

GROUNDWATER MONITORING PLAN

**Greeneville/Greene County Class III Disposal Facility
Greene County, Tennessee**

Prepared For:
Town of Greeneville

And

Johnson City Environmental Field Office,
Tennessee Department of Environmental Conservation

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1.0 INTRODUCTION

1.1 Background

The Groundwater Monitoring Plan (GMP) is designed to evaluate the potential impact on groundwater quality in the uppermost aquifer underlying the proposed Greeneville/Greene County Class III Disposal Facility. The GMP was developed in accordance with Rule 0400-11-01-.04(7)(c) of Tennessee Solid Waste Management Rules (TSWMR), which states that Class III facilities must meet the same groundwater protection/monitoring standards as Class I facilities detailed in TSWMR Rule 0400-11-01-.04(7)(a).

The GMP was prepared for the Part II Permit Application for the Class III Disposal Facility. The GMP serves as the controlling document in the operating record for groundwater monitoring at the facility. The objective of the GMP is to provide representative groundwater samples from the uppermost aquifer underlying the waste unit of the facility, direct groundwater quality analyses in accordance with TSWMR, and provide data for evaluation of groundwater quality at the facility.

The proposed Greeneville/Greene County Class III Disposal Facility is located approximately 2 and 3/4 miles northeast of the Town of Greeneville on a 114 acre site that comprises a closed Class I disposal facility, an existing Class IV facility, and an existing Class I solid waste transfer station. The site is jointly owned by the Town of Greeneville and Greene County. The Class III disposal unit is located between the landfill entrance and the Class I facility (DSWM SNL #30-104-0190) where the existing Class IV facility is currently situated. The Class III disposal unit will overlie the existing Class IV disposal unit. This GMP will supersede current monitoring requirements for the existing Class IV facility and will serve to monitor both the existing Class IV facility as well as the proposed Class III facility. A general vicinity topographic map and mile-radius drinking water well and spring user survey is presented as Figure 1, and a vicinity aerial photograph map is presented as Figure 1A. A groundwater monitoring plan and potentiometric surface map is depicted in Figure 2.

1.2 Hydrogeologic Summary

Geology

The site is situated within the Valley and Ridge Physiographic Province of Eastern Tennessee, characterized by elongated, northeast trending ridges and valleys created by differential weathering of the underlying bedrock. The Geologic Map of Tennessee (1966) identifies the Upper Cambrian/Lower Ordovician Knox group and the Ordovician Sevier Shale within the vicinity of the site. The Geologic Map of East Tennessee, compiled by John Rodgers and found in Debuchananne and Richardson (1956), also delineates the Knox Group within the vicinity of the site.

Two University of Tennessee PhD Dissertations (Byerly, 1966, and Little, 1969) and unpublished maps by Dr. Byerly were utilized to describe the local geology. Dr. Byerly mapped two units in the vicinity of the site, including the Lower Ordovician Jonesboro Limestone and Upper Cambrian Conococheague Limestone (Knox Group). The Middle Ordovician Sevier Shale (Chickamauga Group) is located northwest of the site. All units trend northeast. The Conococheague Limestone is located in the northwest portion and directly south of the of the

landfill property. The Jonesboro Limestone conformably overlies the Conococheague Limestone within a northeast plunging anticline. The Conococheague Limestone plunges beneath the bedrock surface in the northwest portion of the landfill property. The lower 200 to 300 feet of the Jonesboro contains numerous beds of fine-to-medium grained, cross-bedded limestone that weathers to a characteristic bluish gray, with thin layers which impart a ribboned effect. The Conococheague Limestone consists mainly of alternate thin to medium beds of dark bluish gray limestone and silty dolomite. The lighter colored dolomite forms “ribbons” within the limestone beds. In the upper portion of the Conococheague, the limestone weathers to a medium bluish gray color, similar in appearance to much of the overlying Jonesboro. Chert is sparse in both the Jonesboro and Conococheague.

Hydrogeology

The landfill site is situated in an area of extensive, well-developed karst topography. Groundwater flow in karst areas cannot be described using the same concepts typical of flow in granular or uniformly-fractured media. Generally carbonate rock has very low primary porosity and permeability. Most of the flow occurs in cave or cavern-like conduits formed by solution enlargement along fractures, bedding plans, or joints. In mature carbonate aquifers, perforated by integrated solution conduits, surface impacts flow directly into the conduit system with little impediment. The flow can terminate in springs or other groundwater resurgences, which can be fairly representative of the water quality of the entire basin.

Figure 2 illustrates the potentiometric surface at the site inferred from the groundwater elevations observed on April 3, 2012. A dominant southwest flow gradient is inferred at the site, although it appears that groundwater flows in three primary directions at the site. A southwest gradient, parallel with the bedding planes of the limestone bedrock, appears to be dominant across the site with groundwater flow towards Moon Creek. Weaker components of groundwater flow also exist both to the southeast and northeast of the site, towards Moon Creek and Hall Branch, respectively. The regional flow direction is southeast.

An average groundwater flow rate is estimated to be 0.022 m/sec, a mean flow velocity figure for conduit/diffuse flow limestone systems (personal communication with Robert Benfield, former geologist with the Johnson City Field Office, TDSWM). Note that groundwater flow direction and rates can vary considerably both spatially and temporally within a given conduit/diffuse flow limestone aquifer system. The changes exhibited by both spring discharge rates and the potentiometric surface, as water levels have fluctuated over the past several years, illustrates this groundwater flow direction and rate variability.

Table 1 is a summary of groundwater elevation data collected since December 1995. Depth to groundwater across the site typically ranges from approximately 10 feet below ground surface (BGS) at MW-2 to approximately 94 feet BGS at MW-B18.

2.0 DESIGN: GROUNDWATER MONITORING PROGRAM

The GMP is designed to fulfill regulatory requirements for groundwater monitoring. The GMP will be implemented to detect potential changes to groundwater concentrations that may present impacts to the environment, and identify constituents that may be migrating from the waste unit. Protocols for sample collection and handling, laboratory analyses, quality assurance and quality control, and record keeping and reporting are specified below. Monitoring well locations are depicted on Figure 2.

2.1 Groundwater Monitoring Network

The groundwater monitoring network is comprised of a network of two compliance monitoring wells, located adjacent and downgradient of the proposed Class III disposal area, and a spring, S-2, located downgradient of the proposed Class III disposal area between the landfill entrance and Moon Creek.

- MW-1,
- MW-B18, and
- Spring S-2

Spring S-2 is actually comprised of two separate spring discharge points (designated S-2N and S-2S) and a seep (designated S-2A); these individual discharge points have been sampled separately since September 1997. These springs are not always available for sampling, as they are only sampled when flowing.

The compliance monitoring network for the debris landfill is designed to monitor the uppermost water-bearing zone of a conduit/diffuse flow limestone aquifer existing beneath the site. The locations of the monitoring wells are shown on Figure 2. Monitoring well elevations are provided in Table 1.

Groundwater flows radially from the site; therefore all wells are located downgradient from the disposal area.

2.2 GMP Sampling Schedule

The GMP monitoring network for the Class III facility will be monitored semiannually in accordance with TSWMR Rule 0400-11-01-.04(7)(b)3. The monitoring events for the Class III facility will be completed concurrent with the semiannual monitoring events for the Class I facility during the post-closure period for the Class I facility

2.3 GMP Target Analytes

The GMP monitoring network for the Class III facility will be monitored semiannually for inorganic Appendix 1 constituents. A list of TSWMR Appendix I constituents is provided in Appendix B.

