PREPARED FOR:
WILKES COUNTY DEPARTMENT OF SOLID WASTE
9219 ELKIN HIGHWAY
ROARING RIVER, NORTH CAROLINA 28669

ROARING RIVER LANDFILL
WILKES COUNTY, NORTH CAROLINA
PERMIT NO. 97-04

PHASE 4 EXPANSION

WATER QUALITY MONITORING PLAN

APPROVED
DIVISION OF WASTE MANAGEMENT
SOLID WASTE SECTION
DATE 9-12-11 BY Brian Wells
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VOLUME 3
HYDROGEOLOGY
SECTION VII – WATER QUALITY MONITORING PLAN

JANUARY 2011

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Water Quality Monitoring Certification Statement:

We certify that the Water Quality Monitoring Plan included in this report, when implemented, will be effective in providing early detection of any release of hazardous constituents to the upper and lower aquifers, so as to be protective of public health and the environment.

VOLUME 3, SECTION VII
WATER QUALITY MONITORING PLAN

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1.0 INTRODUCTION

This *Water Quality Monitoring Plan* (WQMP) will serve as a guidance document for collecting and analyzing groundwater samples, managing the associated analytical results, and monitoring for any potential releases to the uppermost aquifer from the Wilkes County Roaring River Landfill, which consists of the Phases 1, 2, 3, and proposed Phase 4 vertical expansion. The Plan complies with Rules .1630 through .1637 of the North Carolina Solid Waste Management Rules, Title 15A, Subchapter 13B.

1.1 Site Description

The Wilkes County Roaring River Landfill is owned and operated by Wilkes County under Permit No. 97-04. The landfill property is located near the town of Roaring River, North Carolina. The site is located on a group of knolls rising over 150 feet above the floodplain of the Yadkin River. The property boundary and disposal area are indicated on an enlarged portion of the USGS 7 ½ minute topographic map for Ronda, North Carolina (Drawing No. WQMP-T). The landfill facility boundary includes most of the area between the disposal cells and the floodplain of the Yadkin River.

The approximately 145-acre site was originally investigated for suitability as a solid waste management facility in 1989 by Westinghouse Environmental and Geotechnical Services, Inc. (Westinghouse). Additional site characterization work was performed at the site in 1990 and 1991 by Municipal Engineering Services, P.A., during preparation of the Construction Plan Application for the Phase 1 cell, in accordance with expected revisions to the North Carolina Solid Waste Management Rules (NCSWMR), in response to Subtitle D regulations. Further site characterization work was performed in 1994, as part of the Transition Plan for the facility.

Wilkes County submitted a *Design Hydrogeologic Report* in 1991 to North Carolina Department of Environment and Natural Resources (NCDENR) and the facility began accepting waste in the Subtitle D lined Phase 1 in 1993. This cell, which occupies approximately 11.7 acres of the facility, reached final capacity in 1999. A site investigation and *Design Hydrogeologic Report* for the 7.3 acre Phase 2 was completed in December 1998. The Phase 2 disposal area reached final capacity in July 2006. A *Design Hydrogeologic Report* for the 6.7 acre Phase 3 was completed in May 2004 and construction was completed January 2006. Phase 4 of the waste disposal unit will be a vertical expansion of the Phase 3 area.

1.2 Site Geology and Hydrogeology

The site is located at the boundary of the Inner Piedmont Belt and Blue Ridge Belt in the Brevard Fault Zone. In the vicinity of the site, the Brevard Zone is a five-mile wide, east-northeast trending fault zone with a complex structural and metamorphic history. Finely interlayered gneiss and schist within the zone are amphibolite facies, with peak metamorphism as high as the kyanite zone for pelitic assemblages. Typically, the more highly-strained and faulted parts of the zone have experienced retrograde metamorphism to greenschist facies. Rocks in the Brevard Zone have undergone various degrees of both ductile and brittle deformation. Espenshade and

others mapped four continuous faults that either bound the zone or separate rock units consistently over long distances. These faults contain both mylonitic and cataclastic rock, and exhibit the greatest degree of retrograde metamorphism. Two of these faults cross on or near the site. Bedrock at the site and in the Brevard Zone generally is more highly fractured than rock typical of most Piedmont and Mountain sites.

The uppermost aquifer is unconfined and includes both saprolite and fractured bedrock, which are strongly connected. The groundwater level measurements taken on April 11, 2011 were used to construct the groundwater surface contours shown in Drawing No. 1. Historical static water levels are provided in Table 1. Groundwater flow is generally to the south-southwest.

Hydraulic conductivities (K) were based on slug test values from the *Design Hydrogeologic Report* submitted in April 2004. An effective porosity of 16% was used to estimate average linear groundwater flow velocities. Linear groundwater flow velocities for wells screened in saprolite were computed using the following modified Darcy equation:

$$V = Ki/n_e$$

where V = average linear velocity (feet per day), K = hydraulic conductivity (ft/day), i = horizontal hydraulic gradient, and n_e = effective porosity.

Based on calculations from the most recent sampling event, the average estimated linear groundwater flow velocity for the site is approximately 0.25 ft/day (Table 2). This falls within the range of historical estimates for groundwater flow velocities at this site. The linear velocity equation and resulting rates make the simplified assumptions of a homogeneous and isotropic aquifer. This equation can over-estimate velocities when applied to heterogeneous and/or anisotropic conditions such as are believed to exist at this site. The regolith and fractured bedrock common in Piedmont terrain are characteristically heterogeneous. Site boring logs record that regolith sampled at the site commonly exhibits relict foliation. These structures can result in locally anisotropic groundwater flow directions. Although the regolith and bedrock are hydraulically connected, the effective porosity generally decreases with depth into the underlying fractured bedrock.

2.0 GROUNDWATER MONITORING

The groundwater monitoring network was designed to monitor for potential releases to the uppermost aquifer from existing Phases 1, 2, 3, and proposed Phase 4 at the Wilkes County Roaring River Landfill. Eleven active groundwater monitoring wells comprise the monitoring network at the Roaring River Landfill. The current compliance network consists of the following monitoring wells: MW-13 (facility background well), MW-5, MW-6, MW-7, MW-8, MW-9, MW-10, MW-12S, MW-12D, MW-17, and MW-18.

Monitoring Well	Date Installed	Classification	Monitoring Program	Total Depth from TOC (ft)	Lithology of Screened Interval
MW-2R	4/08/02	Abandoned	-	116.00	Bedrock
MW-5	8/12/93	Compliance	Detection	38.11	Saprolite
MW-6	8/13/93	Compliance	Detection	37.60	Saprolite
MW-7	8/11/93	Compliance	Detection	41.77	Saprolite
MW-8	8/11/93	Compliance	Detection	58.50	Bedrock
MW-9	8/12/93	Compliance	Detection	37.57	Saprolite
MW-10	9/02/98	Compliance	Detection	76.75	Bedrock
MW-12S	3/07/00	Compliance	Detection	104.00	Partially Weathered Rock
MW-12D	3/07/00	Compliance	Detection	134.00	Partially Weathered Rock
MW-13	2/05/01	Background	Detection	88.00	Partially Weathered Rock
MW-17	8/26/03	Compliance	Detection	24.63	Saprolite
MW-18	8/26/03	Compliance	Detection	46.85	Saprolite

Monitoring well MW-13 is the upgradient background monitoring well for the facility. This well replaced former background monitoring well MW-2R which was abandoned on September 13, 2010. Well MW-13 was installed in February 2001 to serve as the background well for the proposed C&D landfill; however, no C&D landfill has been constructed at this time. Well MW-13 was sampled for the first time on November 1, 2010 during the second semiannual event.

Monitoring wells MW-5, -6, -7, -8, -9, and -10 are monitored to detect potential releases from Cell 1. Monitoring wells MW-12S and -12D were installed in March 2000 to be incorporated into the monitoring network to effectively monitor Cell 2, while monitoring wells MW-11S and MW-11D were abandoned for Phase 2 construction. Wells MW-17 and MW-18 were installed during the Design Hydrogeologic Investigation for Phase 3 and were incorporated into the facility network after the June 2006 approval of the revised Groundwater Monitoring Plan.

3.0 INSTALLATION AND MAINTENANCE OF THE GROUNDWATER MONITORING NETWORK

The existing monitoring wells will be used and maintained in accordance with design specifications throughout the life of the monitoring program. The specifications are outlined in 15A NCAC Subchapter 2C, Section .0100. Routine well maintenance will include inspection and correction/repair of, as necessary, identification labels, concrete apron condition, locking caps and locks, and access to the wells. Wilkes County will re-evaluate the monitoring network, and provide recommendations to the Division of Waste Management (DWM) for modifying, rehabilitating, abandoning, or installing replacement or additional monitoring wells, as appropriate.

3.1 Groundwater Sampling Methodology

Groundwater samples will be collected in accordance with Solid Waste Management Rules 15A NCAC 13B .1632 and the Solid Waste Section: Guidelines for Groundwater, Soil, and Surface Water Sampling (April 2008). Copies of the documents, as well as additional guidelines and memorandums are included in Appendix VII- 4.Details of well purging, sample withdrawal, and decontamination methods, as well as chain-of-custody procedures are outlined below.

3.1.1 Static Water Levels

Static water elevations and the total well depth will be measured to the nearest 0.01 of a foot in each well prior to the sampling of each well. An electronic water level meter will be used for the measurements. The distance from the top of the well casing to the water surface (and if not already known, the distance to the bottom of the well) will be measured using the tape attached to the probe. In between wells and following completion of the field sampling, the water level meter will be decontaminated using the following procedure.

1) Phosphate-free soap and distilled water wash;
2) Distilled water rinse;
3) Air dry.

