>
2.	<u>15.2 "</u>	<u>6.82</u>	<u>1950 "</u>	<u>1424</u>	<u>11</u>
3.	<u>16.6 "</u>	<u>6.89</u>	<u>191.4 "</u>	<u>1426</u>	<u>7</u>
4.	<u>14.8 "</u>	<u>6.86</u>	<u>191.7 "</u>	<u>1428</u>	<u>8</u>

Misc. Field Observations SAMPLED @ 1430

Sampler signatures (date/time) [Signature] 7-12-95 1445
[Signature] 7-12-95 1445

ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit #95-02

Well # MW-17 date 7-11-95 time 11:15

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 18.11 (in feet)

Total depth of well = TD = 94.54 (in feet)

Water column length = $L_{c(ft.)} = (TD-DTW) = \underline{76.43}$ (in feet)

Volume of water in well casing = $V_{c(gal.)} = L_{c(ft.)} * 0.163 \text{ gal/ft.}$
 = 12.46 gal

Volume of water in filter pack = $V_{f(gal.)} =$
 $= [L_{c(ft.)}, \text{ Not to exceed } 12.0 \text{ ft.}] * 0.522 \text{ gal/ft.}$
 = 6.26 gal

Unit Well Volume = V_w (Gallons) = $(V_c + V_f) = \underline{18.72 \text{ gal}}$

Minimum Purge Volume (Gallons) = $3 * V_w = \underline{56 \text{ gallons}}$

Description of water before purging clear - no odor

Measurements collected during purging:

1138 began purging at 1.0 gpm

	Time	Temperature	pH	Conductivity	Pumping Rate	NV	gals
1.	<u>1139</u>	<u>15.1 °C</u>	<u>6.71</u>	<u>501 uS/cm</u>	<u>1 GPM</u>	<u>13</u>	<u>1</u>
2.	<u>1144</u>	<u>16.6 °C</u>	<u>6.91</u>	<u>331 uS/cm</u>	<u>1 GPM</u>	<u>9</u>	<u>6</u>
3.	<u>1151</u>	<u>17.3 °C</u>	<u>6.82</u>	<u>300 uS/cm</u>	<u>1 GPM</u>	<u>9</u>	<u>13</u>
4.	<u>1157</u>	<u>16.8 °C</u>	<u>6.89</u>	<u>336 uS/cm</u>	<u>1 GPM</u>	<u>7</u>	<u>19</u>

Total volume of water purged -20 gals

Description of water after purging CLEAR

Measurements collected after purging:

pH Calibration: 4.7

Final four (4) replicate measurements of:

	Temperature	pH	NV	Conductivity	Time
1.	<u>17.1 °C</u>	<u>6.98</u>	<u>4</u>	<u>348 uS</u>	<u>1215</u>
2.	<u>17.2 °C</u>	<u>6.93</u>	<u>5</u>	<u>354 uS</u>	<u>1217</u>
3.	<u>17.3 °C</u>	<u>6.94</u>	<u>5</u>	<u>336 uS</u>	<u>1219</u>
4.	<u>17.6 °C</u>	<u>6.90</u>	<u>6</u>	<u>340 uS</u>	<u>1221</u>

Misc. Field Observations SAMPLED @ 1220

Sampler signatures (date/time) [Signature] 7-11-95 1245
[Signature] 7-11-95 1245

ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit #95-02

Well # MW-18 date 7-13-95 time 0750

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 17.94' (in feet)
 Total depth of well = TD = 73.20 (in feet)
 Water column length = $L_{c(ft.)} = (TD-DTW) = \underline{55.26}$ (in feet)

Volume of water in well casing = $V_{c(gal.)} = L_{c(ft.)} * 0.163 \text{ gal/ft.}$
 = 9.0 gallons

Volume of water in filter pack = $V_{f(gal.)} =$
 = [$L_{c(ft.)}$, Not to exceed 12.0 ft.] * 0.522 gal/ft.
 = 6.26 gal.

Unit Well Volume = V_w (Gallons) = ($V_c + V_f$) = 15.26 gal
 Minimum Purge Volume (Gallons) = $3 * V_w = \underline{45.8 \text{ gal}}$

Description of water before purging clear - no odor

Measurements collected during purging:

0807 - STARTED PURGING

+ 13 minutes

Time	Temperature	pH	mV	Conductivity	Pumping Rate	MV	Gal
1. 0808	13.7°C	7.33	-15	104.8 $\mu\text{S/cm}$	2.5 GPM		2.5
2. 0815	14.2°C	6.77	10	91.4 $\mu\text{S/cm}$	2.5 GPM		20 GALS
3. 0822	*	*	*	71.3 $\mu\text{S/cm}$	2.5 GPM		37.5 GALS
4. 0828	*	*	*	92.1 $\mu\text{S/cm}$	2.5 GPM		52.5 yls

Total volume of water purged + 52 minutes

Description of water after purging clear - no odor

Measurements collected after purging:

pH Calibration: 7.00 and 4.00

Final four (4) replicate measurements of:

	Temperature	pH	Conductivity	Time
1.	_____	_____	_____	_____
2.	_____	_____	_____	_____
3.	_____	_____	_____	_____
4.	_____	_____	_____	_____

Misc. Field Observations Sampled at 0850
Final four replicates in 20 minutes were not collected due to a malfunction in meter

Sampler signatures (date/time) [Signature] 7-13-95 0900
[Signature] 7-13-95 0920

STANDARD FIELD PROTOCOL - FINAL ACTIVITIES

Project: Watauga County Landfill Permit #95-02 Date: 7-13-95

Internal temperature of shipping containers at completion of sampling:
< 4°C

Sample destination _____

Method of transportation _____

Sampler signatures (date/time) [Signature] 7-13-95 1130

[Signature] 7-13-95 1130

- SDG-1 (7-12-95) CompuChem - Research Triangle Park, NC - 2 coolers (Fed Ex) ^{HKYA 76}
CT&E - Charleston, WV, (CT&E pickup at LF office) 6 coolers
ETS - Roanoke, VA - 4 coolers - Fed. Ex HKYA 76

- SDG-3 (7-12-95) CompuChem - RTP, NC - 1 cooler (Fed Ex - HKYA 76)

- SDG-2 (7-13-95) CompuChem - RTP, NC - 2 coolers (Fed Ex HKYA-35)
ETS - 4 coolers - ETS pickup at Blacksburg
CT&E - 6 coolers - CT&E pickup at Blacksburg

(M) John Count NO (1 and 1/1) = Day 11
SE Service Annual Assessment Event
(SE Assessment Event)

DATA: Personnel on site: JEFF PAGE
LEN DITBIC

800 arrived on site
General Notes on Project:

1) Health and Safety: Operating under

Dryer Area: Associates Site Specific Health
and Safety Plan. Health and Safety
Director on site will be Jeff Page.

PPE: Chemical Resistant Vests, face
shield, gloves, safety glasses,
ear plugs, Safety apron (backing
operation only)

Air Monitoring: Air monitoring will not be
conducted due to unavailability of
an monitors. All sampling
sites will be entered with caution
from the upwind direction. The
presence of gases will be detected only
by olfactory means.

2) MW-5 and MW-7 will be purged via
disposable polyethylene bag-in-leak-out
welds will be purged via canisters
dedicated pump systems. Sampling will
be conducted via the same methods as
previously.

- 3) Conductivity meter will be calibrated daily with Risco Chemical company 14088495 conductivity standard.
- 4) pH meter will be calibrated at each sampling point using Baxter prepared pH buffers according to the kit-tried data of the meter.
 - A. Granulometer with pH < 7.0 will be calibrated w/ 4 and 7 buffers.
 - B. Granulometer with pH > 7.0 will be calibrated w/ 7 and 10 buffers.
- 5) Parging will be conducted at flow rate suitable for the exchange rates for each well. (based on kit-tried data) Sample 9 will be conducted at a rate of 100 ml/minute to reduce the potential of volatilization.
- 6) 5 Streams and 2 leachate Seeps will be sampled.
- 7) MW-7 will be purged 7-5-95 and sampled everyday to attempt to collect samples for every method prescribed.