MW-1 and MW-B18 are currently monitored semiannually for all Appendix I and detected Appendix II parameters under a Groundwater Quality Assessment Monitoring Program (GWQAP) for the adjacent Greeneville/Greene County Class I Landfill (DSWM SNL #30-104-

0190). Prior to 2005, the S-2 springs were sampled semiannually for all organic Appendix I constituents; since 2005, spring S-2N has been sampled semiannually for all inorganic and organic Appendix I constituents and detected Appendix II constituents and springs S-2A and S-2S have been sampled for organic Appendix I constituents.

Monitoring of MW-1, MW-B18, and the S-2 springs under the GWQAP will continue for the post-closure period of the Class I facility. Reporting of the semiannual monitoring results of the Class III GMP monitoring network as detailed in this GMP will commence upon initiation of Class III waste disposal at the site.

2.4 GMP Data Analysis and Reporting

Groundwater monitoring results will be evaluated after each semiannual sampling event. If determined necessary, data validation will be conducted in accordance with EPA protocol as described in Section 7.3. TDSWM will be provided with a summary report on monitoring results after each semiannual GMP monitoring event.

Although operated under two separate permits, the groundwater monitoring results for the Class III facility will be combined with the groundwater monitoring results for Class I facility and submitted as one report, with independent narratives provided for each facility. If post closure for the Class I facility ends before post closure period for the Class III facility, the Class III facility's groundwater monitoring results for the will be submitted as an independent report.

Statistical analysis will be completed and included with each report. Due to the absence of a confirmed upgradient location at the site, intra-well statistical analysis will be completed. The statistic method will employ control charts and the Upper Prediction Limit (UPL). MW-1 has been monitored since 1994, MW-B18 has been monitored since 1998, and spring S-2 has been monitored since 1995 (originally designated NS-1 from 1995 to 1997 and LS-1 from 1997-1998). Due to the existence of this background data, no quarterly background data collection will be completed. The UPL will be calculated for all detected constituents using all available background data collected at each subject well prior to the existence of the Class III facility.

Groundwater data will be analyzed for normality using "Groundwater Information Tracking System with Statistical Analysis Capability" (GRITS/STAT) v4.2. GRITS/STAT is analytical software provided by the USEPA. The distribution of data for all parameters will be verified for normality in the original mode and log-transformed mode using the Shapiro-Wilk Test. Normality tests will be performed prior to running parametric tests (tests requiring normal data distribution). If the data is not normally distributed, nonparametric inter-well UPLs will be computed for all the normally distributed constituents.

2.5 Response to GMP Monitoring

Based on statistical increases in the Appendix I constituents, the facility may be required to analyze for constituents that TDSWM identifies as characteristic of the waste and/or Appendix II constituents, in accordance with Rule 0400-11-01-.04(7)(b)5 of TSWMR.

3.0 DRILLING AND CONSTRUCTION OF MONITORING WELLS

The drilling method and materials utilized for the installation of the existing monitoring well network were selected as follows to provide a permanent and non-reactive monitoring well.

3.1 Monitoring Well Drilling

The Closure/Post Closure Plan for the sanitary landfill facility notes that the existing wells were "installed in accordance with Specifications and with approved materials (Vaughn & Melton, Inc, 1994). No boring or monitoring well completion logs are available for the existing monitoring wells. Monitoring well borings drilled in the future will be advanced using a 6-inch air rotary hammer. No drilling fluids are expected to be necessary during drilling, as the wells are anticipated to be relatively shallow. The wells will be drilled until groundwater is encountered and then extended to a desired depth, with sufficient recharge to produce adequate groundwater for sample collection. Samples of subsurface material will be collected during well drilling for characterization. Equipment used to advance the boring for a monitoring well, or used to construct a monitoring well, will be decontaminated by steam cleaning (using clean municipal water) prior to entering the site and drilling the first well, and subsequent to installing each monitoring well.

3.2 Monitoring Well Construction Materials

The well casing and screen for the monitoring wells will be constructed of 2-inch inner diameter schedule 40 PVC which provides a strong and chemically resistant well in the event that organic and/or inorganic constituents may be present (Curran and Tomson, 1983 Sykes et al., 1986; Parker et al., 1990). Filter packing of clean, well sorted sand will be poured around the screen and extended approximately 2-feet above the top of screen. After the sand filter packing will be constructed, bentonite will be poured into the well bore, around the well casing, extending a minimum of two feet above the sand filter packing. The remaining well bore will be filled with a cement grout and 5% bentonite by volume mixture. A steel protective casing with lock will be placed over the well casing above ground level and secured into a 6-foot by 6-foot, four inches thick concrete slab. Existing well materials and installation are consistent with that described in this section.

3.3 Monitoring Well Documentation

The Closure/Post Closure Plan for the sanitary landfill facility notes that the existing wells were "installed in accordance with Specifications and with approved materials (Vaughn & Melton, Inc, 1994). A figure of a typical well monitoring well, as provided in the Closure/Post Closure Plan, is provided in in Appendix A. Boring logs and well completion diagrams for any future wells will be submitted to TDSWM along with the certification required under Rule 0400 of TSWMR within 44 days of well completion. Total completed well depths will be measured and recorded on the respective monitoring well construction log after installation. Additional monitoring wells will be located by horizontal and vertical survey to the 0.01-foot precision.

3.4 Monitoring Well Development

Monitoring wells were developed by surging and continual pumping until each well appeared clean and silt free and conductivity and pH levels in the purged groundwater stabilized. Well development serves to minimize the effects of drilling by removing fine formation material

from the well screen, and restoring as closely as possible the natural aquifer permeability. Additional monitoring wells will be developed in similar fashion.

3.5 Monitoring Well Abandonment

The well abandonment procedure that will be followed in the event that an existing monitoring well is abandoned is listed below.

1. Upon prior approval by the TDSWM, the entire well bore will be over drilled to remove all casing, sand filter pack material and grout. Additionally, the open resulting borehole will be filled with a 5% by volume mixture of type I Portland cement grout and bentonite, or
2. The monitoring well will be filled with a 5% by volume mixture of type I Portland cement grout and bentonite powder. The bentonite prevents the grout mixture from shrinking while curing, and thus provides a good seal in the abandoned casing to prevent possible paths of surface water impact to the aquifer.

In the event that monitoring wells are abandoned, abandonment procedures will follow current written Tennessee Department of Health and/or TDSWM regulations and requirements. Upon completion of the well abandonment procedure, the facility will notify TDSWM of the abandonment and describe the well(s) that was abandoned, the procedure followed, and a map showing the location of the abandoned well.

3.6 Operation and Maintenance Procedures

Access to each monitoring well will be maintained at the facility throughout the life of the GMP. The concrete pad surrounding each monitoring well will be observed on each groundwater sampling event and repaired if cracks or other damage are observed. The drain hole in the protective casing of each well will be inspected and cleaned if necessary to prevent fluid accumulation.

Groundwater monitoring wells in the shallow, uppermost aquifer underlying the landfill facility may experience a buildup of suspended material from the aquifer matrix, which invades the well filter pack and screen during well purging and sample collection. If suspended materials are observed to be accumulating in the monitoring well, the well will be redeveloped in accordance with procedures described above. Should a monitoring well be damaged so as to compromise sample integrity or prevent sample collection, the monitoring well will be replaced in accordance with procedures described above.

Total well lengths will be verified annually. Any changes in total well length will be recorded and provided in subsequent monitoring reports. The cause for changes (e.g., invasion of aquifer fines) will be evaluated, and if necessary the well(s) will be redeveloped.

Replacement parts for routine wear and tear maintenance of the electric submersible pumps will be made ready at each sample collection event should pump service be required. If a pump malfunctions to the degree that it must be replaced, the well will be purged and sampled with a bailer, and the pump repaired or replaced prior to the next event.