3.1.2 Purging and Sampling Methodology

A low-yield well (one that is incapable of yielding three well volumes within a reasonable time) will be purged so that water is removed from the bottom of the screened interval. Low-yield wells will be evacuated to dryness once. Within 24 hours of purging, the first sample will be field tested for pH, temperature, and specific conductance. Samples will then be collected and containerized in the order of the parameter's volatilization sensitivity (i.e., total organic then total metals).

A high-yield well (one that is capable of yielding more than three well volumes during purging) will be purged so that water is drawn down from the uppermost part of the water column to ensure that fresh water from the formation will move upward in the screen. At no time will a well be evacuated to dryness if the recharge rate causes the formation water to vigorously cascade down the sides of the screen, which could cause an accelerated loss of volatiles.

A minimum of three well volumes will be evacuated from high-yield wells prior to sampling. A well volume is defined as the water contained within the well casing and pore spaces of the surrounding filter pack. The well volume will be calculated using the following formulas:

$V_c = (d_c^2/4) \times 3.14 \times h_w \times (7.48 \text{ gallons/cubic foot})$
$V_c \text{ (gallons)} = 0.163 \times h_w$ (for a 2-inch well)

where:
V_c = volume in the well casing in gallons

d_c = casing diameter in feet (d_c = 0.167 for a 2-inch well)
h_w = height of the water column in feet (i.e., well depth minus depth to water)

Each well will be evacuated (purged) and sampled with a disposable bailer or a sampling pump. The bailer or pump will be lowered gently into the well to minimize the possibility of causing degassing of the water. If sampled with a pump, flow rates will be regulated to minimize turbidity and degassing of the water.

All equipment used for sampling will be handled in such a manner to ensure that the equipment remains decontaminated prior to use. In between wells and following completion of the field sampling, water level meters, sampling pumps, or any other reusable sampling equipment will be properly decontaminated. Clean disposable gloves will be worn by sampling personnel and changed between wells.

The upgradient/background well will be sampled first, followed by the downgradient wells. The order of sampling of the downgradient wells will be evaluated each sampling event to provide a sequence going from less contaminated to more contaminated, if applicable, based on the previous sampling event.

Field measurements of temperature, pH, specific conductance, and turbidity will be made before sample collection. The direct reading equipment used at each well will be calibrated according to the manufacturer's specifications prior to each sampling event. Groundwater samples will be collected and containerized in the order of the volatilization sensitivity (i.e., volatile organic compounds {VOCs} first, followed by the metals).

3.1.3 Sample Collection, Bottling, and Transportation

Pre-preserved sample containers are properly prepared by the analytical laboratory scheduled to perform the analysis. No cleaning or preparation of sampling bottles by field personnel should be performed.

The VOC vials will be filled in such a manner that no headspace remains after filling. Immediately upon collection, all samples will be placed in coolers on ice where they will be stored prior to and during transit to the laboratory.

Samples collected will be properly containerized, packed into pre-cooled coolers, and either hand-delivered or shipped via overnight courier to the laboratory for analysis. The chain-of-custody program will allow for tracing of possession and handling of samples from the time of field collection through laboratory analysis. The chain-of-custody program will include sample labels and seals, field logs, chain-of-custody records, and laboratory logs.

Labels sufficiently durable to remain legible when wet will contain the following information:

- Job and sample identification;
- Monitoring well number or other location;

- Date and time of collection;
- Name of collector;
- Parameter or method to be analyzed; and
- Preservative, if applicable.

The shipping container will be sealed to ensure that the samples have not been disturbed during transport to the laboratory. If the sample cannot be analyzed because of damage or disturbance, whenever possible, the damaged sample will be replaced during the same compliance period.

The field log will contain sheets documenting the following information:

- Identification of the well;
- Well depth;
- Static water level depth;
- Presence of immiscible layers, odors or other indications of potential contamination;
- Purge volume (given in gallons);
- Time well was purged;
- Date and time of collection;
- Well sampling sequence;
- Field analysis data and methods;
- Field observations on sampling event;
- Name of collector(s);
- Climatic conditions (temperature, precipitation).

A sample field log sheet for groundwater is provided in Appendix VII-1.

The chain-of-custody record is required to establish the documentation necessary to trace sample possession from time of collection to time of receipt at destination. A chain-of-custody record will accompany each individual shipment. The record will contain the following information:

- Sample destination and transporter;
- Sample identification numbers;
- Signature of collector;
- Date and time of collection;
- Sample type;
- Identification of well;
- Number of sample containers in shipping container;
- Parameters requested for analysis;
- Signature of person(s) involved in the chain of possession;
- Inclusive dates of possession; and
- Internal temperature of shipping container upon opening (noted by the laboratory).

A copy of the completed chain-of-custody sheet will accompany the shipment and will be returned to the shipper with the analytical results. The chain of custody record will also be used as the analysis request sheet. A sample chain-of-custody form is included in Appendix VII-2.

3.1.4 Field and Trip Blanks

A field blank will be collected and analyzed during each sampling event to verify that the sample collection and handling processes have not affected the integrity of the field samples. The field blank will be prepared in the field from lab pure water (Type II reagent grade water) supplied by the laboratory. One field blank will be prepared for each sampling event. The field blank will be generated by exposing the lab pure water to the sampling environment in the same manner as actual field samples being collected. The lab will provide appropriate sample containers for generation of the field blank(s). The field blank will be subjected to the same analysis(es) as the groundwater samples. As with all other samples, the time(s) of the field blank collection will be recorded so that the sampling sequence is documented. The field blank monitors for contamination from contamination that might occur between samples and sample containers as they are opened and exposed to the sampling environment.

Whenever groundwater samples are being collected for volatiles analysis, a trip blank will be generated by the laboratory prior to shipment of sampling containers and coolers to the field, using lab pure water as described above. The trip blank shall be transported with the empty sampling containers to the field, but will not be opened at any time prior to analysis at the laboratory. The trip blank will accompany the groundwater samples in the cooler(s) back to the laboratory and will be analyzed by the same volatile methods as the associated field samples. The trip blank monitors for potential cross-contamination that might occur between samples or that may be a result of the shipping environment.

Detectable levels of contaminants found in the field blanks or trip blanks will not be used to correct the groundwater data, but will be noted accordingly. Detections of constituents in site groundwater or surface water samples may be blank-qualified if the concentration detected in the sample is less than 5 times (or 10 times, in the case of some common laboratory contaminants such as methylene chloride and some phthalates) the concentrations of that constituent detected in the field, trip, or method blanks. Contaminants present in trip blanks or field blanks at concentrations within an order of magnitude of those observed in the corresponding groundwater samples may be cause for resampling.

3.2 Sample Analysis Requirements

Analysis of groundwater samples from the facility will be conducted by a laboratory certified by the NCDENR. Analyses will be performed in accordance with U.S. Environmental Protection Agency (EPA) SW-846 methods. Groundwater samples will be analyzed for the constituents listed in NCSWMR Appendix I in accordance with 15A NCAC 13B.1633 (Detection Monitoring Program). In addition, field analyses for temperature, pH, specific conductance, and turbidity will be performed for each sample. Appendix C includes a table of all Appendix I and Appendix II constituents with their respective analytical methods, CAS numbers, DENR Solid Waste Section Limits (SWSL), 15A NCAC 2L (NC 2L) groundwater standards, and groundwater protection standards (GWPS). All limits and standards are current as of the submittal date of the WQMP.

3.3 Reporting and Record Keeping

The laboratory analytical results will be submitted to the Solid Waste Section at least semiannually. The following measurements, analytical data, calculations, and other relevant groundwater monitoring records will be kept throughout the active life of the facility and the post-closure care period:

- Records of all groundwater quality data;
- Associated sample collection field logs and measurements, such as static water level measured in compliance wells at the time of sample collection; and
- Notices and reports of NC 2L Standard and/or GWPS exceedences, reporting or data error, missing data, etc.

3.4 Well Abandonment

Any monitoring wells at the site which need to be abandoned due to damage, construction activities, or approved changes in the monitoring network will be properly abandoned in accordance with the procedures for permanent abandonment, as described in 15A NCAC 2C Rule .0113(d). Prior to abandonment, approval must be received from the Solid Waste Section and will also be certified by a licensed geologist. No wells will be abandoned without prior approval from the SWS.

4.0 COMPARISONS TO THE NC 2L AND GWPS

Constituents detected in the groundwater samples collected from the compliance network shall be compared to the NC 2L Standards established by 15A NCAC 2L.0202. For constituents without NC 2L Standards, the groundwater samples shall be compared to the GWPS established by the SWS. Unless otherwise established by DENR, the standards for all constituents shall be equal to their respective NC 2L or GWPS (see Appendix VII-3), unless the NC 2L or GWPS is below the SWSL, in which case the standard shall be equal to the SWSL. If a statistically-determined background concentration for a constituent is greater than the applicable NC 2L or GWPS, the background may be considered the standard for comparison. The initial comparison will be performed using a value-to-value procedure.

If an analyte is detected above the NC 2L or GWPS in a given sampling event, confidence limits may be calculated based on the most recent four sampling events, and if the lower confidence limit is not above the NC 2L or GWPS, the detection shall not be considered a statistically significant level compared to the NC 2L or GWPS. If an analyte is detected below the NC 2L or GWPS, even if it is a quantifiable concentration, compliance action will not be required unless it is demonstrated to represent a statistically significant increase over background.

If a suspect NC 2L or GWPS exceedance is noted during the value-to-value comparison, a confirmation sample may be collected. The results from a confirmation sample will be

compared to the NC 2L or GWPS in a value-to-value comparison, or the value may be statistically compared to background.

5.0 STATISTICAL ANALYSES

The background data are to be evaluated through the use of Parametric Prediction Limits, Parametric Tolerance Intervals, Non-Parametric Prediction Limits, or Poisson Prediction Limits as appropriate. Tests for normality, outliers, Aitchison's adjustment, tolerance intervals, or prediction limits are to be included as appropriate based on the background data.