Identifications:

1) Groundwater Environmental Remediation

Monitoring wells: MW1's 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 and 13

a. CUP method (Table 2 SS1-8916 table 2 weight)

b. CUP AB10 A - Spindle (Table 2 SS1-8916)

2) Monitoring wells: MW's 5, 13, 14, 15, 16, and 18

a. CUP method (Form A method - H5300)

b. CUP method (Form 4 - H5300)

c. CUP method (Form 4 - H5300)

d. CUP method (Form 4 - H5300)

e. CUP method (Form 4 - H5300)

f. CUP method (Form 4 - H5300)

g. CUP method (Form 4 - H5300)

h. CUP method (Form 4 - H5300)

i. CUP method (Form 4 - H5300)

j. CUP method (Form 4 - H5300)

k. CUP method (Form 4 - H5300)

l. CUP method (Form 4 - H5300)

m. CUP method (Form 4 - H5300)

n. CUP method (Form 4 - H5300)

2) CUP Environmental Services

1) Core analysis: Sand at 60cm

a. B011 GC VOAS (Table 2 SS1-8916)

b. B021 GC VOAS (Table 2 SS1-8916)

c. B081 GC PASTEVA (Table 2 SS1-8916)

d. B15 GC HEAD-105 (Table 2 SS1-8916)

e. B310 GC PASTEVA (Table 2 SS1-8916)

f. B012 GC VOAS (Form 4 VOAS)

g. B012 GC VOAS (Form 4 VOAS)

h. No surface and leachate samples for CUP.

C.) ETS Analytical Services

(22)

1. Core wells: same as before

a. B260 GCUS VAI (Table 2 SW-846)

b. B260 acrylonitrile/acrolein GCUS VAI (Table 2 SW-846)

c. B270A GCUS Sens-Vol (Table 2 SW-846)

d. 9030 sulfides (Table 2 SW-846)

2. No boundary wells surface and leachate samples for ETS.

9.) Performance Evaluation samples have been prepared and will be submitted to the laboratories as Sample I.D.

MW-1A (Fictitious well)

Comp Chem: P.E. for CIP metal (Table 2)

CTE: P.E. for 8021 (Table 2, list)

ETS: P.E. for B260 (Table 2, list)

10.) Order of sampling:

a.) B260/B260 acrylonitrile/acrolein

b.) 8021/8011

c.) CIP volatiles

d.) B270A/8310

e.) CIP 9010A Granite

1.) 9030 sulfides

a.) 8021/B261

b.) CIP total metals

Water: Temp 86°F and sulfur

1809 MW-11 will be used for dry end and allow for discharge for maximum of 24 hours

for the sampling container and at 10:00 AM

total dissolved solids cond. stat. DTM 408 PB

Water (Revised) test bail from MW-11. Water is clear w/ no odor

1809 MW-11 dry after 10:00 AM

Water sampling 2:45

1840 test site at the dry

[Signature]
7-11-95
1840

Address to 1-9-95 notes

(Incorporate)

CIP metal: HND2, PUK22, field presence
CIP sampling: NAD2, HNT2, field presence
B260: HNT2, HNT2, field presence
B260 acrylonitrile/acrolein: HNT2, field presence
8021: HNT2, field presence
8011: PUK22, field presence
B270A: no presence
8310/8310: no presence
9030: pres. of sulfur in the field

1995

(23)

Book 3
 598 495 TN 6520-21 DATE: MONDAY 7-10-95 (24)

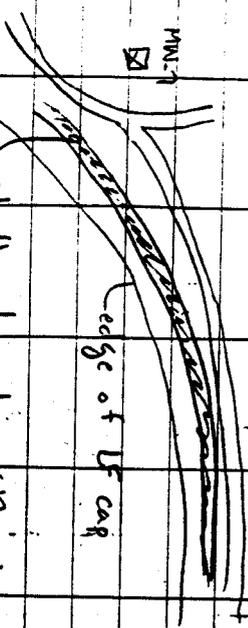
Waburger County LE - Day 2
 1st Semi-Annual Assessment Event
 JSP/LLD

Weather: 0710 sunny, temp in mid 60's, foggy
 expected highs in the high 80's and
 high humidity, 20-30% chance of
 afternoon showers.

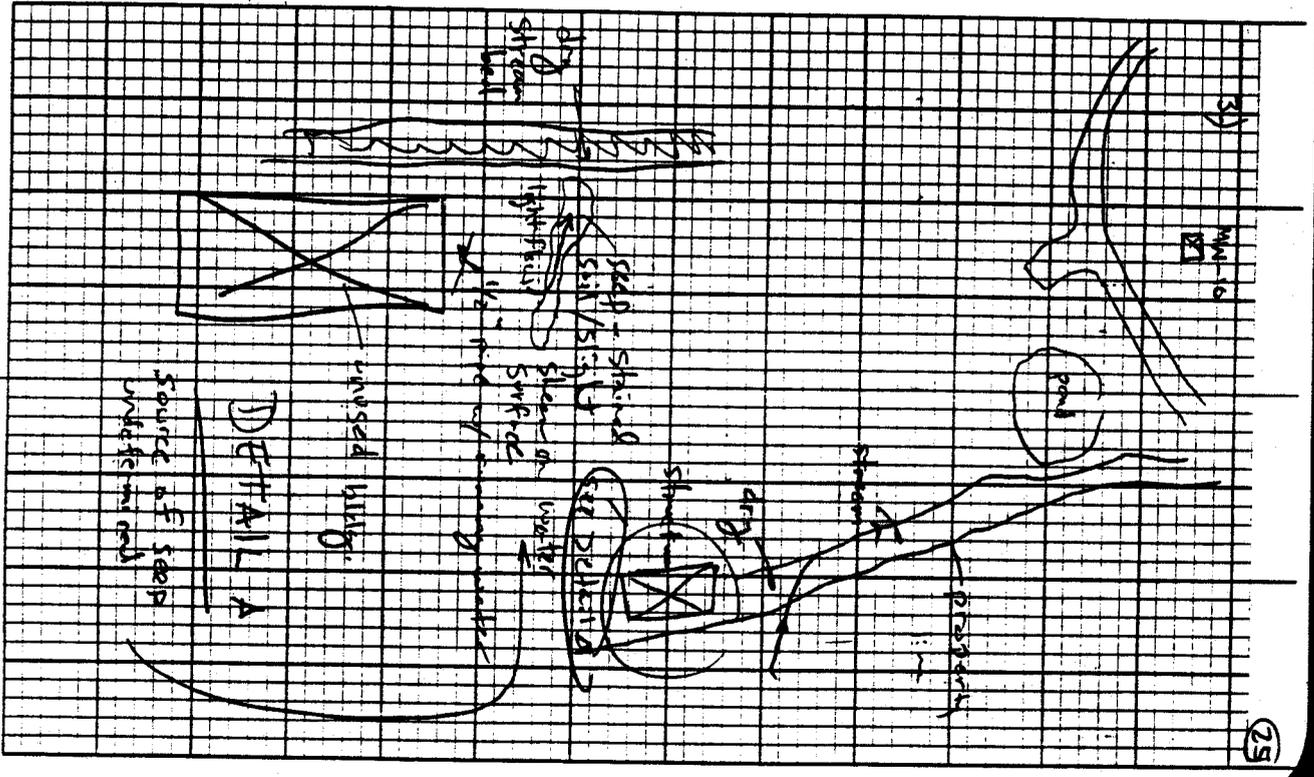
0710 arrived on site
 0720 site walkover

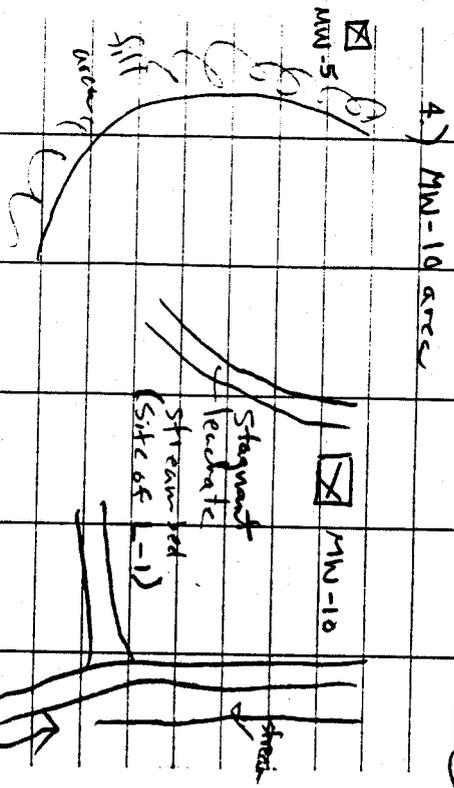
1) NE of animal shelter - no
 leaded seeps present, however
 strong odor of landfill gases

2)



shallow track with rainwater
 and slight displacement of
 leaded. Slight odor - water
 is stagnant, cannot sample.