Field meters (e.g., pH, temperature, etc.) will be maintained and calibrated prior to each groundwater monitoring event. When possible, backup meters will be made ready at each event. The nature of field operations routinely includes complications derived from weather, infrastructure, and mechanical malfunctions. Should unanticipated events occur during a monitoring event, the issue will be resolved as quickly and effectively as practical so that the groundwater monitoring event can be completed within the compliance monitoring period.

4.0 FIELD PROCEDURES

Groundwater sample collection events will be conducted in accordance with protocols described in this section. A field log book will be utilized for documenting groundwater sample collection event procedures prior to initiating purging, during purging and sample collection, and final activities, respectively.

4.1 Monitoring Well Sample Collection Order

Monitoring well sample collection order is as follows: MW-1, MW-B18 and the S-2 springs.

4.2 Purging and Sample Collection Equipment Used

Prior to the collection of groundwater samples, an electronic water level meter will be used to measure the depth to water in each well. Subsequently, monitoring wells will be purged using non-dedicated stainless steel and Teflon Grundfos submersible electric impeller driven pump and/or disposable Teflon bailers.

4.3 Monitoring Well Purging

Prior to collecting groundwater samples from each well, three well casing volumes of water (or until dry) will be purged from the well. Alternatively, wells may be purged using low-flow protocol, by purging until field parameters, pH, specific conductivity, and temperature, stabilize.

The field book will be completed during monitoring events to calculate the minimum purge volume of water from the well prior to sample collection, and to record the field pH, specific conductivity, and temperature measurements for each well sampled.

4.4 Monitoring Well Sample Collection Procedure

Collection of groundwater samples should be performed according to the following procedures.

- Step 1.** Prepare field log book and labels for each well, and the following decontaminated equipment:
- (a) Electronic water level meter with measurement accuracy of 0.01 foot.
 - (b) Submersible pumps, control box, and generator.
 - (c) Digital pH meter to measure the pH of the groundwater. Prior to sampling each monitoring well, the pH meter will be calibrated using two pH buffer solutions, where buffer solutions of 4 ± 0.01 , 7 ± 0.01 or 10 ± 0.01 pH units are recommended in order to calibrate the meter over an expected range of pH. The buffer solutions will be purchased from a licensed manufacturer of chemicals, or prepared by a certified laboratory.

- (d) Digital or standard thermometer.
- (e) Specific conductivity meter to measure the specific conductance, or current carrying ability of the groundwater, which gives an indication of its ionic strength. The specific conductivity meter will be calibrated per instrument specifications.
- (g) Sufficient coolers with ice or other cooling agent to keep temperature at approximately 4°C (35°F) for storage and transport of collected groundwater samples.
- (h) A five gallon bucket to collect initial bail water from well for flow rate estimation, and examine for the presence of nonaqueous phase liquids (NAPLs).
- (i) Modified level D personal protective equipment, as well as any other desired protective apparatus to shield worker from sample preservatives and/or impacted groundwater.
- (k) Proper sample containers and preservatives for the target parameters under applicable phase of monitoring, as specified in Test Methods for Evaluating Solid Waste-Physical Chemical Methods, EPA document SW-846, as updated.

When all the above listed equipment is decontaminated and in good working order Step 2 will commence.

Step 2. Record monitoring well location and well number. Measure and record depth to groundwater in the well (static water level) with the electronic water meter. The reference point from which the depth to water is measured will be the top of the well casing. In accordance with the TDSWM policy, the dedicated pump residing in each monitoring well will be removed at least once per year, and using the water level meter the total depth of the well referenced from the top of the well casing will be measured.

Step 3. Calculate and record the volume of water in the well casing volume from the following equation: $v \text{ (gallons)} = \pi \times r^2 \text{ (feet}^2\text{)} \times h \text{ (feet)} \times 7.48 \text{ (gallons/feet}^3\text{)}$, using the procedure listed below:

(a) π (pi) is approximately 3.141

(b)

pipe I.D. (inches) (ID)	pipe radius (inches) (r)	pipe radius (feet) (r ²)	pipe radius squared (feet ²)
1	0.5	0.042	0.002
2	1	0.083	0.007
3	1.5	0.125	0.016
4	2	0.166	0.028
5	2.5	0.208	0.043
6	3	0.25	0.063
7	3.5	0.292	0.085
8	4	0.333	0.111

- (c) Calculate the height of water within the well casing in feet, by subtracting the measured water level in the well from the total depth of the well (both of these measurements were made in Step 2),
- (d) Multiply $3.141 (\pi)$, r^2 , h and a conversion factor of 7.48 (gallons/ ft^3) to convert volume from cubic feet to gallons, in the equation

$$v = 3.141 \times r^2 \times h \times 7.48 = \text{gallons of water.}$$

Step 4. Unless low flow-protocol is employed, at least three well casing volumes of water (calculated in Step 3) will be purged from each well prior to sample collection. High yield wells should be purged at less than 4 gallons per minute. The evacuation procedure for low yield wells will be to purge the well until dry without allowing formation water entering the well to cascade down the well casing.

Pump the water out into the decontaminated five-gallon bucket, making temperature, pH and specific conductivity measurements on approximately every well volume of water purged from the well. This will be done to monitor for changes in the groundwater quality during purging, and to verify that a sufficient volume of water has been purged and water representative of the aquifer is being sampled. Purging will continue even after removal of three well casing volumes if stabilization of pH and specific conductivity has not been achieved. Stabilization of pH and specific conductivity is defined as a tolerance of $\pm 10\%$ from the last measurement recorded during purging. Temperature, pH and specific conductivity will be recorded in the field book during these activities.

Step 5. After purging three well casing volumes of water from the well, or low flow purging until field parameters stabilize, decrease the flow rate on the pump to 100 ml/minute. This is done to evacuate potentially volatilized groundwater within the discharge hose and pump prior to sampling. Begin filling the prepared sample bottles. Low yield wells must be sampled within 24 hours of purging. If yield is insufficient to obtain the required sample volume, note in the field log that samples were not obtainable. During sample collection all sample bottles will be inspected prior to filling and observations will be recorded in the field book. Samples will be collected in the following order of decreasing volatility so as to diminish the loss of volatile components from the water: volatile organics, semivolatiles, cyanide, pesticides, herbicides, and total and dissolved metals.

Step 6. Affix a properly completed sample label to each sample bottle similar to the one shown below.

EXAMPLE OF SAMPLE LABEL

Name of Collector: _____	Sample No.: _____
Sample Location: _____	Preservative: _____
Date: _____	Time: _____
Field Information: _____	

- Step 7.** After collecting water samples, immediately place bottles in cooler at approximately 4°C. Avoid exposure of samples to direct sunlight as much as possible due to the potential of increasing biological activity in the water and thus changing the sample quality. The cooled samples will be transported at 4°C in coolers.
- Step 8.** Measure and record temperature, pH and specific conductance of the groundwater in the well after sample collection. After retrieving groundwater from the well for the final measurement of pH, temperature, and specific conductance, shut off the pump, disconnect control box to pump and effluent pipe to pump connections, and secure the monitoring well.
- Step 9.** Information for each sample will be recorded on the chain-of-custody form at the time of collection, and the COC will accompany samples from the time of collection until receipt by the laboratory.
- Step 10.** All equipment and accessories that contact the groundwater samples will be thoroughly cleaned and decontaminated prior to sampling the first groundwater monitoring well, and after each subsequent sample collection event.

4.5 Sample Preservation and Handling

Samples will be preserved with the proper preservatives in accordance with Table 2, taken from *Test Methods for Evaluating Solid Waste - Physical/Chemical Methods* (SW-846).