The statistical test by which downgradient data are compared to facility background data is based upon the nature of the data and the number of data values that are less than the laboratory limit of detection. All statistical tests are evaluated at the 0.05 level of significance, 95% confidence level, and are conducted as one-tailed tests. These methods and the criteria for their use are discussed below.

5.1 Treatment of Censored Data

Generally, background data are censored as follows. When less than or equal to 15% of the background data values are less than the applicable reporting limit (SWSL), any data reported less than the SWSL will be treated as one-half the SWSL.

5.2 Assumption of Normality

Prior to conducting statistical tests that are based on the assumption of normally distributed data, normality of the background data is evaluated using the Shapiro-Wilk statistic (W). Normality is assessed at the 95% confidence level. In the event that the raw data fail to follow a normal distribution, the data are transformed using a base-10 logarithm. The transformed data are then tested for normality using the Shapiro-Wilk statistic. In the event that the log-transformed data also fail to follow a normal distribution, a non-parametric approach is applied.

5.3 Parametric Upper Tolerance Limit

In some cases the background data consist of a minimum of eight independent data values and less than or equal to 15% of the background data values are less than the RL for a given analyte. The downgradient values are then compared to the parametric upper tolerance limit in accordance with the procedure summarized in the USEPA guidance documents, *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Interim Final Guidance* (USEPA, 1989) and *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Addendum to Interim Final Guidance* (USEPA, 1992).

5.4 Aitchison's Adjusted Parametric Upper Prediction Limit

In those cases where the background data consist of a minimum of eight independent data values and more than 15%, but less than or equal to 50%, of the background data values are less than the RL for a given analyte, the mean and standard deviation are adjusted. This is done in accordance with the procedure described by Aitchison (1955) and summarized in the USEPA guidance document (USEPA, 1992). After the adjustments are made, the downgradient values are compared to the Aitchison's adjusted parametric upper prediction limit in accordance with the procedures summarized in the USEPA guidance documents (USEPA, 1989 and USEPA, 1992).

5.5 Non-parametric Upper Tolerance Limit

In those cases where more than 50%, but less than or equal to 90%, of the background data values are less than the RL for a given analyte or the background data fail to follow a normal or log-normal distribution, downgradient values are compared to the non-parametric upper tolerance limit. This procedure is done in accordance with the procedures summarized in the USEPA guidance documents (USEPA, 1989 and USEPA, 1992).

5.6 Poisson Upper Prediction Limit

In those cases where more than 90% of the background data values are less than the RL for a given analyte, the downgradient values are compared to the Poisson upper prediction limit. These comparisons are made in accordance with the procedure summarized in the USEPA guidance document (USEPA, 1992).

6.0 SURFACE WATER MONITORING (RULE .0602)

Surface water monitoring has not been conducted in the past and none is proposed in this plan.

7.0 ABILITY TO EFFECTIVELY MONITOR RELEASES

There are no known conditions, physical or hydrogeologic, which will interfere with the effective monitoring of Phases 1, 2, and 3, including the proposed Phase 4 vertical expansion. Depths to groundwater and bedrock are well defined in and around the site, especially in the area of Phase 3/4. This condition presents a significant environmental advantage for the long term monitoring of this unit by retarding the downward migration of any potential releases of solid waste constituents.

The proposed Water Quality Monitoring Plan, when implemented, will be effective in providing early detection of any release of hazardous constituents to the surficial aquifer beneath the Roaring River Landfill, so as to be protective of public health and the environment.

8.0 REFERENCES

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TABLES

TABLE 1

SUMMARY OF HISTORICAL GROUNDWATER ELEVATIONS

Location	Background		Downgradient									
	MW-2	MW-2R	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10	MW-12S	MW-12D	MW-17	MW-18
TOC Elevation	1115.00	1118.10	996.15	981.01	984.08	984.46	971.89	1024.10	1052.79	1052.89	986.68	1026.49
Well Depth	81.50	116.00	38.11	37.60	41.77	58.50	37.57	76.75	104.00	134.00	24.63	46.85
Oct-94	1042.13	NI	966.74	949.27	947.37	948.60	943.17	NI	NI	NI	NI	NI
Apr-95	1042.19	NI	966.73	949.01	946.65	948.07	943.08	NI	NI	NI	NI	NI
Oct-95	1041.70	NI	967.05	948.73	946.67	947.85	943.24	NI	NI	NI	NI	NI
Apr-96	1043.10	NI	968.15	950.20	947.21	948.46	943.34	NI	NI	NI	NI	NI
Nov-96	1040.56	NI	967.40	949.28	946.75	947.96	943.36	NI	NI	NI	NI	NI
Mar-97	1041.55	NI	968.14	951.06	947.61	948.99	944.23	NI	NI	NI	NI	NI
Sep-97	1039.38	NI	966.55	948.88	947.07	951.62	943.81	NI	NI	NI	NI	NI
Mar-98	1037.72	NI	969.55	949.61	946.98	948.34	944.19	NI	NI	NI	NI	NI
Sep-98	1042.12	NI	967.92	950.09	947.36	948.57	943.43	956.95	NI	NI	NI	NI
Oct-98	1040.53	NI	967.13	948.76	946.77	947.98	943.37	956.08	NI	NI	NI	NI
Nov-98	1039.10	NI	966.53	947.76	946.33	947.68	943.64	955.13	NI	NI	NI	NI
Dec-98	1038.41	NI	966.20	947.24	946.08	947.35	942.29	954.56	NI	NI	NI	NI
Feb-99	1036.80	NI	968.43	947.79	946.31	947.61	943.77	953.18	NI	NI	NI	NI
Apr-99	Dry	NI	967.89	948.44	946.36	947.61	943.34	952.93	NI	NI	NI	NI
Sep-99	Dry	NI	965.54	946.43	945.33	946.50	942.86	NA	NI	NI	NI	NI
Apr-00	Dry	NI	965.71	945.72	945.34	947.85	943.31	951.29	958.39	958.38	NI	NI
Sep-00	Dry	NI	964.15	945.49	945.20	946.52	943.43	949.79	956.37	956.58	NI	NI
Mar-01	Dry	NI	964.30	944.87	944.86	946.21	943.49	948.39	954.38	954.56	NI	NI
Oct-01	Dry	NI	960.32	944.79	944.15	945.46	943.49	947.56	954.05	953.23	NI	NI
Apr-02	Dry	1018.99	961.64	946.59	944.28	945.71	943.38	947.40	952.78	949.37	NI	NI
Nov-02	AB	1032.21	961.81	946.92	943.07	946.25	943.90	947.40	949.98	946.52	NI	NI
May-03	AB	1037.34	964.50	951.47	946.87	948.19	944.07	947.43	951.89	944.49	NI	NI
Nov-03	AB	1041.84	962.60	950.27	946.77	948.05	943.42	948.66	955.89	954.78	NS	NS
Apr-04	AB	1041.41	963.52	948.59	946.70	947.51	943.88	948.54	954.92	954.11	967.57	995.90
Oct-04	AB	1041.53	962.11	947.33	945.43	945.76	943.68	950.62	954.06	954.41	967.30	995.49
May-05	AB	1041.82	963.19	949.53	946.57	946.85	943.96	948.89	954.14	954.73	967.46	987.81
Oct-05	AB	1042.35	960.87	945.83	945.05	945.27	943.51	948.62	954.36	953.60	967.19	993.87
29-Jun-06	AB	1030.65	958.18	943.61	944.08	944.52	946.31	948.21	952.45	952.55	963.04	991.49
07-Dec-06	AB	1039.79	959.85	Dry	944.43	944.76	943.76	Dry	951.34	951.34	Dry	992.24
28-Jun-07	AB	1040.52	959.61	Dry	944.40	944.82	942.93	947.61	951.35	951.38	966.53	979.73
19-Dec-07	AB	1038.71	958.68	Dry	942.46	942.74	941.34	947.61	949.72	930.89	966.68	979.73
28-Apr-08	AB	1067.25	959.42	Dry	942.67	943.02	941.66	947.42	949.95	949.97	966.79	993.45
30-Dec-08	AB	1037.69	958.27	Dry	942.39	NS	942.20	947.41	950.11	944.41	967.03	990.66
24-Jun-09	AB	1038.56	958.47	946.16	944.79	NS	944.39	947.57	951.65	943.56	962.69	994.60
16-Dec-09	AB	1041.43	960.52	950.67	952.89	NS	944.70	947.37	952.90	940.66	967.30	996.27
22-Jun-10	AB	1045.29	959.14	950.08	946.27	NS	944.20	947.61	955.62	936.47	966.86	995.72

Notes:

1. Dry = Monitoring well was considered to be dry and no water level measured.
2. AB = Monitoring well was abandoned.
3. NI = Monitoring well was not installed.
4. NS = Monitoring well was not sampled.
5. NA = Not available.

TABLE 2

ESTIMATED HYDRAULIC GRADIENTS AND AVERAGE LINEAR VELOCITIES

GRADIENT CALCULATION SEGMENT	FLOW LINE LENGTH (feet)	FLOW DIRECTION	June 2010				
			GROUNDWATER ELEVATION (feet)	HORIZONTAL GRADIENT i (ft/ft)	HYDRAULIC CONDUCTIVITY K (ft/day)	EFFECTIVE POROSITY n	LINEAR VELOCITY V (ft/day)
i_1	858	W-SW	1030 970	0.070	5.5E-01	0.16	0.24
i_2	1365	S-SW	1030 950	0.059	5.5E-01	0.16	0.20
i_3	1039	S-SE	1040 950	0.087	5.5E-01	0.16	0.30
			Average	0.072		Average	0.25

Notes:

1. Linear flow velocities in plain type = Ki/n_e.
2. Effective porosity is based on average specific yields calculated using the Johnson (1967) textural classification triangle from the Design Hydrogeologic Report and Groundwater Monitoring Plan prepared by Joyce Engineering, Inc. in April 2004.
3. Hydraulic conductivity is based on a geomean of individual well slug tests performed for wells at the site.
4. Gradient calculation segments were obtained from Drawing No. 1.