Stream to the right of the road is extremely discolored with iron.

5) S1, S2, S3, and SS area all areas of this stream are extremely iron discolored. Very strong odors.

0800 Office - talked w/ J.B. - Mark Cools replacement. Asked J.B. to grade roads to MW-5, 2, 4, 16 and move dumpster to MW-9.

Piezometer Swells

PZ 14	DTM 18.47'
PZ 13	DTM 18.07'
PZ 23	DTM 23.71'

0817	MW-17	DTM 15.24'
0818A	MW-18A	DTM 16.49'
0818	MW-18	DTM 16.01'
0822	MW-22	DTM 14.15'
<u>0835 Non-Hazardous - 10611 Swells</u>		
083	MW-8	17.42'
0843	MW-5	50.29'
0847	MW-6	43.73'
0852	MW-10	7.91'
0856	MW-2	6.60'
0857	MW-4	8.74'
0864	MW-16	4.54'
0868	MW-5	11.96'
0870	MW-4	7.74'
0871	MW-11	4.20'
0872	MW-9	80.17'
0873	MW-17	18.11'
0875	MW-3	17.83'
0878	MW-11	12.53'
0879	MW-12	10.48'
0883	MW-13	19.62'
0885	MW-18	17.94'
0850	MW-8	DTM 17.42'

Note: Measure used Swell of MW-7 on 7-9-95

calibrated with 908 P 48 and 578 SWL 400 and 750 Swells

1020	began purging at 0.50 gpm water clear w/ no odor			
1038	obtained conductivity well dry after ~ 14 gallons purged.	stabilization		
1041	will sample when today			
1048	MW-10 calibrated w/ fresh 7000 and 1000 buffers	DTM 7.911'		
1054	began purging at 0.75 gpm water clear, no odor			
1114	obtained stabilization of conductivity well dry after + 16.5 gallons			
1116	will sample 7.11.95 by 1115			
1125	MW-1 calibrated w/ 4000 and 7.00 fresh buffers	DTM 41.20'		
1140	began purging at 4.0 gpm reduced flow to < 100 mL/min (19 min)			
1211	after stabilization purged + 130 gallons erythritol/acetoin blank added 4 drops 1.0M HCl			(JSP)
	PH paper tested 4.4 - 4.7			
	ETS pH blank < 2			(SSP)
	ETS pH blank < 2			(SSP)
	ETS pH blank < 2			(SSP)

11250	Sample in PVC (GWD)			
	preserved (GWD) netted w/ 11103 (< 2)			
	(LUD) (GWD) portion w/ 11103 (SITE)			
	(SITE FIELD) (ADD) w/ 0.5M HCl (4-5)			
	(SLIP) (NO AT REQUEST)			
	remaining methods were either preserved or preserved.			
11310	left site to get waste lid			
11320	MW-6 DTM 43.78'			
	calibrated w/ 4000 and 7.00 buffers			
11347	began purging at 0.75 gpm water clear, no odor			
11357	well dry at 2.5 gpm - allowed to rebound MW-6 (JSP)			
1430	sampled MW-6 (JSP)			
	erythritol/acetoin blank (GWD)			
	added 6 drops 0.1M HCl			
	PH paper tested 4.4 - 4.7			
	ETS pH blank < 2 (SSP)			
	ETS pH blank < 2 (SSP)			
	preserved (GWD) netted w/ 11103 (< 2)			
	(GWD) portion w/ 11103 (SITE)			
	stabilized w/ 2M Ac (0.2M)			
	(GWD)			
	erythritol/acetoin w/ (GWD)			
	1.0M HCl (4.5)			

1455 MW-3 DTM 17.43'

calibrated w/ 4.00 and 7.00

1504 began purging at 2.0 gpm reduced flow to < 1.0 gpm/minute (+ 10 minutes)

1530 sampled MW-3 (JSP)

acrylamide required 7 drops 1.0N

HCl (4-5) (LID)

pH blanks (ETS) < 2 (JSP)

pH blanks (CTE) < 2 (JSP)

metals < 2 (JSP)

DO/A > 2 (JSP)

ac/c 4.5 (LID)

sw/fiber preserved (JSP)

1600 MW-7

no replicate measurements taken due to insufficient water

1620 sampled MW-7 (LID)

collected only 1 8200 400ml bottle

1 8021 400ml bottle

1 8011 400ml bottle

well dry

will sample 7-11-75 by 1600.

Next priority method will be 8210A.

will attempt to get 500ml.

1635 MW-8

1645 Sampled MW-8 (LID)

acrylamide - req'd 10 drops 1.0N

HCl (4-5) (LID)

pH blanks (ETS) < 2 (JSP)

pH blanks (CTE) < 2 (JSP)

metals/cyanide/sulfides (LID)

1705 1st site for the day



7-10-75

Book 3
 3894-58 JN 6520-21 DATE: Tuesday, 7-11-95
 (32)

Washington County LE - Day 3
 1st Semi-Annual Assessment Event

TSP/LED

Weather: Temp. in mid 60's (0720) sunny
 Expected highs in high 80's - low 90's

0720 arrived on site

0725 MW-13 DTM 19.62'

calibrated cond. meter and pH
 meter w/ fresh 4 and 7 buffers

0735 - STARTED Reservoir MW 13 @ 5:00am

WATER DATA

0803 well dug after 14.0 gallons purged

obtained stabilization

0820 sampled MW-13 (TSP)

cup handle / 8021 methods

prepared 100 mL to pH < 2 (LED)

0832 returned to office to call

Compu Chem and CTFE

0850 MW-11 DTM 12.53'

calibrated w/ 4 and 7 buffers

0857 began purging at 3 gpm

0915 reduced flow to < 100 mL/minute

0830 sampled MW-10 (LED)
 cond / degs added 5 drops 1.0 N HCl
 pH = 4.5 (TSP)
 pH = 4.2 (TSP)
 metals present < 2 (LED)
 Sw fields present (LED)
 field present (TSP)

1000 MW-10
 sampled MW-10
 deg / degs 5 drops 1.0 N HCl (TSP)
 pH = 4.2 (TSP)
 (LED) metals / deg / degs present

1035 to LE office to get J.S. for calibration & reading

1100 temp site to get J.S. and J.S.