Prior to sample collection, the laboratory will prepare sample bottles. If any or all samples leave the immediate control of the person(s) who collected and is responsible for the samples (e.g., during shipment to a laboratory by common carrier), a seal must be placed on the shipping container or on each individual sample. The seal must verify that the samples were not disturbed during transport.

All sample containers shall be packed in a cooler with ice as soon as they are collected. Samples shall be transported to the laboratory in this cooler.

In the event that final receipt by the laboratory of any shipping container or sample bottle indicates a broken seal or other evidence of compromised sample integrity, the laboratory QA/QC officer or his/her representative shall notify the facility operator within 24 hours of receipt. Subsequent to notification, sample integrity will be evaluated and appropriate actions will be taken to assure representative samples. Sample integrity determinations and need for additional actions will be conducted according to QA/QC guidance from SW-846. Resample collection events will be conducted if determined necessary.

4.6 Decontamination

Purging and sample collection events shall be conducted using dedicated equipment or where necessary one-time use disposable equipment; therefore, the need for decontaminating such equipment is not anticipated.

In the event that it becomes necessary to purge the wells and sample groundwater using non-dedicated equipment (such as re-usable bailers), then such purging and sample collection equipment shall be decontaminated by washing equipment with phosphate-free, laboratory-grade detergent and rinsing the equipment with distilled water.

The water level indicator and other field meter probes will also be decontaminated by washing with a phosphate-free, laboratory-grade detergent and rinsing with distilled water.

4.7 Information Recorded for Each Sample Collection Event

The following information will be recorded in the field log book for each sample collection event:

- Names of collectors.
- Order in which monitoring wells were sampled.
- Air temperature.
- Static water level measurement technique.
- Well evacuation procedure and equipment.
- Sample withdrawal procedure and equipment.
- Types of sample containers used.
- Preservatives used.
- Internal temperature of field and shipping containers at the beginning of each event and/or day.
- Temperature and conductivity equipment and calibration method.
- All specific conductivity calibration measurements with time-of-day.
- Internal temperature of shipping containers at the completion of the sample collection event and/or day
- Sample shipping method.
- Destination.
- Signature of sampler.

4.8 Information Recorded for Each Well

The following information is unique to each well or spring (where appropriate) and will be recorded at the time the groundwater samples are collected.

- Sample collection date,
- Monitoring well identification,
- Condition of well upon arrival (security, well completion, well pipe),
- Static water level, measured relative to top PVC well casing,
- Total well depth, measured relative to top PVC well casing,
- Length of the water column,
- Calculated purge volume,
- Actual purge volume,
- Pumping rate,
- Time purging began,
- Time purging ended,

- Presence or absence of non-aqueous phase liquids (NAPLs),
- Temperature and specific conductivity (as measured before, during and after purging),
- Instrument calibration measurements,
- Sample collection time, and
- Other observations (e.g., distinct odors, activities occurring in vicinity of well).

4.9 Chain-of-Custody Documentation

Standardized Chain of Custody forms will be used to document custody of the samples from the time they were collected in the field to the time the samples were relinquished to the analytical laboratory. Chain of Custody documentation includes site location information, sample collection locations, numbers and types of sample containers, sample preservation methods, filtration procedures, MS and MSD samples, blank samples, dates and times of sample collections, names of sample collectors, and dates and times of each custody change. Chain of Custody documentation will be transported with the samples to the analytical laboratory.

5.0 ANALYTICAL PROCEDURES

The analytical methods referenced in SW-846 (*Test Methods for Evaluating Solid Waste*, latest edition) will be used to analyze TSWMR inorganic Appendix I target analytes. All inorganic analytes will be analyzed as "total" fractions; no samples will be filtered in the field. Note that dissolved metals analyses may be conducted additionally at the discretion of the owner; dissolved metals will be field filtered and subsequently acidified.

Groundwater or spring samples will be collected in EPA-approved containers, which are prepared and supplied with appropriate preservatives, by the analytical laboratory. The types and volumes of sample containers used, as well as the respective methods of preservation shall be recorded on Chain of Custody documentation and field notes. All groundwater samples will be containerized and preserved in accordance with EPA protocols, labeled, and immediately placed on ice in a cooler. Each cooler containing groundwater samples will be transported by laboratory personnel, by the owner or operator of the landfill, by a qualified contractor, or by overnight carrier to the analytical laboratory with appropriate Chain of Custody documentation.

6.0 QUALITY CONTROL / QUALITY ASSURANCE

6.1 Field Program

Field analytical instruments (such as pH, temperature, or conductivity meters) will be calibrated in accordance with the manufacturers' instructions.

Quality control (QC) samples will consist of trip blanks for required analyses. The trip blanks will be prepared and supplied by the analytical laboratory and in sample containers identical in physical and chemical integrity to the containers used for actual sample collection. The trip blanks will be filled with a water matrix, preserved, and sealed by the analytical laboratory. The trip blanks will accompany the actual field samples throughout the sample collection event and serve to evaluate potential sample contamination associated with sample kit preparation, field activities, and/or transportation. Since dedicated equipment will be utilized, equipment blanks are not

required. In the event that non-dedicated equipment is used, equipment blanks should be collected.

Additionally, duplicate, matrix spike (MS), and matrix spike duplicate (MSD) samples may be collected from various monitoring wells at the discretion of the owner or operator of the landfill. Resultant data for these samples may be used to evaluate long-term precision and accuracy of the analytical method and to demonstrate acceptable parameter recovery at the time of analysis.

6.2 Laboratory Program

To meet regulatory, analytical method, and QA/QC requirements, a commercial analytical laboratory is recommended to provide identification and quantitation of analytical parameters as required under the respective monitoring program. The laboratory performing the analytical services will follow QA/QC procedures described in SW-846, latest edition, or the EPA document, *Methods for Chemical Analysis of Water and Waste* (600/4-79-202, latest edition), for each specific analysis of the groundwater monitoring parameter. The QA/QC procedures, including the analysis of blanks, duplicates and spiked samples of water, test the accuracy and precision of the analyses. As well, any additional QA/QC procedures implemented by a qualified laboratory will be followed.

7.0 LABORATORY REPORT

7.1 Laboratory Analytical Report

Final results will be submitted in a bound report by the analytical laboratory and will include at a minimum the following:

- Original chain-of-custody form(s)
- Sample matrix information
- Sample result
- Case narrative
- Analytical method date, time, analyst, result,
- Laboratory limit of detection for the method and parameter,
- Laboratory level of quantification for the method and parameter,
- Signature of Laboratory Director or other qualified representative of the laboratory, and
- Copy of all required cover letters bound within the report.

Should the primary laboratory subcontract samples for analysis, the analytical results from the subcontract laboratory must be included in the primary laboratory's final report. The subcontracted laboratory report will be provided as an appendix.