DRAWINGS

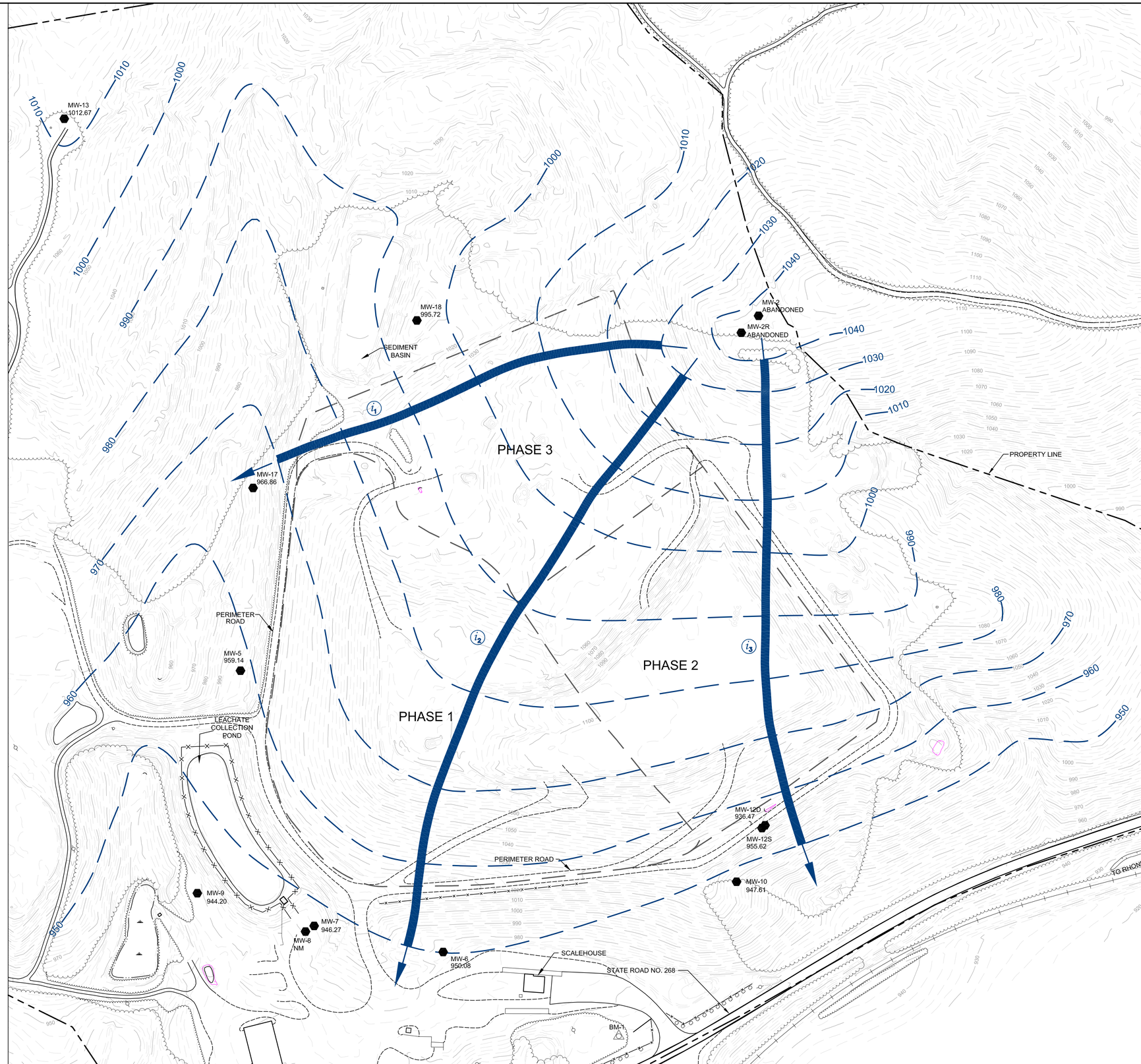
LEGEND

- 1070 — EXISTING 10' TOPOGRAPHIC CONTOUR
- EXISTING 2' TOPOGRAPHIC CONTOUR
- 970 — GROUNDWATER SURFACE CONTOUR [FEET ABOVE MEAN SEA LEVEL (AMSL)]
- PROPERTY LINE
- EXISTING ROAD
- APPROXIMATE LIMITS OF WASTE
- CENTERLINE OF STREAM
- TREELINE
- MW-9 944.20 — GROUNDWATER MONITORING WELL LOCATION AND IDENTIFICATION WITH STATIC WATER LEVEL ELEVATION (FEET AMSL)
- GROUNDWATER FLOW DIRECTION WITH GRADIENT CALCULATION SEGMENT
- i_1 — SEGMENT USED FOR GRADIENT CALCULATIONS

NOTES:

1. TOPOGRAPHIC CONTOUR INTERVAL = 2 FEET.
2. GROUNDWATER SURFACE CONTOUR INTERVAL = 10 FEET.
3. STATIC WATER LEVELS MEASURED ON 06/22/10.
4. GROUNDWATER CONTOURS BASED ON LINEAR INTERPOLATION BETWEEN AND EXTRAPOLATION FROM KNOWN DATA, TOPOGRAPHIC CONTOURS, AND KNOWN FIELD CONDITIONS. THEREFORE, GROUNDWATER CONTOURS MAY NOT REFLECT ACTUAL GROUNDWATER CONDITIONS.
5. DIGITAL MAPPING PROVIDED BY SPATIAL DATA CONSULTANTS, INC. FLYOVER DATE: MARCH 11, 2003. GROUND CONTROL AND PROPERTY LINE TIE-IN TO NC GRID COORDINATE SYSTEM SET BY SUTTLES SURVEYING, INC.
6. GROUNDWATER CONTOUR LINES SHOW THE WATER TABLE SHAPE AND ELEVATION. THESE CONTOURS ARE INFERRED LINES FOLLOWING THE GROUNDWATER SURFACE AT A CONSTANT ELEVATION ABOVE SEA LEVEL. THE GROUNDWATER FLOW DIRECTION IS GENERALLY PERPENDICULAR TO THE GROUNDWATER SURFACE CONTOURS, SIMILAR TO THE RELATIONSHIP BETWEEN SURFACE WATER FLOW AND TOPOGRAPHIC CONTOURS.
7. MW-12D WATER ELEVATIONS ARE NOT INCLUDED IN REGARDS TO MAPPING THE GROUNDWATER SURFACE CONTOURS.

GRAPHIC SCALE
0 50 100 200
(FEET)



NO	BY	CK	APP
1	CTM	CTM	JJK

DATE	REVISIONS AND RECORD OF ISSUE
5/27/11	DEPICT THE LOCATION OF MW-13; LABEL MW-2 & MW-2R AS ABANDONED

DESIGNED ACE
DRAWN ACE/JJK
CHECKED JJK
APPROVED JJK
DATE 09/02/10

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JOYCE ENGINEERING, INC.
2211 W. MEADOWVIEW ROAD
GREENSBORO, NC 27407
PHONE: (336) 323-0092

ROARING RIVER LANDFILL
WILKES COUNTY, NORTH CAROLINA

GROUNDWATER SURFACE CONTOUR MAP
JUNE 22, 2010
PERMIT NO. 97-04

PROJECT NO.
356.1002.11

SCALE
AS NOTED

DRAWING NO.
WQMP-01

P:\Wilkes\Roaring River\Permitting NC\2010 MSW Permit Amendment\Task 03 - Construction Plan Application\VII - Monitoring Plans\GW Map 2010.dwg Layout=Layout1

APPENDIX VII-1

FIELD LOG DATA SHEET

DATE:_____

GROUND WATER SAMPLING LOG

Project Name: _____ **Project No./Task No.:** _____

Well ID: _____ **Sampler(s):**_____

Well Location:_____

Well Diameter: _____inches

Initial Depth to Water (DTW): _____feet

Depth to Bottom (DTB): _____feet

Water Column Thickness (WCT): _____feet [DTB-DTW]

Calculation for One Well Volume (WV):

For 2" Well: WCT X 0.163 = _____gallons

For 4" Well: WCT X 0.653 = _____gallons

For THREE Well Volumes: WV X 3 = _____gallons

Actual Amount Purged/Bailed : _____gallons

Purged with: _____

Sampled with: _____

Depth to Water before Sampling : _____feet

Gallons	Time	Temp(°C)	pH	Cond. (µS)	Turb.(ntu)	Initials
Before Sampling						

Comments (weather conditions, odor, color, silt, etc.): _____

_____

_____

_____

Signature: _____ **Date:** _____

QA/QC Sign Off: _____ **Date:** _____

APPENDIX VII-2

SAMPLE CHAIN OF CUSTODY

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page : Of

Section A
Required Client Information:

Company:
Address:
Email To:
Phone: Fax:
Requested Due Date/TAT:

Section B
Required Project Information:

Report To:
Copy To:
Purchase Order No.
Client Project ID:
Container Order Number:

Section C
Invoice Information:

Attention:
Company Name:
Address:
Quote Reference:
Project Manager:
Profile #:

Regulatory Agency
State / Location

Requested Analysis Filtered (Y/N)