1115 arrived at MW-17
 DTM 18.11'

1130 calibrated w/ 4 and 7 buffers

1138 began purging at 110 gpm

1200 well dug at 20 gallons purged

1220 sampled MW-17 (LED)
 cup / deg / degs = 5 drops 1.0 N HCl
 pH = 4.2 (TSP)
 metals / Sw fields present (LED)
 Sw fields present (TSP)

2:45 MW-15 DTM 11.94'

calibrated w/ 4 and 7 buffers

1250 began purging at 1.5 gpm

1324	well dry at 45 gpd/hr		
	Obtained stabilization of conductivity		
1345	Sample 1 MW-1E		
	acryl/acra: < 2 (ug)		
	pH blanks: < 2 (FSF)		
	metals preserved (ug)		
1400	S-3 Area		
1405	Sample 0 S-3 (heavy iron dissolution)		
	CIP metals/CIP VDA's		
1420	sampled S-1 (heavy dissolution)		
	CIP metals/CIP VDA's		
1430	sampled S-2 (heavy dissolution)		
	strong lactate odor		
1445	sampled S-5 (heavy dissolution)		
	stray leachate odor		
1500	L-1 (near MW-10) - const		
	sample - leachate stream bed		
	is stagnant with approximately 1/4" thickness of leachate in the stream bed.		
1510	sampled S-4		
	CIP metals/CIP VDA's		

11525 MW-1 - will attempt to sample Sealed off BZ10A

1230 Sample 0 MW-1 = 2000 mg of water - called out for BZ10A method. Next grade water to meet minimum volume required for analysis (stand)

1350 Temperature 91°F and sunny. Located some shade to begin working out samples to be shipped - 112-45

1425 1 sec site to get Tee

Page Ending Day 3

[Signature]
7-11-95

1830 Accepted Fed Ex assembly package of PE signal from Environmental Resources Association of Nevada, Collieries.

Below are the tags w/ lot numbers for each of the samples

CTE - 8021 P.E. VOAs

(36)

3 40ml sample bottles (clear glass)

lot # 0710-95-02

preserved w/ HCl by CTE

VOAs free of air bubbles

ETS - 8240 P.E. VOAs

3 40ml sample bottles (clear glass)

lot # 0710-95-02

preserved w/ HCl by ETS

VOAs free of air bubbles

Comp/Chan - 1 CLP method

1 one liter white plastic bottle

lot # 0710-95-02

preserved w/ HNO₃ by Environmental Resources Associates

[Signature]

Boat 3
JSD 4-95

TN 6520-21 WEDNESDAY 7-12-95

(37)

Package Case - DAY 4

JSD/LLD

Weather: Temp ~ 70's (0713)

expected temp in low 90's / sunny

0735 GRINED on site

0745 MW-91 Aladdin's SPIKED!!!

9 TW 80.17

failed w/ 100% loss for the day

4:00 - 7:00 w/ filter

0750 began pouring at 07:50 pm

0800 reduced flow to 400 ml/min

(400 minutes)

- acrylonitrile / acrylamide? total to drop

of 1.0 N HCl (1H-5) (LLD)

- pH blanks < 2 (SSB)

0845 sampled MW-9 (LLD)

water / filter preserved (SSB)

SSB (LLD)

0910 PAWELL STW 0.481

distilled w/ 100% 1 liter

0915 began purging at 3:30 pm

0922 reduced flow to 400 ml/min

(10:50 & 5) gauges (11:18 - 11:25)

every 15 min blank record 4 strips on

(11:45) (LLD)

0945 blank < 2: (SSB)

1000 sample MW-12 (USD)
 method/s/50g preserved (SSP)
 cyanide preserved (USD)

1015 left site to get ice

1035 returned to site to repack casks w/ ice and prepare SDG-1 shipment. Computer/ETS skinned via FedEx. Express. CITE pickup at LF office.

1400 - Smarter to examine music @ Zorn water cove

1417 - Ground Traps Rare on MW 16 water cove - + 54 Gms Food

1430 - Sampled Mollie
 6021 + Normal contents

1440 MW-14 DTM 7.14'

1446 began purging at 1.5 gpm

1530 SSP to attempt to sample MW-7 CIP metal

14543 DTM Down MW 14 + 88 Gms
 Record water cove

1543 - MW 7 Dry ARD Antidote
 10 Collect Sample 50g SSB WAT on water cove by 19p

1000 collected 2 spots of food for CIP metal. Will not submit sample for analysis. DTM not at site to sample any remaining material due to insufficient food.

1000 - Sampled MW 12 Normal
 worked preserved 20 (SSP)

1410 MW 2 DTM 6.65'
 collected with 1.0 gpm 10 purges

1415 began purging at 1.0 gpm

1443 reduced rate to 0.100 ml/min
 purged + 11.2 gallons
 (+ 4.4 purged)

1730 Sampled MW-22
 6021 + Normal contents
 1.0 on Well (SSP) + draw

1745 MW-4 DTM 8.84'
 purged 10 purges
 1.0 on Well (SSP) + draw

1747 began purging at 2.0 gpm

1802 reduced rate to 0.100 ml/min
 purged + 3.0 gallons

1815 Sampled MW-4
 6021 + Normal contents
 1.0 on Well (SSP) + draw

1815 Sampled MW-4
 6021 + Normal contents
 1.0 on Well (SSP) + draw

1835 left site

[Signature]

7-12-75

(40)

Boor 3
JSP 4-95 TN 6520-21 DMC
Thursday 7-13-95

(41)

Underage Co. LT - Day 5
JSP/LLS

0745 arrived on site
overhead hang mid 70s - expected
Might be low-mid 70s issuing

0750 MMU-1B DTW 11,941
estimated by 4 and 7 buffers
and 1400.0 rest cond. still

0807 began working at 2.5 gpm
pH meter - real function - constant
conductor first 4 or 10 minute
readings.

0818 reduced flow to 1.0 gpm/min
(1.8 min) - gaged + 52 gpd/min

0850 sampled MM-18 (JSP)
total pressure 52 (LLS)

0900 MM-5 DTW 50.729
44 bells (ill gages are
pumped)

0900a LLS began dialing

0950 sampled MM-5 (JSP)
water 42 (JSP)

0950 to the 54000 to pack up 506.2
of the 54000 for shipping arrangements

0950 to the 54000 for shipping arrangements

1115 shipping arrangements made

1130 project complete
left site

~~Glad~~

7-13-95

1130

Addenda:

- CompuChem samples were shipped via
Federal Express

- ETS/OT&E samples were returned to
Blacksburg for lab pickups at 1500.

APPENDIX III

**Previous Landfill Groundwater Organic Analysis
Summary Table and Data Evaluation**

W...UGA ...UNL... AN... GROUNDWATER
 ORGANIC CONSTITUENTS DETECTED
 December 11, 1990, November 16-18, 1992 and March 3, 1993 SAMPLING EVENTS

Analyte	Date Sampled	Analytical Method	MDL	MW-1	MW-2	MW-3	MW-4	PZ-24	NCS	MCL	TRIP
Trichloroethene (TCE)	December 11, 1990	SW846 Method 8240	5			9		---	2.8	5	
	November 16-18, 1992	SW846 Method 8010	1			23		110	2.8	5	
1,1,1-Trichloroethane (1,1,1-TCA)	March 5, 1993	EPA Method 502.2	0.2	0.4	2.4	18.1	0.7		2.8	5	
	March 5, 1993	SW846 Method 8021	0.2		2.1	15.7	0.8	79.5	2.8	5	
	December 11, 1990	SW846 Method 8240	5		394	102			200	200	
	November 16-18, 1992	SW846 Method 8010	1		980	68	6		200	200	
Tetrachloroethene (PCE)	March 5, 1993	EPA Method 502.2	0.4		1646	19.0	10.5		200	200	
	March 5, 1993	SW846 Method 8021	0.4		1212	19.0	22.5	1.4	200	200	
	December 11, 1990	SW846 Method 8240	5		7	25			0.7	5	
	November 16-18, 1992	SW846 Method 8010	1		5	39		4	0.7	5	
1,1-Dichloroethane (1,1-DCA)	March 5, 1993	EPA Method 502.2	0.5	0.5	11.2		1.6		0.7	5	
	March 5, 1993	SW846 Method 8021	0.5		11.8	24.9	1.6	12.5	0.7	5	
	December 11, 1990	SW846 Method 8240	5		52	178			700'	---	
	November 16-18, 1992	SW846 Method 8010	1		41	250		81	700'	---	
1,1-Dichloroethene (1,1-DCE)	March 5, 1993	EPA Method 502.2	0.7		96	173.3	1.2	77	700'	---	
	March 5, 1993	SW846 Method 8021	0.7		82	161	1.1	43.7	700'	---	
	December 11, 1990	SW846 Method 8240	5		80	7			7	7	
	November 16-18, 1992	SW846 Method 8010	1		110	14			7	7	
cis-1,2-Dichloroethene (cis-1,2-DCE)	March 5, 1993	EPA Method 502.2	0.7		232	10.3	5.1	0.9	7	7	
	March 5, 1993	SW846 Method 8021 and *(8240)	0.7 *(0.3)		143.6	9	4.5	*	7	7	
cis-1,2-Dichloroethene (cis-1,2-DCE)	March 5, 1993	EPA Method 502.2	0.7	0.7	1.4	36.4		225	70	70	
	March 5, 1993	SW846 Method 8021 and *(8240)	0.7 *(0.7)		1	26.6	*	87.8	70	70	