REFERENCES

- Alexander, E. Calvin Jr. 2005. Flow Velocities in Karst Aquifers. Geology and Geophysics, Univ of Minnesota, Paper No. 12-5, presented at the 2005 Salt Lake City Annual Meeting (October 16–19, 2005).
- Byerly, D.W. 1966. Structural Geology Along a Segment of the Pulaski Fault, Greene County, Tennessee, University of Tennessee PhD Dissertation.
- Debuchananne, G.D. and Richardson, R.M. 1956. Ground Water Resources of East Tennessee: Bulletin 58, Part I, TN Division of Geology.
- EPA. 1994. Contract Laboratory Program National Functional Guidelines for Inorganic Data Review.
- EPA. 1994. Contract Laboratory Program National Functional Guidelines for Organic Data Review.
- EPA. Latest Edition. RCRA Groundwater Monitoring Technical Enforcement Guidance Document. OSWER 99501.
- EPA. 1987. rev. Test Methods for Evaluating Solid Waste -Physical Chemical Methods (SW-846), Third Edition, Final Update I,I/IIA, III.
- Little, R.L. 1969. Lithostratigraphy and Structural Geology of a Portion of the Dunham Ridge Thrust Block, Greene and Washington Counties, Tennessee, University of Tennessee PhD Dissertation.
- S&ME, Inc. 1995. Greeneville/Greene County Demolition Landfill, Geotechnical/Hydrologic Investigation, S&ME Project No. 1404-94-051-A.
- S&ME, Inc., 1996. Greeneville/Greene County Demolition Landfill, Site Specific Condition #5, S&ME Project No. 1404-94-051-B.
- TDEC. March 2013. Tennessee Solid Waste Management Regulations, Rule 0400-11-01
- USDA. 1956. Soil Survey of Sevier County Tennessee, Soil Conservation Service. August 1956.
- Vaughn & Melton (Tennessee), Inc., 1994. Greeneville/Greene County Sanitary Landfill, SNL 30-104-0190, Closure/Post Closure Plan.

Tables

GREENEVILLE/GREENE COUNTY LANDFILL

Greene County, Tennessee

TABLE 1

DAA JN: 7686

TDSWM SNL# 30-104-0190

Groundwater Elevations

	MW-1	MW-2	MW-3	MW-4	MW-5	B-18
REF. ELEVATION	1520.75	1524.80	1576.76	1604.53	1564.90	1615.00
DATE	DEPTH TO WATER FROM MEASURING POINT					
12/21/95	21.75	17.00	89.67	88.75	-	-
02/29/96	22.21	7.38	53.52	83.16	50.00	-
06/03/96	22.67	12.33	57.17	58.50	54.50	-
08/29/96	22.58	12.50	59.42	90.33	53.50	-
10/31/96	23.17	14.25	61.17	93.67	58.92	-
03/13/97	20.41	3.00	35.40	82.00	47.75	-
06/27/97	22.33	11.66	56.00	87.08	54.33	-
09/19/97	23.33	14.50	60.00	94.50	56.83	-
02/24/98	20.95	9.69	55.83	84.35	48.94	92.05
07/29/98	22.23	12.02	56.66	89.69	52.96	94.01
01/26/99	19.42	9.38	58.88	82.52	ABAN.	91.13
08/23/99	22.37	13.05	58.90	93.25	ABAN.	94.80
01/06/00	22.84	14.05	61.02	95.01	ABAN.	95.99
7/11/00	20.82	12.89	59.93	93.46	ABAN.	93.60
01/16/01	22.77	14.21	61.77	94.15	ABAN.	95.97
07/09/01	20.07	13.29	60.12	93.60	ABAN.	76.72
11/12/01	22.83	13.66	60.93	94.06	ABAN.	97.36
05/06/02	19.13	12.20	58.75	92.37	ABAN.	95.92
12/09/02	17.32	11.59	59.65	89.34	ABAN.	95.05
06/24/03	20.41	12.20	55.05	90.89	ABAN.	96.22
11/10/03	20.5	12.89	58.93	93.68	ABAN.	97.67
06/03/04	17.00	11.69	65.81	90.48	ABAN.	96.27
12/06/04	19.13	12.55	59.02	92.84	ABAN.	97.48
06/20/05	19.68	11.80	55.41	87.90	ABAN.	96.65
12/19/05	22.00	13.85	60.54	93.95	ABAN.	98.65
06/05/06	19.39	12.23	57.48	89.97	ABAN.	97.48
12/11/06	19.74	13.22	59.60	93.24	ABAN.	98.55
03/07/07	19.66	12.96	60.12	93.79	ABAN.	98.38
06/11/07	21.12	13.38	60.18	93.60	ABAN.	98.58
09/04/07	21.93	13.74	60.99	94.07	ABAN.	98.83
11/28/07	22.85	13.86	61.69	94.07	ABAN.	100.15
02/20/08	19.07	12.79	61.36	94.45	ABAN.	98.38
05/27/08	20.12	13.08	60.27	93.31	ABAN.	98.71
08/19/08	21.83	13.79	61.38	94.20	ABAN.	99.98
11/05/08	22.52	13.86	62.00	94.69	ABAN.	100.86
03/02/09	15.95	10.99	59.42	89.72	ABAN.	97.05
05/20/09	19.31	11.80	59.42	92.96	ABAN.	98.14
08/19/09	19.23	12.71	60.61	94.08	ABAN.	98.79
11/18/09	13.68	9.64	59.19	84.93	ABAN.	97.17
04/07/10	18.82	10.71	60.10	90.45	ABAN.	97.46
10/06/10	21.12	13.12	60.18	93.65	ABAN.	98.72
04/06/11	13.15	13.49	54.24	86.22	ABAN.	89.98
10/12/11	20.82	13.08	58.06	93.33	ABAN.	98.76
04/03/12	17.55	10.35	54.84	87.50	ABAN.	96.83
09/12/12	18.26	12.13	57.07	92.50	ABAN.	98.58
03/11/13	15.56	5.66	53.33	81.97	ABAN.	95.58

GREENEVILLE/GREENE COUNTY LANDFILL

Greene County, Tennessee

TABLE 1

DAA IN: 7686

TDSWM SNL# 30-104-0190

Groundwater Elevations

REF. ELEVATION	MW-1	MW-2	MW-3	MW-4	MW-5	B-18
	1520.75	1524.80	1576.76	1604.53	1564.90	1615.00
GROUNDWATER ELEVATION						
DATE	MW-1	MW-2	MW-3	MW-4	MW-5	B-18
12/21/95	1499.00	1507.80	1487.09	1515.78		
02/29/96	1498.54	1517.42	1523.24	1521.37	1514.90	
06/03/96	1498.08	1512.47	1519.59	1546.03	1510.40	
08/29/96	1498.17	1512.30	1517.34	1514.20	1511.40	
10/31/96	1497.58	1510.55	1515.59	1510.86	1505.98	
03/13/97	1500.34	1521.80	1541.36	1522.53	1517.15	
06/27/97	1498.42	1513.14	1520.76	1517.45	1510.57	
09/19/97	1497.42	1510.30	1516.76	1510.03	1508.07	
02/24/98	1499.80	1515.11	1520.93	1520.18	1515.96	1522.95
07/29/98	1498.52	1512.78	1520.10	1514.84	1511.94	1520.99
01/26/99	1501.33	1515.42	1517.88	1522.01		1523.87
08/23/99	1498.38	1511.75	1517.86	1511.28		1520.20
01/06/00	1497.91	1510.75	1515.74	1509.52		1519.01
7/11/00	1499.93	1511.91	1516.83	1511.07		1521.40
01/16/01	1497.98	1510.59	1514.99	1510.38		1519.03
07/09/01	1500.68	1511.51	1516.64	1510.93		1538.28
11/12/01	1497.92	1511.14	1515.83	1510.47		1517.64
05/05/02	1501.62	1512.60	1518.01	1512.16		1519.08
12/09/02	1503.43	1513.21	1517.11	1515.19		1519.95
06/24/03	1500.34	1512.60	1521.71	1513.64		1518.78
11/10/03	1500.25	1511.91	1517.83	1510.85		1517.33
06/03/04	1503.75	1513.11	1510.95	1514.05		1518.73
12/06/04	1501.62	1512.25	1517.74	1511.69		1517.52
06/20/05	1501.07	1513.00	1521.35	1516.63		1518.35
12/19/05	1498.75	1510.95	1516.22	1510.58		1516.35
06/05/06	1501.36	1512.57	1519.28	1514.56		1517.52
12/11/06	1501.01	1511.58	1517.16	1511.29		1516.45
03/07/07	1501.09	1511.84	1516.64	1510.74		1516.62
06/11/07	1499.63	1511.42	1516.58	1510.93		1516.42
09/04/07	1498.82	1511.06	1515.77	1510.46		1516.17
11/28/07	1497.90	1510.94	1515.07	1510.46		1514.85
02/20/08	1501.68	1512.01	1515.40	1510.08		1516.62
05/27/08	1500.63	1511.72	1516.49	1511.22		1516.29
08/19/08	1498.92	1511.01	1515.38	1510.33		1515.02
11/05/08	1498.23	1510.94	1514.76	1509.84		1514.14
03/02/09	1504.80	1513.81	1517.34	1514.81		1517.95
05/20/09	1501.44	1513.00	1517.34	1511.57		1516.86
08/19/09	1501.52	1512.09	1516.15	1510.45		1516.21
11/18/09	1507.07	1515.16	1517.57	1519.60		1517.83
04/07/10	1501.93	1514.09	1516.66	1514.08		1517.54
10/06/10	1499.63	1511.68	1516.58	1510.88		1516.28
04/06/11	1507.60	1511.31	1522.52	1518.31		1525.02
10/12/11	1499.93	1511.72	1518.70	1511.20		1516.24
04/03/12	1503.20	1514.45	1521.92	1517.03		1518.17
09/12/12	1502.49	1512.67	1519.69	1512.03		1516.42
03/11/13	1505.19	1519.14	1523.43	1522.56		1519.42