ITEM#	SAMPLE ID One Character per box. (A-Z, 0-9 / , -) Sample Ids must be unique MATRIX CODE: Drinking Water DW, Water WT, Waste Water WW, Product P, Soil/Solid SL, Oil OL, Wipe WP, Air AR, Other OT, Tissue TS	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED START DATE	COLLECTED START TIME	COLLECTED END DATE	COLLECTED END TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Analyses Test	Y/N											Residual Chlorine (Y/N)
1																														
2																														
3																														
4																														
5																														
6																														
7																														
8																														
9																														
10																														
11																														
12																														

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME

SAMPLE CONDITIONS

TEMP in C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER:

SIGNATURE of SAMPLER: DATE Signed:

APPENDIX VII-3

GROUNDWATER LIMITS AND STANDARDS

North Carolina Appendix I, II, and C and D Constituents

NC App. I & II - Total Metals

Number	NC App. #	ANALYTE	CLASS	CAS RN	ANALYTICAL METHOD	GROUNDWATER			NOTES
						NC SWSL	NC 2L	GWP STD.	
1	App. I	Antimony	metal	7440-36-0	6010	6	-	1	(RCRA METAL)
2	App. I	Arsenic	metal	7440-38-2	6010	10	10	-	(RCRA METAL)
3	App. I	Barium	metal	7440-39-3	6010	100	700	-	
4	App. I	Beryllium	metal	7440-41-7	6010	1	-	4	(RCRA METAL)
5	App. I	Cadmium	metal	7440-43-9	6010	1	2	-	
6	App. I	Chromium	metal	7440-47-3	6010	10	10	-	(RCRA METAL)
7	App. I	Cobalt	metal	7440-48-4	6010	10	-	1	
8	App. I	Copper	metal	7440-50-8	6010	10	1000	-	EPA MCL is a secondary standard
9	App. I	Lead	metal	7439-92-1	6010	10	15	-	EPA MCL is an action level. (RCRA METAL)
10	App. I	Nickel	metal	7440-02-0	6010	50	100	-	
11	App. I	Selenium	metal	7782-49-2	6010	10	20	-	(RCRA METAL)
12	App. I	Silver	metal	7440-22-4	6010	10	20	-	EPA MCL is a secondary standard. (RCRA METAL)
13	App. I	Thallium	metal	7440-28-0	6010	5.5	-	0.2	
14	App. I	Vanadium	metal	7440-62-2	6010	25	-	0.3	
15	App. I	Zinc	metal	7440-66-6	6010	10	1000	-	EPA MCL is a secondary standard. *(AL)* = NC2B Action Level
16	App. II	Mercury	metal	7439-97-6	7470	0.2	1	-	(RCRA METAL)
17	App. II	Tin	metal	7440-31-5	6010	100	-	2000	

NC App. II - Cyanide/ Sulfide

Number	NC App. #	ANALYTE	CLASS	CAS RN	ANALYTICAL METHOD	GROUNDWATER			NOTES
						NC SWSL	NC 2L	GWP STD.	
1	App. II	Cyanide	inorganic	57-12-5	9012A	10	70	-	
2	App. II	Sulfide	inorganic	18496-25-8	9030B	1000	-	-	

NC - Additional Constituents for C&D Landfills

Number	NC App. #	ANALYTE	CLASS	CAS RN	ANALYTICAL METHOD	GROUNDWATER			NOTES
						NC SWSL	NC 2L	GWP STD.	
1	C&D	Alkalinity	inorganic	SW337	SM 2320B	-	-	-	
2	C&D	Chloride	inorganic	SW301	SM 4500-Cl-E	-	250000	-	
3	C&D	Iron	metal	7439-89-6	6010	300	300	-	
4	C&D	Manganese	metal	7439-96-5	6010	50	50	-	
5	C&D	Mercury	metal	7439-97-6	7470	0.2	1	-	(RCRA Metal)
6	C&D	Sulfate	inorganic	14808-79-8	300.0	250000	250000	-	
7	C&D	Total Dissolved Solids (TDS)	inorganic	SW311	SM 2540C	-	500000	-	

NC App. I & II - Method 8260

Number	NC App. #	ANALYTE	CLASS	CAS RN	ANALYTICAL METHOD	GROUNDWATER			NOTES
						NC SWSL	NC 2L	GWP STD.	
1	App. I	Acetone	volatile	67-64-1	8260B	100	6000	-	
2	App. I	Acrylonitrile	volatile	107-13-1	8260B	200	-	-	
3	App. I	Benzene	volatile	71-43-2	8260B	1	1	-	
4	App. I	Bromochloromethane	volatile	74-97-5	8260B	3	-	0.6	
5	App. I	Bromodichloromethane	volatile	75-27-4	8260B	1	0.6	-	*MCL for total trihalomethanes
6	App. I	Bromoform	volatile	75-25-2	8260B	3	4	-	*MCL for total trihalomethanes
7	App. I	Carbon disulfide	volatile	75-15-0	8260B	100	700	-	
8	App. I	Carbon tetrachloride	volatile	56-23-5	8260B	1	0.3	-	
9	App. I	Chlorobenzene	volatile	108-90-7	8260B	3	50	-	
10	App. I	Chloroethane	volatile	75-00-3	8260B	10	3000	-	
11	App. I	Chloroform	volatile	67-66-3	8260B	5	70	-	*MCL for total trihalomethanes
12	App. I	Dibromochloromethane	volatile	124-48-1	8260B	3	0.4	-	*MCL for total trihalomethanes
13	App. I	1,2-Dibromo-3-chloropropane (DBCP)	volatile	96-12-8	8260B	13	0.04	-	
14	App. I	1,2-Dibromoethane (EDB)	volatile	106-93-4	8260B	1	0.02	-	
15	App. I	o-Dichlorobenzene / 1,2-Dichlorobenzene	volatile	95-50-1	8260B	5	20	-	
16	App. I	p-Dichlorobenzene / 1,4-Dichlorobenzene	volatile	106-46-7	8260B	1	6	-	
17	App. I	trans-1,4-Dichloro-2-butene	volatile	110-57-6	8260B	100	-	-	
18	App. I	1,1-Dichloroethane	volatile	75-34-3	8260B	5	6	-	
19	App. I	1,2-Dichloroethane	volatile	107-06-2	8260B	1	0.4	-	
20	App. I	1,1-Dichloroethylene	volatile	75-35-4	8260B	5	7	-	
21	App. I	cis-1,2-Dichloroethylene	volatile	156-59-2	8260B	5	70	-	
22	App. I	trans-1,2-Dichloroethylene	volatile	156-60-5	8260B	5	100	-	
23	App. I	1,2-Dichloropropane	volatile	78-87-5	8260B	1	0.6	-	
24	App. I	cis-1,3-Dichloropropene	volatile	10061-01-5	8260B	1	0.4	-	
25	App. I	trans-1,3-Dichloropropene	volatile	10061-02-6	8260B	1	0.4	-	
26	App. I	Ethylbenzene	volatile	100-41-4	8260B	1	600	-	
27	App. I	2-Hexanone / Methyl butyl ketone (MBK)	volatile	591-78-6	8260B	50	-	280	
28	App. I	Methyl bromide / Bromomethane	volatile	74-83-9	8260B	10	-	10	
29	App. I	Methyl chloride / Chloromethane	volatile	74-87-3	8260B	1	3	-	
30	App. I	Methylene bromide / Dibromomethane	volatile	74-95-3	8260B	10	-	70	
31	App. I	Methylene chloride / Dichloromethane	volatile	75-09-2	8260B	1	5	-	
32	App. I	Methyl ethyl ketone / 2-Butanone (MEK)	volatile	78-93-3	8260B	100	4000	-	
33	App. I	Methyl iodide / Iodomethane	volatile	74-88-4	8260B	10	-	-	
34	App. I	4-Methyl-2-pentanone / Methyl isobutyl ketone	volatile	108-10-1	8260B	100	-	560	
35	App. I	Styrene	volatile	100-42-5	8260B	1	70	-	
36	App. I	1,1,1,2-Tetrachloroethane	volatile	630-20-6	8260B	5	-	1	
37	App. I	1,1,2,2-Tetrachloroethane	volatile	79-34-5	8260B	3	0.2	-	
38	App. I	Tetrachloroethylene (PCE)	volatile	127-18-4	8260B	1	0.7	-	
39	App. I	Toluene	volatile	108-88-3	8260B	1	600	-	
40	App. I	1,1,1-Trichloroethane	volatile	71-55-6	8260B	1	200	-	
41	App. I	1,1,2-Trichloroethane	volatile	79-00-5	8260B	1	-	0.6	
42	App. I	Trichloroethylene	volatile	79-01-6	8260B	1	3	-	
43	App. I	Trichlorofluoromethane (CFC-11)	volatile	75-69-4	8260B	1	2000	-	
44	App. I	1,2,3-Trichloropropane	volatile	96-18-4	8260B	1	0.005	-	
45	App. I	Vinyl acetate	volatile	108-05-4	8260B	50	-	88	
46	App. I	Vinyl chloride	volatile	75-01-4	8260B	1	0.03	-	
47	App. I	Xylenes (total)	volatile	see note	8260B	5	500	-	Includes o-xylene, p-xylene, and unspecified xylenes (dimethyl benzenes (CAS RN 1330-20-7).