Note: All Concentrations are in ppb (ug/L) (other footnotes located on page 4)

WAIAUGA COUNTY LANDFILL GROUNDWATER
 ORGANIC CONSTITUENTS DETECTED
 DECEMBER 11, 1990, NOVEMBER 16-18, 1992 AND MARCH 5, 1993 SAMPLING EVENTS

Analyte	Date Sampled	Analytical Method	MDL	MW-1	MW-2	MW-3	MW-4	PZ-24	NCS	MCL	TRIP
Methylene Chloride	December 11, 1990	SW846 Method 8240	5			23		---	5	5	
	November 16-18, 1992	SW846 Method 8010	1			16		15	5	5	
	March 5, 1993	EPA Method 502.2	0.6		4.2	9.4			5	5	
	March 5, 1993	SW846 Method 8021	0.6						5	5	
Vinyl Chloride	December 11, 1990	SW846 Method 8240	10					---	.015	2	
	November 16-18, 1992	SW846 Method 8010	1			3		12	.015	2	
	March 5, 1993	EPA Method 502.2	0.4			3.4		18.3	.015	2	2.6
	March 5, 1993	SW846 Method 8021 and *(8240)	0.4 *(1.0)			*		*	.015	2	
Dichlorodifluoromethane	December 11, 1990	SW846 8240	5			21		---	0.19	---	
	November 16-18, 1992	SW846 Method 8010	1						0.19	---	
	March 5, 1993	EPA Method 502.2	0.8			11.8		6.9	0.19	---	
	March 5, 1993	SW846 Method 8021 and *(8240)	0.8 *(0.8)			*			0.19	---	
Chloroethane	December 11, 1990	SW846 Method 8240	10					---	---	---	
	November 16-18, 1992	SW846 8010	1			5		8	---	---	
	March 5, 1993	EPA Method 502.2	1.4		2.6				---	---	
	March 5, 1993	SW846 method 8021 and *(8240)	1.4 *(10)			*		*	---	---	
Trans-1,3-Dichloropropene	December 11, 1990	SW846 Method 8240	5			9-J		---	70	100	
	November 16-18, 1992	SW846 Method 8010	1					3	70	100	
	March 5, 1993	EPA Method 502.2	0.7			0.9		5.5	70	100	
	March 5, 1993	SW846 Method 8021 and *(8240)	0.7 *(0.7)			*			70	100	

Note: All Concentrations are in ppb (ug/L) (other footnotes located on page 4)

WATAUGA COUNTY LANDFILL GROUNDWATER
 ORGANIC CONSTITUENTS DETECTED
 DECEMBER 11, 1990, NOVEMBER 16-18, 1992 AND MARCH 5, 1993 SAMPLING EVENTS

Analyte	Date Sampled	Analytical Method	MDL	MW-1	MW-2	MW-3	MW-4	PZ-24	NCS	MCL	TRIP
Benzene	December 11, 1990	SW846 Method 8240	5					---	1.0	5	
	March 5, 1993	EPA Method 502.2	0.1			1.5	0.5	6.3	1.0	5	
	March 5, 1993	SW846 Method 8021	0.1			1.3		6.3	1.0	5	
1,4-Dichlorobenzene	November 15-18, 1992	SW846 Method 8010	0.3			0.5			0.19	75	
	March 5, 1993	EPA Method 502.2	0.5		0.8				1.8	75	
Chloroform	March 5, 1993	SW846 Method 8021	0.5						1.8	75	
	December 11, 1990	SW846 Method 8240	5					---	0.19	100	
	November 16-18, 1992	SW846 Method 8010	1				2	1	0.19	100	3
1,2-Dichloropropane	March 5, 1993	EPA Method 502.2	0.3						0.19	100	
	March 5, 1993	SW846 Method 8021	0.3			0.5			0.19	100	
	December 11, 1990	SW846 Method 8240	5					---	0.56	5	
2,2-Dichloropropane	November 16-18, 1992	SW846 Method 8010	1						0.56	5	
	March 5, 1993	EPA Method 502.2	0.3		0.3	0.3			0.56	5	
	March 5, 1993	SW846 Method 8021 and *(8240)	0.3 *(0.3)			*	*	*	0.56	5	
1,1-Dichloropropene	March 5, 1993	EPA Method 502.2	0.7	0.7	1.4				---	---	
	March 5, 1993	SW846 Method 8021 and *(8240)	0.7 *(0.7)		*	*	*	*	---	---	
Bis(2-ethylhexyl)phthalate	March 5, 1993	SW846 Method 8240	0.5	3.8					---	---	
	March 5, 1993	SW846 Method 8270	2		20				---	---	
Xylenes, Total	March 5, 1993	SW846 Method 8021	0.4					1	0.4	10	
	March 5, 1993	SW846 Method 8080	0.1					0.1	---	---	

Note: All Concentrations are in mgb (ug/l.) (other footnotes located on page 4)

WATAUGA COUNTY LANDFILL GROUNDWATER
 ORGANIC CONSTITUENTS DETECTED
 DECEMBER 11, 1990, NOVEMBER 16-18, 1992 AND MARCH 5, 1993 SAMPLING EVENTS

Analyte	Date Sampled	Analytical Method	MDL	MW-1	MW-2	MW-3	MW-4	PZ-24	NCS	MCL	TRIP
Bromodichloromethane	December 11, 1990	SW846 Method 8240	5					---	---	100	
	November 16-18, 1992	SW846 Method 8010	1						---	100	
	March 5, 1993	EPA Method 502.2	0.3		0.6				---	100	
Carbon Tetrachloride	December 11, 1990	SW846 Method 8240	5					---	0.3	5	
	November 16-18, 1992	SW846 Method 8010	1						0.3	5	
	March 5, 1993	EPA Method 502.2	0.1			0.2	0.2	0.3	0.3	5	
1,2-Dichloroethane	March 5, 1993	SW846 Method 8021	0.1						0.3	5	
	March 5, 1993	SW846 Method 8021	0.3						0.38	5	
	December 11, 1990	SW846 Method 8240	5					---	0.38	5	
1,2-Dichloroethane	November 16-18, 1992	SW846 Method 8010	1						0.38	5	
	March 5, 1993	EPA Method 502.2	0.3		0.3				0.38	5	
	March 5, 1993	SW846 Method 8021 and *(8240)	0.3 *(0.3)		*	*		*	0.38	5	

PA SW-846 Methods 8011, 8030, 8040, 8090, 8120, 8150, and 8310 were Also Performed on Samples Collected on March 5, 1993, Resulting in No Analytes Detected.

IDL Analytical Method Detection Limit
 CS North Carolina Water Quality Standard (DEHNR: 15A NCAC 2L .0202)
 ICL EPA Primary Drinking Water Standard Maximum Contaminant Level

December 11, 1990 Sampling Event - Conducted by Engineering Tectonics and split-sampled with the NCDEHNR Solid Waste Section - Analysis performed by the North Carolina State Laboratory of Public Health.
 November 16-18, 1992 and March 5, 1993 Sampling Event - Conducted by Draper Aden Associates - Analysis performed by Central Virginia Laboratories and Consultants, Inc. (CVLC).