1) ALL MEASUREMENTS IN FEET.

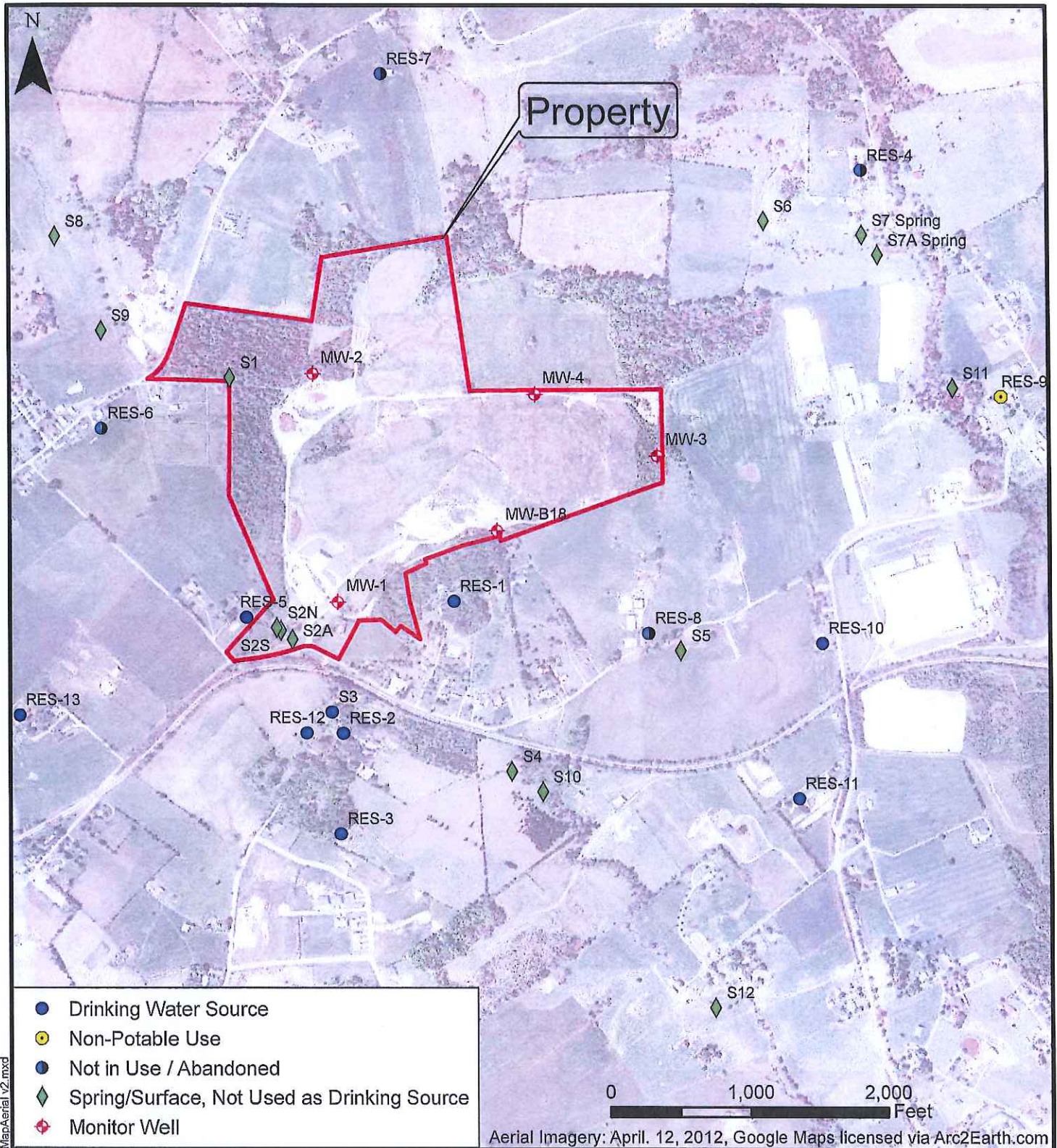
2) ALL ELEVATIONS REFERENCE MEAN SEA LEVEL (APPROX. REF. ELEV. FOR B-18).

3) [-] NOT AVAILABLE

**Table 2: TDSWM APPENDIX I and II PARAMETERS
SAMPLING AND PRESERVATIVE PROCEDURES**

PARAMETER	CONTAINER/ VOLUME REQUIRED	PRESERVATIVE	MAXIMUM HOLDING TIME
INORGANIC TESTS			
Cyanide	P, G - 500 ml	Cool to 4°C, NaOH to pH>12, 0.6 g ascorbic acid.	14 days
Sulfide	P, G - 500 ml	Cool to 4°C, add Zinc acetate	7 days
METALS TESTS			
Mercury (total)	300 ml	HNO ₃ to pH<2	13 days (Plastic)
Metals (total) except Mercury and Chromium VI	1 L	HNO ₃ to pH<2	6 months
ORGANIC TESTS			
Acrolein and acrylonitrile	2 - 40 ml VOA ³ w/ G, Teflon-lined septum	Cool to 4°C, 0.008% Na ₂ S ₂ O ₃ , HCL to pH 4-5	14 days
Benzidines	G, Teflon-lined cap - 1 L	Cool to 4°C, 0.008% Na ₂ S ₂ O ₃	7 days until extraction; 40 days after extraction
Haloethers	G, Teflon-lined cap - 1 L	Cool to 4°C, 0.008% Na ₂ S ₂ O ₃	7 days until extraction; 40 days after extraction
Phthalate esters	G, Teflon-lined cap - 1 L	Cool to 4°C	7 days until extraction; 40 days after extraction
Nitrosamines	G, Teflon-lined cap - 1 L	Cool to 4°C, store in dark, 0.008% Na ₂ S ₂ O ₃	7 days until extraction; 40 days after extraction
Nitroaromatics and cyclic ketones	G, Teflon-lined cap - 1 L	Cool to 4°C, store in dark, 0.008% Na ₂ S ₂ O ₃	7 days until extraction; 40 days after extraction
PCBs	G, Teflon-lined cap - 1 L	Cool to 4°C	7 days until extraction; 40 days after extraction
Phenols	G, Teflon-lined cap - 1 L	Cool to 4°C, store in dark, 0.008% Na ₂ S ₂ O ₃	7 days until extraction; 40 days after extraction
Purgeable Aromatic Hydrocarbons	2 - 40 ml VOA ³ G, Teflon-lined septum	Cool to 4°C, store in dark, 0.008% Na ₂ S ₂ O ₃	14 days
Purgeable Halocarbons	2 - 40 ml VOA ³ G, Teflon-lined septum	Cool to 4°C, store in dark, 0.008% Na ₂ S ₂ O ₃	14 days
Polynuclear aromatic hydrocarbons	G, Teflon-lined cap - 1 L	Cool to 4°C, store in dark, 0.008% Na ₂ S ₂ O ₃	7 days until extraction; 40 days after extraction
Chlorinated hydrocarbons	G, Teflon-lined cap - 1 L	Cool to 4°C, 0.008% Na ₂ S ₂ O ₃	7 days until extraction; 40 days after extraction
PESTICIDES TESTS			
Pesticides	G, Teflon-lined cap - 1 L	Cool to 4°C, pH 5-9	7 days until extraction; 40 days after extraction