NC App. II - Method 8260

Number	NC App. #	ANALYTE	CLASS	CAS RN	ANALYTICAL METHOD	GROUNDWATER			NOTES
						NC SWSL	NC 2L	GWP STD.	
48	App. II	Acetonitrile (methyl cyanide)	volatile	75-05-8	8260B	55	-	42	
49	App. II	Acrolein	volatile	107-02-8	8260B	53	-	4	
50	App. II	Allyl chloride (3-chloroprene)	volatile	107-05-1	8260B	10	-	-	
51	App. II	Chloroprene	volatile	126-99-8	8260B	20	-	-	
52	App. II	m-Dichlorobenzene / 1,3-Dichlorobenzene	volatile	541-73-1	8260B	5	200	-	
53	App. II	Dichlorodifluoromethane	volatile	75-71-8	8260B	5	1000	-	
54	App. II	1,3-Dichloropropane	volatile	142-28-9	8260B	1	-	-	
55	App. II	2,2-Dichloropropane	volatile	594-20-7	8260B	15	-	-	
56	App. II	1,1-Dichloropropene	volatile	563-58-6	8260B	5	-	-	
57	App. II	Isobutyl alcohol	volatile	78-83-1	8260B	100	-	-	
58	App. II	Methacrylonitrile	volatile	126-98-7	8260B	100	-	-	
59	App. II	Methyl methacrylate	volatile	80-62-6	8260B	30	-	25	
60	App. II	Propionitrile	volatile	107-12-0	8260B	150	-	-	
61	App. II	1,2,4-Trichlorobenzene	volatile	120-82-1	8260B	10	70	70	
62	App. II	Naphthalene	volatile	91-20-3	8260B or 8270C	10	6	-	
63	App. II	Hexachlorobutadiene	semi-volatile	87-68-3	8270C or 8260B	10	0.4	0.44	
64	App. II	Ethyl methacrylate	semi-volatile	97-63-2	8270C or 8260B	10	-	-	

North Carolina Appendix I, ..., and C and D Constituents

NC App. II - Method 8270

Number	NC App. #	ANALYTE	CLASS	CAS RN	ANALYTICAL METHOD	GROUNDWATER			NOTES
						NC SWSL	NC 2L	GWP STD.	
1	App. II	Acenaphthene	semi-volatile	83-32-9	8270C	10	80	-	
2	App. II	Acenaphthylene	semi-volatile	208-96-8	8270C	10	200	-	
3	App. II	Acetophenone	semi-volatile	98-86-2	8270C	10	-	700	
4	App. II	2-Acetylaminofluorene	semi-volatile	53-96-3	8270C	20	-	-	
5	App. II	4-Aminobiphenyl	semi-volatile	92-67-1	8270C	20	-	-	
6	App. II	Anthracene	PAH	120-12-7	8270C	10	2000	-	
7	App. II	Benz[a]anthracene; Benzanthracene	PAH	56-55-3	8270C	10	0.05	-	
8	App. II	Benzo[b]fluoranthene	PAH	205-99-2	8270C	10	0.05	-	
9	App. II	Benzo[k]fluoranthene	PAH	207-08-9	8270C	10	0.5	-	
10	App. II	Benzo[g,h,i]perylene	PAH	191-24-2	8270C	10	200	-	
11	App. II	Benzo[a]pyrene	PAH	50-32-8	8270C	10	0.005	-	
12	App. II	Benzyl alchohol	semi-volatile	100-51-6	8270C	20	-	700	
13	App. II	Bis(2-chloroethoxy)methane	semi-volatile	111-91-1	8270C	10	-	-	
14	App. II	Bis(2-chloroethyl)ether	semi-volatile	111-44-4	8270C	10	-	0.031	
15	App. II	Bis(2-chloro-1-methylethyl)ether	semi-volatile	108-60-1	8270C	10	-	-	Bis (2-chloroisopropyl) ether
16	App. II	Bis(2-ethylhexyl)phthalate	semi-volatile	117-81-7	8270C	15	3	-	
17	App. II	4-Bromophenyl phenyl ether	semi-volatile	101-55-3	8270C	10	-	-	
18	App. II	Butyl benzyl phthalate	semi-volatile	85-68-7	8270C	10	1000	-	
19	App. II	p-Chloroaniline (4-Chloroaniline)	semi-volatile	106-47-8	8270C	20	-	-	
20	App. II	Chlorobenzilate	semi-volatile	510-15-6	8270C	10	-	-	
21	App. II	p-Chloro-m-cresol (4-chloro-3-methylphenol)	semi-volatile	59-50-7	8270C	20	-	-	
22	App. II	2-Chloronaphthalene	semi-volatile	91-58-7	8270C	10	-	-	
23	App. II	2-Chlorophenol	semi-volatile	95-57-8	8270C	10	0.4	-	
24	App. II	4-Chlorophenyl phenyl ether	semi-volatile	7005-72-3	8270C	10	-	-	
25	App. II	Chrysene	PAH	218-01-9	8270C	10	5	-	
26	App. II	m-Cresol (3-Methylphenol)	semi-volatile	108-39-4	8270C	10	400	-	
27	App. II	o-Cresol	semi-volatile	95-48-7	8270C	10	-	35	
28	App. II	p-Cresol (4-Methylphenol)	semi-volatile	106-44-5	8270C	10	40	-	
29	App. II	Diallate	semi-volatile	2303-16-4	8270C	10	-	-	
30	App. II	Dibenz[a,h]anthracene	PAH	53-70-3	8270C	10	0.005	-	
31	App. II	Dibenzofuran	semi-volatile	132-64-9	8270C	10	-	28	
32	App. II	Di-n-butyl phthalate	semi-volatile	84-74-2	8270C	10	700	-	
33	App. II	3,3'-Dichlorobenzidine	semi-volatile	91-94-1	8270C	20	-	-	
34	App. II	2,4-Dichlorophenol	semi-volatile	120-83-2	8270C	10	-	0.98	
35	App. II	2,6-Dichlorophenol	semi-volatile	87-65-0	8270C	10	-	-	
36	App. II	Diethyl phthalate	semi-volatile	84-66-2	8270C	6000	6000	-	
37	App. II	O,O-Diethyl O-2-pyrazinyl phosphorothioate	OP pesticide	297-97-2	8270C	20	-	-	Thionazine
38	App. II	Dimethoate	OP pesticide	60-51-5	8270C	20	-	-	
39	App. II	p-(Dimethylamino)azobenzene	semi-volatile	60-11-7	8270C	10	-	-	
40	App. II	7,12-Dimethylbenz[a]anthracene	semi-volatile	57-97-6	8270C	10	-	-	
41	App. II	3,3'-Dimethylbenzidine	semi-volatile	119-93-7	8270C	10	-	-	
42	App. II	2,4-Dimethylphenol (M-xylenol)	semi-volatile	105-67-9	8270C	10	100	-	
43	App. II	Dimethyl phthalate	semi-volatile	131-11-3	8270C	10	-	-	
44	App. II	m-Dinitrobenzene	semi-volatile	99-65-0	8270C	20	-	-	
45	App. II	4,6-Dinitro-o-cresol (2-methyl 4,6-dinitrolphenol)	semi-volatile	534-52-1	8270C	50	-	-	
46	App. II	2,4-Dinitrophenol	semi-volatile	51-28-5	8270C	50	-	-	
47	App. II	2,4-Dinitrotoluene	semi-volatile	121-14-2	8270C	10	-	-	
48	App. II	2,6-Dinitrotoluene	semi-volatile	606-20-2	8270C	10	-	-	
49	App. II	Di-n-octyl phthalate	semi-volatile	117-84-0	8270C	10	100	-	
50	App. II	Diphenylamine	semi-volatile	122-39-4	8270C	10	-	-	
51	App. II	Disulfoton	OP pesticide	298-04-4	8270C	10	0.3	-	
52	App. II	Ethyl methanesulfonate	semi-volatile	62-50-0	8270C	20	-	-	
53	App. II	Famphur	semi-volatile	52-85-7	8270C	20	-	-	
54	App. II	Fluoranthene	PAH	206-44-0	8270C	10	300	-	
55	App. II	Fluorene	PAH	86-73-7	8270C	10	300	-	