PA Metho 502.2 Co-elutes compounds cis-1,2-Dichloroethene and 2,2-Dichloropropane

denotes estimated result
 denotes proposed NCS
 denotes *(method) utilized and analyte not detected

Data Evaluation

The organic compounds detected in the groundwater at Watauga County Landfill are primarily dense Chlorinated solvents. The solvents have little affinity for soils and are seldom a problem in surface water because of their volatility. (EPA/600/8-83/019. May 1983). Metals concentrations detected in the groundwater are generally low or are below the analytical method detection limit, although several metals, Cadmium and Iron in particular, have been observed at levels above those established by the EPA MCL and the Secondary MCL, respectively.

Metal concentrations observed during the Assessment monitoring program will be evaluated to determine if groundwater resources are being adversely impacted by sources not directly related to the aquifer medium. The Groundwater and Surface Water Monitoring Program (SAP - Appendix I) included as an attachment to the Watauga County Assessment Plan describes the metal analysis to be conducted as part of the Assessment Plan. Cadmium, Iron, Barium, and Mercury will comprise the initial metal target analyte list for the first year of Assessment monitoring. Subsequent to complete annual Appendix II analyses conducted on the 'core' assessment monitoring well network, appropriate revisions to the target analyte list will be made.

The Groundwater and Surface Water Monitoring Program, Appendix I of the Assessment Plan, also describes the organic analysis to be conducted as part of the Assessment Plan. The following twelve "primary detected organic compounds" will initially be included in the target analyte list for the first year of Assessment monitoring. Analytical results of additional organic analytes provided by the necessary methods will also be provided. Subsequent to the complete annual Appendix II analyses conducted on the 'core' assessment monitoring well network, appropriate revisions to the target analyte list will be made.

A descriptive summary of constituents detected as a result of prior sampling and analysis is contained in the Evaluation of Existing Data contained in Section II of the Assessment Plan. Tables presenting data summaries of landfill well groundwater, potable well water, stream, and leachate analyses are also contained within Section II of the Assessment Plan. The following data evaluation explores in greater detail the organic constituents detected at the site.

Primary Detected Organic Compounds

The organic compounds detected at significant levels in three (3) previously existing downgradient groundwater monitoring wells (i.e. MW-2, MW-3, and MW-6), listed by order of decreasing occurrence and concentration are:

<i>Parameters detected at significant levels in virtually all downgradient monitoring wells</i>	Highest concentration reported (ppb)	NCS/MCL (ppb, ug/L)	Location of highest concentration
1,1,1-Trichloroethane (1,1,1-TCA)	1646	200/200	MW-2
1,1-Dichloroethene, <i>1,1-Dichloroethylene</i> (1,1-DCE)	232	7/7	MW-2
1,1-Dichloroethane (1,1-DCA)	250	700 (proposed)/--	MW-3
cis-1,2-Dichloroethene, <i>cis-1,2-Dichloroethylene</i> (cis-1,2-DCE)	225	70/70	MW-6
Tetrachloroethene, <i>tetrachloroethylene</i> , <i>perchloroethylene</i> (PCE)	39	0.7/5	MW-3
Trichloroethene, <i>trichloroethylene</i> (TCE)	110	2.8/5	MW-6

All of the constituents listed above were detected above associated EPA Maximum Contaminant Levels (MCL) and the North Carolina Groundwater Quality Standards (NCS) in one or more site groundwater monitoring wells (except for 1,1-DCA which does not have an established MCL or NCS).

All of the compounds listed above were also detected in three (3) of the potable water wells neighboring the site (i.e.: Nissan-Mazda, BREMCO and Carroll residence wells). PCE and TCE were detected above associated MCLs and NCSs in the Nissan-Mazda and Carroll residence wells. In the BREMCO potable well, all (6) compounds were observed only at unquantifiable levels below 1 ppb or at the detection limit of 1 ppb (1,1-DCE).

Five (5) of these compounds (i.e. 1,1,1-TCA, 1,1-DCE, 1,1-DCA, PCE, and TCE) were additionally detected at lower concentrations in five (5) other potable water wells neighboring the site (i.e.: Bolick rental, Greer, Shared Well #2, Ward, and Simko residences). All five (5) of these compounds were not detected in each potable water well and were mostly detected close to the method detection limit for each compound. The presence or source of these trace level compounds in these five (5) potable water wells can not be confirmed at this time.

A summary of the landfill groundwater analysis results for organic compounds listed above can be found on page 1 of the attached detected organic constituent summary table. Page 1 of the summary table presents all the groundwater analysis results for these six chlorinated volatile organics collected to date for the Watauga County Landfill monitoring wells, MW-1, MW-2, MW-3, MW-4, and MW-6. A summary of residential and business potable well analysis results can be found on Table 2.

The organic compounds detected at significant levels primarily in previously existing downgradient groundwater monitoring points located along the Bolick site (i.e.: MW-3 and MW-6), listed by order of decreasing occurrence and concentration are:

<i>Parameters detected at significant levels primarily in downgradient monitoring points located along the Bolick Site</i>	Highest concentrations reported (ppb)	NCS/MCL (ppb; ug/L)	Location of highest concentration
Methylene Chloride, dichloromethane (DCM)	23	5/5	MW-3
Dichlorodifluoromethane	21	0.19/---	MW3
Vinyl Chloride	18	0.015/2	MW-6
Benzene	6	1/5	MW-6
Trans-1,3-Dichloropropene	9	70/100	MW-3
Chloroethane	8	---/---	MW-6

Methylene Chloride and Vinyl Chloride were detected above associated MCLs and NCSs in both groundwater wells, MW-3 and MW-6. Methylene chloride was found just below the MCL at MW-2. It was found recently at the Carroll's residence at 138.2 ppb, well above the MCL of 5 ppb.

Dichlorodifluoromethane was also detected above the NCS in both MW-3 and MW-6 but does not have an established MCL.

Benzene was also detected above the MCL and NCS in MW-6 but only above the NCS in MW-3.

Trans-1,3-Dichloropropene was detected twice in MW-3 and MW-6, although well below the established NCS and MCL.

Chloroethane, although analyzed in four (4) sampling events, was only detected in MW-3 and MW-6 on one (1) event and additionally detected in MW-2 on a different sampling event. Chloroethane does not have an established MCL or NCS.

Methylene Chloride was detected in the Carroll residence well water in two out of three sampling events and Vinyl Chloride was detected in the Carroll residence well water in only one out of three sampling events. Although detected on different sampling events the two compounds have also been detected in the accompanying trip blank. The concentrations of Methylene Chloride and Vinyl Chloride detected in the Carroll residence well were above the established NCS and MCL for Methylene Chloride, and above and approaching, respectively, the established NCS and MCL for Vinyl Chloride. Methylene Chloride was detected at 138.2 ppb in the June 23, 1993 sampling of the Carroll residence well water, well above the MCL of 5 ppb.

Methylene Chloride has also been detected at various levels in three (3) other domestic wells within the Rocky Mountain Heights Subdivision. Methylene Chloride was possibly detected in the Perry residence well water although the analytical result was an estimated result denoted by the analytical lab only as <0.06. Methylene Chloride was detected at significant levels in the initial sampling of two other residential wells (Shared well # 1 and the Ward well). Resampling of the Perry residence well, the Shared Well #1 and the Ward residence well resulted in the absence (non-detection) of Methylene Chloride, suggesting a laboratory contaminant source.

Dichlorodifluoromethane was detected above the established NCS in three of the potable water wells neighboring the site (i.e.: Nissan-Mazda, Carroll, and Perry residences). Again, Dichlorodifluoromethane does not have an associated MCL.

Benzene was detected above the established NCS on all three sampling events of the Carroll residence well but below the established MCL. Benzene was not detected in any other potable water well neighboring the site.