Figures



Vicinity Aerial Map

Greenville / Greene County Landfill
Greene County, Tennessee

SCALE 1" = 1000'

PLAN NO. 7686-03



Draper Aden Associates

Engineering ♦ Surveying ♦ Environmental Services

2206 South Main Street
Blacksburg, VA 24060
540-552-0444 Fax: 540-552-0291

Richmond, VA
Charlottesville, VA
Hampton Roads, VA

DESIGNED JES
DRAWN SMF
CHECKED JES
DATE 7-26-12

**FIGURE
1A**

NOTES:

1. TOPOGRAPHIC INFORMATION AND LIMITS OF FILL OBTAINED FROM VAUGHN AND MELTON, FIGURE 4, CONTOURS UPDATED MAY, 1996.
EXISTING CLASS IV (PROPOSED CLASS III) FILL BOUNDARY UPDATED JULY 2011 WITH LIMITS OF FILL OBTAINED FROM VAUGHN AND MELTON, SHEET 3.

LEGEND

MW-1  MONITORING WELL (WITH GROUNDWATER ELEVATION OBTAINED 04-03-12)

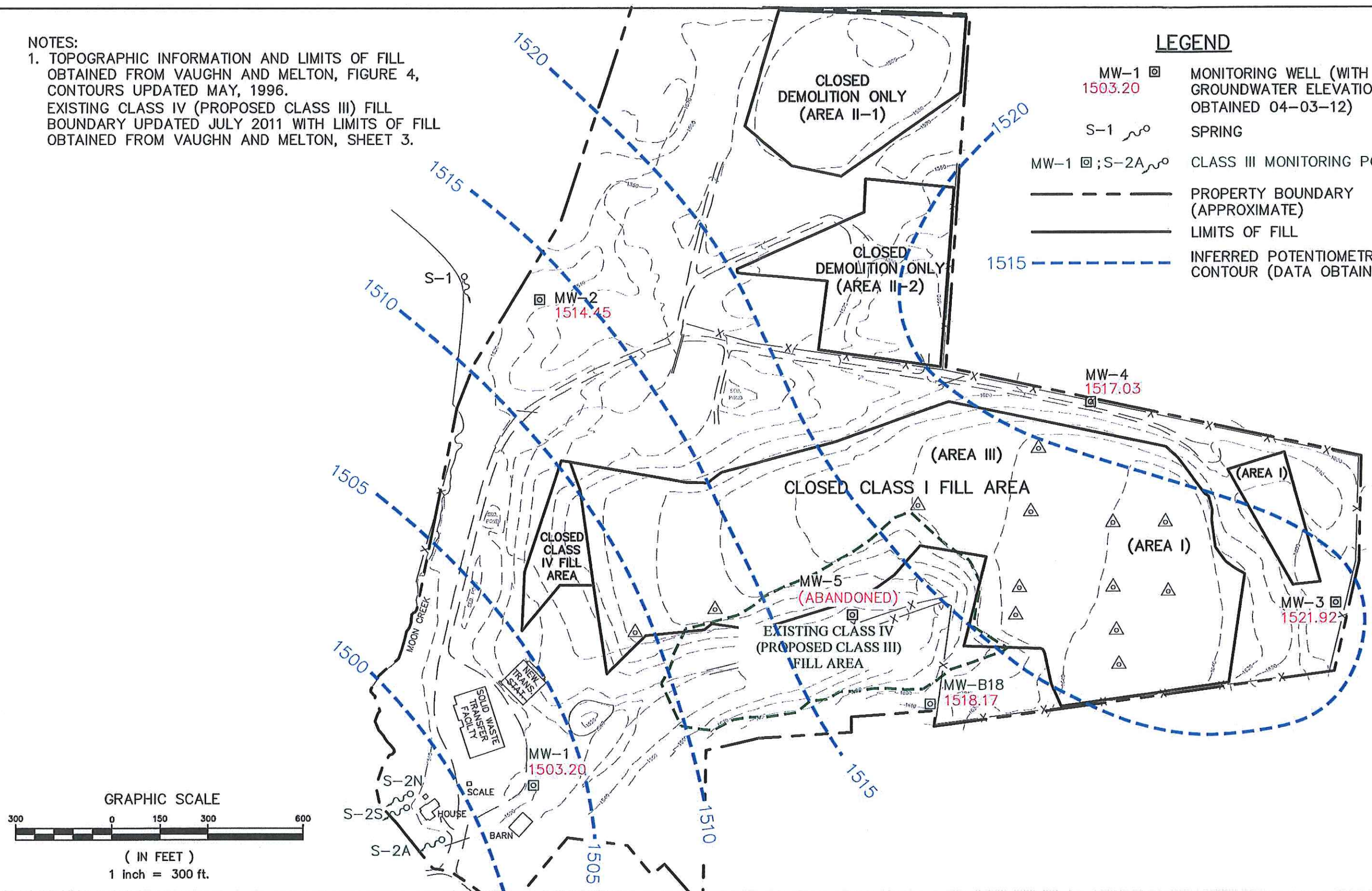
S-1  SPRING

MW-1  ; S-2A  CLASS III MONITORING POINTS

--- PROPERTY BOUNDARY (APPROXIMATE)

— LIMITS OF FILL

1515 --- INFERRED POTENTIOMETRIC SURFACE CONTOUR (DATA OBTAINED 04-03-12)



GRAPHIC SCALE



(IN FEET)

1 inch = 300 ft.



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Richmond, VA
Charlottesville, VA
Hampton Roads, VA
Raleigh-Durham, NC

DESIGNED
DRAWN
CHECKED
DATE

JES
DLD
JES
07/26/2012

GROUNDWATER MONITORING PLAN / POTENTIOMETRIC SURFACE MAP
GREENEVILLE / GREENE COUNTY CLASS III LANDFILL
GREENE COUNTY, TENNESSEE

SCALE: 1" = 300'