NC App. II - Method 8270

Number	NC App. #	ANALYTE	CLASS	CAS RN	ANALYTICAL METHOD	GROUNDWATER			NOTES
						NC SWSL	NC 2L	GWP STD.	
56	App. II	Hexachlorobenzene	semi-volatile	118-74-1	8270C	10	0.02	-	
57	App. II	Hexachlorocyclopentadiene	semi-volatile	77-47-4	8270C	10	-	50	
58	App. II	Hexachloroethane	semi-volatile	67-72-1	8270C	10	-	2.5	
59	App. II	Hexachloropropene	semi-volatile	1888-71-7	8270C	10	-	-	
60	App. II	Indeno[1,2,3-cd]pyrene	PAH	193-39-5	8270C	10	0.05	-	
61	App. II	Isodrin	semi-volatile	465-73-6	8270C	20	-	-	
62	App. II	Isophorone	semi-volatile	78-59-1	8270C	10	40	-	
63	App. II	Isosafrole	semi-volatile	120-58-1	8270C	10	-	-	
64	App. II	Kepone	pesticide	143-50-0	8270C	20	-	-	
65	App. II	Methapyrilene	semi-volatile	91-80-5	8270C	100	-	-	
66	App. II	3-Methylcholanthrene	semi-volatile	56-49-5	8270C	10	-	-	
67	App. II	Methyl methanesulfonate	semi-volatile	66-27-3	8270C	10	-	-	
68	App. II	2-Methylnaphthalene	semi-volatile	91-57-6	8270C	10	30	-	
69	App. II	Methyl parathion	semi-volatile	298-00-0	8270C	10	-	-	
70	App. II	1,4-Naphthoquinone	semi-volatile	130-15-4	8270C	10	-	-	
71	App. II	1-Naphthylamine	semi-volatile	134-32-7	8270C	10	-	-	
72	App. II	2-Naphthylamine	semi-volatile	91-59-8	8270C	10	-	-	
73	App. II	o-Nitroaniline (2-Nitroaniline)	semi-volatile	88-74-4	8270C	50	-	-	
74	App. II	m-Nitroaniline (3-Nitroaniline)	semi-volatile	99-09-2	8270C	50	-	-	
75	App. II	p-Nitroaniline (4-Nitroaniline)	semi-volatile	100-01-6	8270C	20	-	-	
76	App. II	Nitrobenzene	semi-volatile	98-95-3	8270C	10	-	-	
77	App. II	5-Nitro-o-toluidine	semi-volatile	99-55-8	8270C	10	-	-	
78	App. II	o-Nitrophenol (2-Nitrophenol)	semi-volatile	88-75-5	8270C	10	-	-	
79	App. II	p-Nitrophenol (4-Nitrophenol)	semi-volatile	100-02-7	8270C	50	-	-	
80	App. II	N-Nitrosodiethylamine	semi-volatile	55-18-5	8270C	20	-	-	
81	App. II	N-Nitrosodimethylamine	semi-volatile	62-75-9	8270C	10	0.0007	-	
82	App. II	N-Nitrosodi-n-butylamine	semi-volatile	924-16-3	8270C	10	-	-	
83	App. II	N-Nitrosodiphenylamine	semi-volatile	86-30-6	8270C	10	-	-	
84	App. II	N-Nitrosodipropylamine	semi-volatile	621-64-7	8270C	10	-	-	
85	App. II	N-Nitrosomethylethylamine	semi-volatile	10595-95-6	8270C	10	-	-	
86	App. II	N-Nitrosopiperidine	semi-volatile	100-75-4	8270C	20	-	-	
87	App. II	N-Nitrosopyrrolidine	semi-volatile	930-55-2	8270C	10	-	-	
88	App. II	Parathion	OP pesticide	56-38-2	8270C	10	-	-	
89	App. II	Pentachlorobenzene	semi-volatile	608-93-5	8270C	10	-	-	
90	App. II	Pentachloronitrobenzene	semi-volatile	82-68-8	8270C	20	-	-	
91	App. II	Phenacetin	semi-volatile	62-44-2	8270C	20	-	-	
92	App. II	Phenanthrene	PAH	85-01-8	8270C	10	200	-	
93	App. II	Phenol	semi-volatile	108-95-2	8270C	10	30	-	
94	App. II	p-Phenylenediamine	semi-volatile	106-50-3	8270C	10	-	-	
95	App. II	Phorate	OP pesticide	298-02-2	8270C	10	1	-	
96	App. II	Pronamide	semi-volatile	23950-58-5	8270C	10	-	-	
97	App. II	Pyrene	PAH	129-00-0	8270C	10	200	-	
98	App. II	Safrole	semi-volatile	94-59-7	8270C	10	-	-	
99	App. II	1,2,4,5-Tetrachlorobenzene	semi-volatile	95-94-3	8270C	10	-	2	
100	App. II	2,3,4,6-Tetrachlorophenol	semi-volatile	58-90-2	8270C	10	200	-	
101	App. II	o-Toluidine	semi-volatile	95-53-4	8270C	10	-	-	
102	App. II	2,4,5-Trichlorophenol	semi-volatile	95-95-4	8270C	10	-	63	
103	App. II	2,4,6-Trichlorophenol	semi-volatile	88-06-2	8270C	10	-	4	
104	App. II	O,O,O-Triethyl phosphorothioate	semi-volatile	126-68-1	8270C	10	-	-	
105	App. II	1,3,5-Trinitrobenzene	semi-volatile	99-35-4	8270C	10	400	-	
106	App. II	Hexachlorobutadiene	semi-volatile	87-68-3	8270C or 8260	10	0.4	-	
107	App. II	Ethyl methacrylate	semi-volatile	97-63-2	8270C or 8270	10	-	-	
108	App. II	Naphthalene	volatile	91-20-3	8260B or 8270	10	6	-	
109	App. II	Pentachlorophenol	herbicide	87-86-5	8151 or 8270	25	0.3	-	

North Carolina Appendix I, ..., and C and D Constituents

NC App. II - Pesticides Method 8081

Number	NC App. #	ANALYTE	CLASS	CAS RN	ANALYTICAL METHOD	GROUNDWATER			NOTES
						NC SWSL	NC 2L	GWP STD.	
1	App. II	Aldrin	pesticide	309-00-2	8081A	0.05	-	0.002	
2	App. II	alpha-BHC	pesticide	319-84-6	8081A	0.05	-	0.006	
3	App. II	beta-BHC	pesticide	319-85-7	8081A	0.05	-	0.019	
4	App. II	delta-BHC	pesticide	319-86-8	8081A	0.05	-	0.019	
5	App. II	gamma-BHC (Lindane)	pesticide	58-89-9	8081A	0.05	0.03	-	
6	App. II	Chlordane	pesticide	see note	8081A	0.5	0.1	-	This entry includes alpha-chlordane (CAS RN 5103-71-9), beta chlordane (CAS RN 5103-74-2), gamma-chlordane (CAS RN 566-34-7), and constituents of chlordane (CAS RN 57-74-9 and 12672-29-6).
7	App. II	4,4'-DDD	pesticide	72-54-8	8081A	0.1	0.1	-	
8	App. II	4,4'-DDE	pesticide	72-55-9	8081A	0.1	-	-	
9	App. II	4-4'-DDT	pesticide	50-29-3	8081A	0.1	0.1	-	
10	App. II	Dieldrin	pesticide	60-57-1	8081A	0.002	0.002	-	
11	App. II	Endosulfan I	pesticide	959-96-8	8081A	0.1	40	-	
12	App. II	Endosulfan II	pesticide	33213-65-9	8081A	0.1	42	-	
13	App. II	Endosulfan sulfate	pesticide	1031-07-8	8081A	0.1	-	-	
14	App. II	Endrin	pesticide	72-20-8	8081A	0.1	2	-	
15	App. II	Endrin aldehyde	pesticide	7421-93-4	8081A	0.1	2	-	
16	App. II	Heptachlor	pesticide	76-44-8	8081A	0.05	0.008	-	
17	App. II	Heptachlor epoxide	pesticide	1024-57-3	8081A	0.075	0.004	-	
18	App. II	Methoxychlor	pesticide	72-43-5	8081A	1	40	-	
19	App. II	Toxaphene	pesticide	see note	8081A	1.5	0.03	-	Includes congener chemicals contained in technical toxaphene (CAS RN 8001 35-2) such as chlorinated camphene.

NC App. II - PCB's Method 8082

Number	NC App. #	ANALYTE	CLASS	CAS RN	ANALYTICAL METHOD	GROUNDWATER			NOTES
						NC SWSL	NC 2L	GWP STD.	
1-6	App. II	Polychlorinated Biphenyls (PCBs)	PCB	see note	8082	2	-	0.09	This category contains congener chemicals, including constituents of Aroclor 1016 (CAS RN 12674-11-2), Aroclor 1221 (CAS RN 11104-28-2), Aroclor 1232 (CAS RN 11141-16-5), Aroclor 1242 (CAS RN 53469-21-9), Aroclor 1248 (CAS RN 12672-29-6), Aroclor 1254 (CAS RN 11097-69-1)). Value given for the NC 2L Standard is the GWP for the Solid Waste Section.

NC App. II - Herbicides 8151

Number	NC App. #	ANALYTE	CLASS	CAS RN	ANALYTICAL METHOD	GROUNDWATER			NOTES
						NC SWSL	NC 2L	GWP STD.	
1	App. II	2,4-Dichlorophenoxyacetic acid (2,4-D)	herbicide	94-75-7	8151A	2	70	-	
2	App. II	Dinoseb (DNBP); 2-sec-Butyl-4,6-dinitrophenol	herbicide	86-85-7	8151A	1	-	7	
3	App. II	Silvex (2,4,5-TP)	herbicide	93-72-1	8151A	2	50	-	
4	App. II	2,4,5-Trichlorophenoxyacetic acid (2,4,5-T)	herbicide	93-76-5	8151A	2	-	-	
5	App. II	Pentachlorophenol	herbicide	87-86-5	8151 or 8270	25	0.3	-	

Notes:

Color denotes NC App. I Constituents

Color denotes remaining NC App. II Constituents

Color denotes C&D Constituents

Color denotes constituents that can be analyzed by more than one method

1. CAS RN: Chemical Abstracts Service Registry Number. Where 'Total' is entered, all species that contain the element are included.
2. Class: General type of compound
3. OP = orthophosphate
4. PAH = polynuclear aromatic hydrocarbon.
5. Volatile EQL of 1 ug/L is based on a 25-mL purge per SW-846, Final Update III, Revision 2, December 1996, page 8260B-35 (most recent revision to method 8260 in SW-846).
6. " - " = not available/not applicable
7. Referenced from North Carolina Dvision of Waste Management website (http://www.wastenotnc.org/sw/swenvmonitoringlist.asp)

APPENDIX VII-4

ENVIRONMENTAL MONITORING GUIDELINES AND MEMORANDUMS

Solid Waste Section
Guidelines for Groundwater, Soil, and Surface Water Sampling

STATE OF NORTH CAROLINA
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
DIVISION OF WASTE MANAGEMENT
SOLID WASTE SECTION

General Sampling Procedures

The following guidance is provided to insure a consistent sampling approach so that sample collection activities at solid waste management facilities provide reliable data. Sampling must begin with an evaluation of facility information, historical environmental data and site geologic and hydrogeologic conditions. General sampling procedures are described in this document.

Planning

Begin sampling activities with planning and coordination. The party contracting with the laboratory is responsible for effectively communicating reporting requirements and evaluating data reliability as it relates to specific monitoring activities.