Trans-1,3-Dichloropropene was not detected in any of the sampled potable water wells neighboring the site.

Chloroethane was detected in the Carroll residence well water at concentrations greater than twenty (20) times the concentrations observed in any of the groundwater monitoring wells at the landfill. Chloroethane was also detected in the Nissan-Mazda well water greater than twice the concentrations observed in any of the groundwater monitoring wells at the landfill. Chloroethane does not have an established MCL or NCS.

In summary, parameters detected in the landfill wells and also detected in potable wells above applicable MCLs are Methylene Chloride (Carroll), TCE (Carroll/Nissan) and PCE (Carroll/Nissan).

A summary of analysis results for the organic compounds discussed above can be found in pages 2 and 3 of the attached detected organic constituent summary table. Page 2 of the summary table lists Chlorinated volatile organics detected primarily in groundwater monitoring points located along the Bolick site and page 3 lists detected Benzene and Propane derivatives.

Questionable Detected Organic Compounds

Other organic compounds identified by landfill groundwater sampling and analysis were:

- 1) Detected at trace levels approaching or at analytical minimum detection limits,
- 2) Previously known as common laboratory contaminants.
- 3) Detected only once and at only one monitoring point, and/or
- 4) Also detected in the Trip Blank.

These compounds are listed with appropriate detection addendums as referenced above are:

Chloroform	1,3,4
Bromodichloromethane	1,2
Carbon Tetrachloride	1
1,2-Dichloroethane	1
1,4-Dichlorobenzene	1
1,2-Dichloropropane	1
2,2-Dichloropropene	1
1,1-Dichloropropene	2
Bis(2-ethylhexyl)phthalate	2,4
Xylenes, Total	1,2
4,4'-DDD	1,2

2,2-Dichloropropane additionally co-elutes with cis-1,2-Dichloroethene when utilizing EPA Method 502.2. Related data sets utilizing different analytical methods suggests 2,2-Dichloropropane detection was likely the result of the presence of cis-1,2-Dichloroethane.

A summary of analysis results for the organic compounds discussed above can be found on pages 3 and 4 of the attached detected organic constituent summary table. These compounds will continue to be analyzed in Full Appendix II monitoring scheduled for "core" assessment wells.

Organic Compounds Only Detected in Potable Water Wells

Organic compounds detected in the residential and business potable water wells neighboring the site but not detected in the monitoring well network at the landfill, listed by order of decreasing occurrence and concentration are:

Parameters detected only at potable water wells	Highest concentration (ppb)	NCS/MCL (ppb; ug/L)	Location Detected
Chloromethane	1.48/<0.9	---/---	Carroll/Perry
Trichlorofluoromethane	37.1/0.4	2100/---	Carroll/Nissan
Styrene	2.8	0.014/100	Carroll/Greer
tert-Butylbenzene	1.1	---/---	Carroll/Bolick
Ethylbenzene	trace	29/700	Greer
Isopropylbenzene	0.7/0.6	---/---	Bolick rental
1,3,5-Trimethylbenzene	0.7	---/---	Bolick rental
Napthalene	0.7	---/---	BREMCO/Perry
Toluene	0.6 ^T /0.8 ^T	1000/1000	Carroll/Nissan/Greer
4-Isopropyltoluene	0.2	---/---	Carroll
alpha-Chlordane	0.4	0.027/2	Shared Well #1
gamma-Chlordane	0.3	0.027/2	Shared Well #1
sec-Butylbenzene	0.2	---/---	Shared Well #1
Tert-Butyl Methyl Ether	2.4	200/---	Carroll
Methyl Ethyl Ketone	trace	170/---	Bolick rental

The fifteen (15) organic compounds listed above are contaminants that have previously been associated with private water well systems (Sorg, Thomas, 1986). Eight (8) of the compounds only detected in the residential and business potable water wells are BTEX components and are often found as the result of activities immediately around the private well heads and/or components of the well systems. Eight (8) of the compounds were detected in the Carroll residence well with three (3) of these same compounds were also detected in the Nissan-Mazda well.

The two (2) Chlordane compounds are commonly used in Termite extermination. The chlordane compounds were detected in only one (1) well, and their occurrence is likely a result of improper application. A resampling of the chlordane contaminated well resulted in no detection of any organic compounds.

A presentation of analytical results for the fifteen (15) organic compounds discussed above can be found in the summary table for the volatile and semi-volatile constituents detected in the residential and business potable water well testing.

APPENDIX IV

Potable Well Organic Analysis Summary Table

POTABLE WELL TESTING - WATAUGA COUNTY, NC
RESULTS OF VOLATILE AND SEMI-VOLATILE ANALYSIS

CONSTITUENT	MARCH 5, 1993*	MARCH 18, 1993*	MARCH 24, 1993*	JUNE 23, 1993**	JULY 13, 1994**	NCS	MCL
Carroll Residence (12)							
Benzene	2.1	1.7		1.9		1.0	5
Chloroethane	173.4	74.5		ND		---	---
Chloromethane	ND	14.8		ND		---	---
Dichlorodifluoromethane	30.6	ND		ND		0.19	---
1,1-Dichloroethane	20.9	17.4		ND		700	---
1,1-Dichloroethene	4.1	1.5		ND		7	7
cis-1,2-Dichloroethene#	1.2	0.9		<1.0		70	70
2,2-Dichloropropane#	1.2	0.9		ND		---	---
4-Isopropyltoluene	ND	0.2	NS	ND	NS	---	---
Isopropylbenzene	0.6	ND		ND		---	---
Methylene Chloride	ND	43.0(XT)		138.2		5	5
Styrene	2.8	0.5		ND		0.014	100
Tri-Butyl Methyl Ether	ND	ND		2.4		200	---
Tetrachloroethene	5.4(X)	4.7		4.2		0.7	5
Toluene	ND	0.6(T)		ND		1000	1000
1,1,1-Trichloroethane	19.7	15.7		29.4		200	200
Trichloroethene	7.0(X)	5.5(X)		7.0		2.8	5
Trichlorofluoromethane	37.1	20.2		ND		2100	---
Vinyl Chloride	1.7(T)	ND		ND		0.015	2
p and m-Xylene	ND	ND		<1.0		400	10,000
o-Xylene	ND	3.4		2.9		400	10,000
Nissan-Mazda Dealership (4)							
Carbon Tetrachloride	0.2		ND		ND	0.3	5
Chloroethane	19.1		ND		ND	---	---
Dichlorodifluoromethane	8.2		8.7		ND	0.19	---
1,1-Dichloroethane	98.5		63.1		104.3	700	---
1,2-Dichloroethane	ND		0.5		ND	0.38	---
1,1-Dichloroethene	5.4		3.7		4.7	7	7
cis-1,2-Dichloroethene#	22.2		13.0		23.7	70	70
1,2-Dichloropropane	0.5		0.3		ND	0.56	5
2,2-Dichloropropane#	22.2	NS	13.0	NS	ND	---	---
Tetrachloroethene	21.8(X)		28.1(X)		30.9	0.7	5
Toluene	ND		0.8(T)		ND	1000	1000
1,1,1-Trichloroethane	14.7		19.3		22.9	200	200
Trichloroethene	11.2(X)		9.1(X)		12.6	2.8	5
Trichlorofluoromethane	0.4		ND		ND	2100	---
o-Xylene	0.4		0.5(T)		ND	400	10,000

NOTE: All Concentrations are in ppb (ug/L).