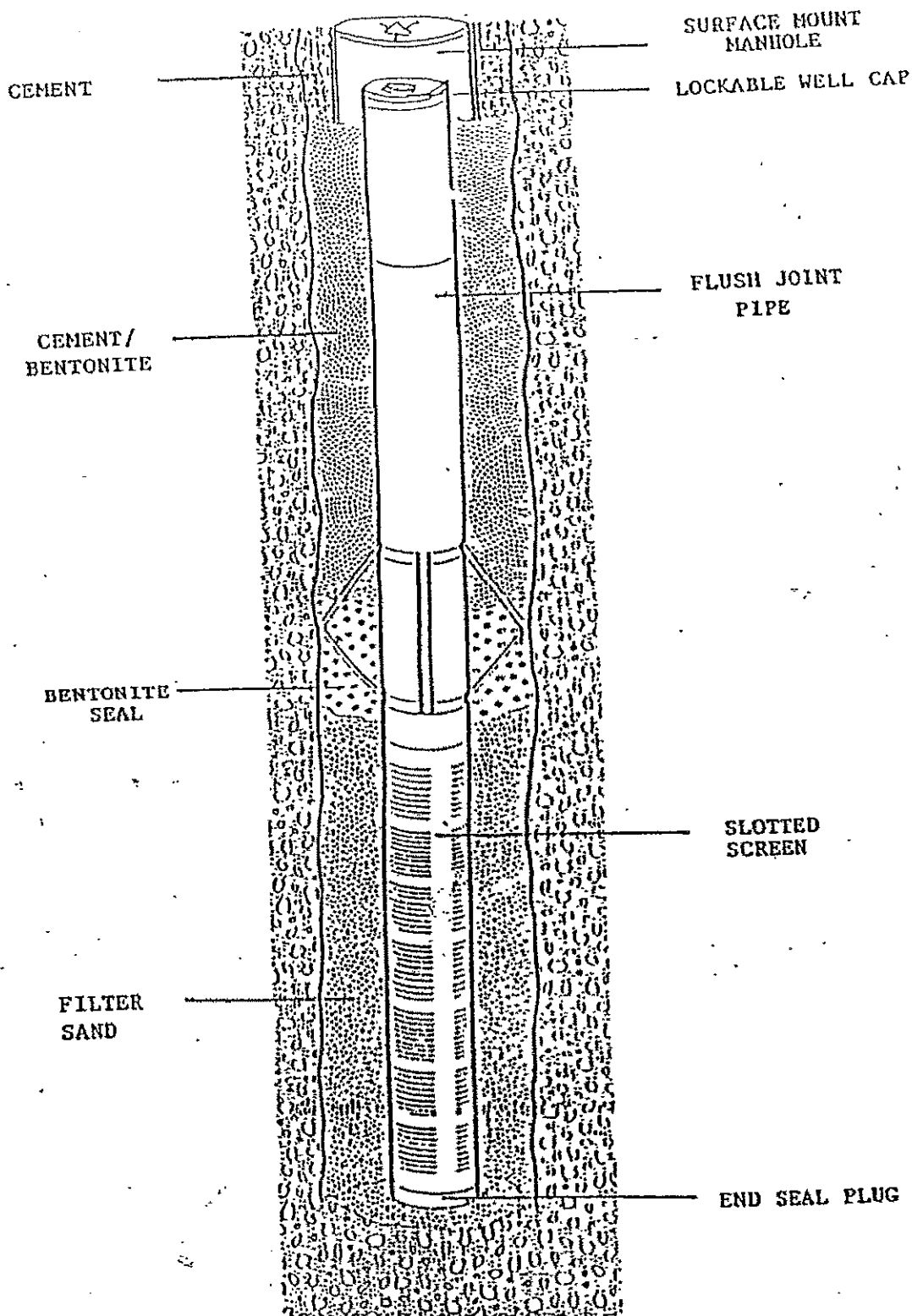
PLAN NO. 7686-09

FIGURE

2

Appendix A

Standard Well Completion Diagram



TYPICAL MONITOR WELL

Appendix B

Appendix I Analyte List

Rule 1200-01-07-.04, continued)

23. Describes the impacts the facility will have on endangered or threatened species of plants, fish, or wildlife or their habitat; and
 24. Describes the random inspection program required under rule 1200-01-07-.04(2)(s).
- (d) Closure/Post-Closure Plan - The Part II permit application must include a closure/post-closure plan as described in rule 1200-01-07.03(2).

APPENDIX I CONSTITUENTS FOR GROUNDWATER MONITORING

INORGANIC CONSTITUENTS

1. Antimony
2. Arsenic
3. Barium
4. Beryllium
5. Cadmium
6. Chromium
7. Cobalt
8. Copper
9. Fluoride
10. Lead
11. Mercury
12. Nickel
13. Selenium
14. Silver
15. Thallium
16. Vanadium
17. Zinc

ORGANIC CONSTITUENTS

18. Acetone
19. Acrylonitrile
20. Benzene
21. Bromochloromethane
22. Bromodichloromethane
23. Bromoform; Tribromomethane
24. Carbon disulfide
25. Carbon tetrachloride
26. Chlorobenzene
27. Chloroethane; Ethyl chloride
28. Chloroform; Trichloromethane
29. Dibromochloromethane; Chlorodibromomethane
30. 1,2-Dibromo-3-chloropropane; DBCP
31. 1,2-Dibromoethane; Ethylene dibromide; EDB
32. o-Dichlorobenzene; 1,2-Dichlorobenzene
33. p-Dichlorobenzene; 1,4-Dichlorobenzene
34. trans-1,4-Dichloro-2-butene
35. 1,1-Dichloroethane; Ethylidene chloride
36. 1,2-Dichloroethane; Ethylene dichloride
37. 1,1-Dichloroethylene; 1,1-Dichloroethene; Vinylidene chloride
38. cis-1,2-Dichloroethylene; cis-1,2-Dichloroethene

Rule 1200-01-07-.04, continued)

39. trans-1,2-Dichloroethylene; trans-1,2-Dichloroethene
40. 1,2-Dichloropropane; Propylene dichloride
41. cis-1,3-Dichloropropene
42. trans-1,3-Dichloropropene
43. Ethylbenzene
44. 2-Hexanone; Methyl butyl ketone
45. Methyl bromide; Bromomethane
46. Methyl chloride; Chloromethane
47. Methylene bromide; Dibromomethane
48. Methylene chloride; Dichloromethane
49. Methyl ethyl ketone; MEK; 2-Butanone
50. Methyl iodide; Iodomethane
51. 4-Methyl-2-pentanone; Methyl isobutyl ketone
52. Styrene
53. 1,1,1,2-Tetrachloroethane
54. 1,1,2,2-Tetrachloroethane
55. Tetrachloroethylene; Tetrachloroethene; Perchloroethylene
56. Toluene
57. 1,1,1-Trichloroethane; Methylchloroform
58. 1,1,2-Trichloroethane
59. Trichloroethylene; Trichloroethene
60. Trichlorofluoromethane; CFC-11
61. 1,2,3-Trichloropropane
62. Vinyl acetate
63. Vinyl chloride
64. Xylenes

APPENDIX II

GROUND-WATER MONITORING LIST

Common NameChemical Abstracts Service Index Name

Acenaphthene
 Acenaphthylene
 Acetone
 Acetonitrile; Methyl cyanide
 Acetophenone
 2-Acetylaminofluorene; 2-AAF
 Acrolein
 Acrylonitrile
 Aldrin

 Allyl chloride
 4-Aminobiphenyl
 Anthracene
 Antimony
 Arsenic
 Barium
 Benzene
 Benzo[a]anthracene; Benzantracene
 Benzo[b]fluoranthene
 Benzo[k]fluoranthene

Acenaphthylene, 1,2-dihydro-
 Acenaphthylene
 2-Propanone
 Acetonitrile
 Ethanone, 1-phenyl
 Acetamide, N-9H-fluoren-2-yl-
 2-Propenal
 2-Propenenitrile
 1,4:5,8-Dimethanonaphthalene, 1,2,3,
 4,10,10-hexachloro-1,4,4a,5,8,
 8a-hexahydro-(1a,4a,4aB,5a,8a,8aB)-
 1-Propene, 3-chloro-
 [1,1'-Biphenyl]-4-amine
 Anthracene
 Antimony
 Arsenic
 Barium
 Benzene
 Benz[a]anthracene
 Benz[e]acephenanthrylene
 Benzo[k]fluoranthene