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(Other footnotes located on page 4)

POTABLE WELL TESTING - WATAUGA COUNTY, NC
RESULTS OF VOLATILE AND SEMI-VOLATILE ANALYSIS

CONSTITUENT	3/5/93*	3/18/93*	5/11/93**	6/23/93**	3/30/94**	4/6/94**	8/2/94**	12/7/94**	4/26/95**	10/24/95	NCS	MCL
Blue Ridge Electric Membership Company - (BREMCO) (5)												
1,1-Dichloroethane	0.7					<1.0	1.4	1.0	1.2	1.8	700	---
Naphthalene	0.6					ND	ND	ND	ND	ND	---	---
1,1,1-Trichloroethane	0.2					<1.0	<1.0	<1.0	<1.0	<1.0	200	200
Trichloroethene	0.5	NS	NS	NS	NS	<1.0	<1.0	<1.0	<1.0	<1.0	2.8	5
1,1-Dichloroethene	ND					1.0	1.9	<1.0	1.1	1.7	7	7
cis-1,2-Trichloroethene	ND					<1.0	ND	<1.0	<1.0	<1.0	70	70
Tetrachloroethene	ND					<1.0	<1.0	trace	<1.0	<1.0	0.7	5
Bolick rental resident (2)												
tert-Butylbenzene	1.1					ND				ND	---	---
Isopropylbenzene	0.7					ND				ND	---	---
Trichloroethene	0.5					ND				ND	2.8	5
1,3,5-Trimethylbenzene	0.7	NS	NS	NS	NS	trace	NS	NS	NS	<1.0	700	---
1,1-Dichloroethane	ND					trace				trace	7	7
1,1-Dichloroethene	ND					trace				35.3	170	---
Methyl Ethyl Ketone	ND					trace				42.3	---	---
Tetrahydrofuran	ND					ND					---	---
Perry Residence (11)												
Dichlorodifluoromethane	2.5					ND					0.19	---
Naphthalene	0.7					ND					---	---
Chloromethane	<9	NS	NS	ND		NS	NS	NS	NS	NS	---	---
Methylene Chloride	<0.6					ND					5	5
Chloroform						<1.0					0.19	100
Greer residence (15)												
Benzene						<1.0					1.0	5
Toluene						6.4					1000	1000
Tetrachloroethene	NS	ND	NS	NS	NS	trace	NS	ND	NS	NS	0.7	5
Ethylbenzene						trace					29	700
p and m - Xylene						trace					400	10,000
Styrene						<1.0					0.14	100
Ward residence (24)												
Methylene Chloride											5	5
1,1,1-Trichloroethane			3.2	ND	ND	<1.0		ND	ND	ND	200	200
Trichloroethene			trace	<1.0	<1.0	trace		trace	ND	ND	2.8	5
Tetrachloroethene			ND	trace	<1.0	trace		trace	trace	<1.0	0.7	5
Carbon Tetrachloride			ND	ND	<1.0	ND	ND	ND	ND	ND	0.3	5
1,1-Dichloroethane			ND	ND	<1.0	<1.0		<1.0	<1.0	trace	700	---
Chloroform			ND	ND	trace	trace		ND	trace	trace	0.19	100
1,2-Dibromocyclohexane (EDB)			ND	ND	ND	ND		ND	ND	trace	0.0004	0.05

NOTE: All Concentrations are in ppb (ug/L). (Other footnotes located on page 4)

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RESULTS OF VOLATILE AND SEMI-VOLATILE ANALYSIS

CONSTITUENT	3/18/93*	5/11/93**	9/21/93**	9/30/94**	1/12/95**	10/24/95**	NCS	MCL
Shared Well #1 (8 Houses) (13)								
sec-Butylbenzene	0.2						---	---
Carbon Tetrachloride	0.1						0.3	5
Methylene Chloride	1.5	ND	NS	NS	NS		5	5
alpha-Chlordane	0.4						0.27	2
gamma-Chlordane	0.3						0.27	2
Shared Well #2 (4 Houses) (14)								
1,4-Dichlorobenzene	0.5						---	---
1,1-Dichloroethane	ND		ND	ND	ND	ND	700	---
1,1-Dichloroethene	ND		<1.0	<1.0	<1.0		7	7
Tetrachloroethene	ND		ND	ND	ND	trace	0.7	5
1,1,1-Trichloroethane	ND	NS	NS	NS	NS	trace	200	200
Chloroform	ND						0.19	100
Bromodichloromethane	ND						1.4	100
Dibromochloromethane	ND						<1.0	---
2-Chlorotoluene	ND						1.2	---
4-Chlorotoluene	ND						1.0	---
Methyl Ethyl Ketone	ND						24.6	170
Tetrahydrofuran	ND						13.4	---

CONSTITUENT	3/5/93	4/26/93	NCS	MCL
Chevrolet dealership (7)				
t-butyl methyl ether	ND	24.4	200	---

CONSTITUENT	3/23/93**	5/11/93**	6/23/93**	8/3/93**	9/9/93**	10/20/93**	3/30/94**	9/21/94**	1/12/95**	4/26/95**	NCS	MCL
Simko residence (20)												
1,1,1-Trichloroethane	trace											200
Chloroform	<1.0	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.19	100
Johnson residence (23)												
Chloroform	NS	trace	NS	NS	NS	NS	NS	NS	NS	NS	0.19	100
McLean residence (26)												
Chloroform	NS	NS	<1.0	NS	NS	NS	NS	NS	NS	NS	1.0	100
Yates residence (30)												
Chloroform	NS	NS	NS	<1.0	NS	NS	NS	NS	NS	NS	0.19	100
McClintock residence (33)												
1,2-Dichloroethane	NS	NS	NS	NS	<1.0	NS	NS	NS	NS	NS	0.19	100
Chloroform	NS	NS	NS	NS	<1.0	<1.0	NS	NS	NS	NS	700	---
Welch residence; Meadowview condominiums (38)												
Chloroform	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.19	100
Avastia residence (40)												
Chloroform	NS	NS	NS	NS	NS	<1.0	NS	NS	NS	NS	0.19	100
Chloroform	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.19	100

(Other footnotes located on page 4)

NOTE: All Concentrations are in ppb (ug/L)

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**POTABLE WELL TESTING - WATAUGA COUNTY, NC
WELLS SHOWING NO DETECTED ORGANIC COMPOUNDS**

SAMPLING LOCATION	SAMPLING DATES
Colene Bolick residence (1)	March 5, 1993*
Roten residence (3)	March 5, 1993* and July 3, 1994**
Hollar and Green Produce (6)	March 5, 1993*
Vannoy residence (8)	March 5, 1993*
Martin High County Rentals #1 (9)	March 5, 1993*
Martin High County Rentals #2 (10)	March 5, 1993*
Williamson residence (16)	March 18, 1993*
Sudreth residence (17)	March 18, 1993*, September 21, 1993**, and July 3, 1994**
Taylor residence (18)	March 18, 1993*
Hodges residence (19)	March 18, 1993*
Findt residence (21)	March 18, 1993*
Rusher residence (22)	March 23, 1993**
Younce residence (25)	May 11, 1993**
Medlin residence (27)	June 23, 1993**
Rector residence (28)	June 23, 1993**
Robinson residence (29)	June 23, 1993**
Cook residence (31)	August 3, 1993**
Animal Control Office (32)	August 3, 1993**
Brook Hollow Trailer Park (37)	October 11, 1993**
Green residence (34)	October 20, 1993**
Shared well #3 (35)	October 20, 1993**
BREMCO residence (36)	September 21, 1993**
Isaacs residence (39)	November 16, 1994**
Norris residence (41)	January 12, 1995**

TABLE 5A AND 5B NOTES:

The sampled well reference number as presented on the Vicinity Map (Figure 3) is denoted in parentheses following the sampling locations name

* Laboratory analysis performed by Central Virginia Laboratories and Consultants (CVLC) utilizing EPA Methods 502.2 (Volatiles) and 525.1 (Semi-Volatiles)

** Laboratory Analysis performed by NCDEHNR Division of Laboratory Services utilizing EPA Method 502.2 (Volatiles)

denotes compound co-elutes

ND denotes no compounds detected for entire analytical scan

NS denotes not sampled on that date

NA denotes compound not analyzed on that date

(T) denotes found in Trip Blank

(E) denotes estimated result

(X) denotes above MCL

NSC-North Carolina Water Quality Standard (DEHNR-15A NCAC 2L.0202)

MCL-EPA Primary Drinking Water Standard Maximum Contaminant Level