Sample Collection

<u>Contamination Prevention</u>

a.) Take special effort to prevent cross contamination or environmental contamination when collecting samples.
    1. If possible, collect samples from the least contaminated sampling location (or background sampling location, if applicable) to the most contaminated sampling location.
    2. Collect the ambient or background samples first, and store them in separate ice chests or separate shipping containers within the same ice chest (e.g. untreated plastic bags).
    3. Collect samples in flowing water at designated locations from upstream to downstream.

b.) Do not store or ship highly contaminated samples (concentrated wastes, free product, etc.) or samples suspect of containing high concentrations of contaminants in the same ice chest or shipping containers with other environmental samples.
    1. Isolate these sample containers by sealing them in separate, untreated plastic bags immediately after collecting, preserving, labeling, etc.
    2. Use a clean, untreated plastic bag to line the ice chest or shipping container.

c.) All sampling equipment should be thoroughly decontaminated and transported in a manner that does not allow it to become contaminated. Arrangements should be made ahead of time to decontaminate any sampling or measuring equipment that will be reused when taking samples from more than one well. Field decontamination of

sampling equipment will be necessary before sampling each well to minimize the risk of cross contamination. Decontamination procedures should be included in reports as necessary. Certified pre-cleaned sampling equipment and containers may be used. When collecting aqueous samples, rinse the sample collection equipment with a portion of the sample water before taking the actual sample. Sample containers do not need to be rinsed. In the case of petroleum hydrocarbons, oil and grease, or containers with pre-measured preservatives, the sample containers cannot be rinsed.

d.) Place all fuel-powered equipment away from, and downwind of, any site activities (e.g., purging, sampling, decontamination).

1. If field conditions preclude such placement (i.e., the wind is from the upstream direction in a boat), place the fuel source(s) as far away as possible from the sampling activities and describe the conditions in the field notes.
2. Handle fuel (i.e., filling vehicles and equipment) prior to the sampling day. If such activities must be performed during sampling, the personnel must wear disposable gloves.
3. Dispense all fuels downwind. Dispose of gloves well away from the sampling activities.

<u>Filling Out Sample Labels</u>

Fill out label, adhere to vial and collect sample. Print legibly with indelible ink. At a minimum, the label or tag should identify the sample with the following information:

1. Sample location and/or well number
2. Sample identification number
3. Date and time of collection
4. Analysis required/requested
5. Sampler's initials
6. Preservative(s) used, if any [i.e., HCl, $Na_2S_2O_3$, NO_3, ice, etc.]
7. Any other pertinent information for sample identification

<u>Sample Collection Order</u>

Unless field conditions justify other sampling regimens, collect samples in the following order:

1. Volatile Organics and Volatile Inorganics
2. Extractable Organics, Petroleum Hydrocarbons, Aggregate Organics and Oil and Grease
3. Total Metals
4. Inorganic Nonmetallics, Physical and Aggregate Properties, and Biologicals
5. Microbiological

NOTE: *If the pump used to collect groundwater samples cannot be used to collect volatile or extractable organics then collect all other parameters and withdraw the pump and tubing. Then collect the volatile and extractable organics.*

Health and Safety

Implement all local, state, and federal requirements relating to health and safety. Follow all local, state and federal requirements pertaining to the storage and disposal of any hazardous or investigation derived wastes.

a.) The Solid Waste Section recommends wearing protective gloves when conducting all sampling activities.

1. Gloves serve to protect the sample collector from potential exposure to sample constituents, minimize accidental contamination of samples by the collector, and preserve accurate tare weights on preweighed sample containers.
2. Do not let gloves come into contact with the sample or with the interior or lip of the sample container. Use clean, new, unpowdered and disposable gloves. Various types of gloves may be used as long as the construction materials do not contaminate the sample or if internal safety protocols require greater protection.
3. Note that certain materials that may potentially be present in concentrated effluent can pass through certain glove types and be absorbed in the skin. Many vendor catalogs provide information about the permeability of different gloves and the circumstances under which the glove material might be applicable. The powder in powdered gloves can contribute significant contamination. Powdered gloves are not recommended unless it can be demonstrated that the powder does not interfere with the sample analysis.
4. Change gloves after preliminary activities, after collecting all the samples at a single sampling point, if torn or used to handle extremely dirty or highly contaminated surfaces. Properly dispose of all used gloves as investigation derived wastes.

b.) Properly manage all investigation derived waste (IDW).

5. To prevent contamination into previously uncontaminated areas, properly manage all IDW. This includes all water, soil, drilling mud, decontamination wastes, discarded personal protective equipment (PPE), etc. from site investigations, exploratory borings, piezometer and monitoring well installation, refurbishment, abandonment, and other investigative activities. Manage all IDW that is determined to be RCRA-regulated hazardous waste according to the local, state and federal requirements.
6. Properly dispose of IDW that is not a RCRA-regulated hazardous waste but is contaminated above the Department's Soil Cleanup Target Levels or the state standards and/or minimum criteria for ground water quality. If the drill cuttings/mud orpurged well water is contaminated with hazardous waste, contact the DWM Hazardous Waste Section (919-508-8400) for disposal options. Maintain all containers holding IDW in good condition. Periodically inspect the containers for damage and ensure that all required labeling (DOT, RCRA, etc.) are clearly visible.

Sample Storage and Transport

Store samples for transport carefully. Pack samples to prevent from breaking and to maintain a temperature of approximately 4 degrees Celsius (°C), adding ice if necessary. Transport samples to a North Carolina-certified laboratory as soon as possible. Avoid unnecessary handling of sample containers. Avoid heating (room temperature or above, including exposure to sunlight) or freezing of the sample containers. Reduce the time between sample collection and delivery to a laboratory whenever possible and be sure that the analytical holding times of your samples can be met by the laboratory.

a.) A complete chain-of-custody (COC) form must be maintained to document all transfers and receipts of the samples. Be sure that the sample containers are labeled with the sample location and/or well number, sample identification, the date and time of collection, the analysis to be performed, the preservative added (if any), the sampler's initials, and any other pertinent information for sample identification. The labels should contain a unique identifier (i.e., unique well numbers) that can be traced to the COC form. The details of sample collection must be documented on the COC. The COC must include the following:

1. Description of each sample (including QA/QC samples) and the number of containers (sample location and identification)
2. Signature of the sampler
3. Date and time of sample collection
4. Analytical method to be performed
5. Sample type (i.e., water or soil)
6. Regulatory agency (i.e., NCDENR/DWM – SW Section)
7. Signatures of all persons relinquishing and receiving custody of the samples
8. Dates and times of custody transfers

b.) Pack samples so that they are segregated by site, sampling location or by sample analysis type. When COC samples are involved, segregate samples in coolers by site. If samples from multiple sites will fit in one cooler, they may be packed in the same cooler with the associated field sheets and a single COC form for all. Coolers should not exceed a maximum weight of 50 lbs. Use additional coolers as necessary. All sample containers should be placed in plastic bags (segregated by analysis and location) and completely surrounded by ice.

1. Prepare and place trip blanks in an ice filled cooler before leaving for the field.
2. Segregate samples by analysis and place in sealable plastic bags.
3. Pack samples carefully in the cooler placing ice around the samples.
4. Review the COC. The COC form must accompany the samples to the laboratory. The trip blank(s) must also be recorded on the COC form.
5. Place completed COC form in a waterproof bag, sealed and taped under the lid of the cooler.
6. Secure shipping containers with strapping tape to avoid accidental opening.
7. For COC samples, a tamper-proof seal may also be placed over the cooler lid or over a bag or container containing the samples inside the shipping cooler.

8. "COC" or "EMERG" should be written in indelible ink on the cooler seal to alert sample receipt technicians to priority or special handling samples.
9. The date and sample handler's signature must also be written on the COC seal.
10. Deliver the samples to the laboratory or ship by commercial courier.
    NOTE*: If transport time to the laboratory is not long enough to allow samples to be cooled to 4° C, a temperature reading of the sample source must be documented as the field temperature on the COC form. A downward trend in temperature will be adequate even if cooling to 4° C is not achieved. The field temperature should always be documented if there is any question as to whether samples will have time to cool to 4° C during shipment. Thermometers must be calibrated annually against an NIST traceable thermometer and documentation must be retained.*

Appendix A - Decontamination of Field Equipment

Decontamination of personnel, sampling equipment, and containers - before and after sampling - must be used to ensure collection of representative samples and to prevent the potential spread of contamination. Decontamination of personnel prevents ingestion and absorption of contaminants. It must be done with a soap and water wash and deionized or distilled water rinse. Certified pre-cleaned sampling equipment and containers may also be used.

All previously used sampling equipment must be properly decontaminated before sampling and between sampling locations. This prevents the introduction of contamination into uncontaminated samples and avoids cross-contamination of samples. Cross-contamination can be a significant problem when attempting to characterize extremely low concentrations of organic compounds or when working with soils that are highly contaminated.

Clean, solvent-resistant gloves and appropriate protective equipment must be worn by persons decontaminating tools and equipment.

Cleaning Reagents

Recommendations for the types and grades of various cleaning supplies are outlined below. The recommended reagent types or grades were selected to ensure that the cleaned equipment is free from any detectable contamination.

a.) Detergents: Use Liqui-Nox (or a non-phosphate equivalent) or Alconox (or equivalent). Liqui-Nox (or equivalent) is recommended by EPA, although Alconox (or equivalent) may be substituted if the sampling equipment will not be used to collect phosphorus or phosphorus containing compounds.

b.) Solvents: Use pesticide grade isopropanol as the rinse solvent in routine equipment cleaning procedures. This grade of alcohol must be purchased from a laboratory supply vendor. Rubbing alcohol or other commonly available sources of isopropanol **are not acceptable**. Other solvents, such as acetone or methanol, may be used as the final rinse solvent if they are pesticide grade. However, methanol is more toxic to the environment and acetone may be an analyte of interest for volatile organics.

1. **Do not** use acetone if volatile organics are of interest
2. Containerize all methanol wastes (including rinses) and dispose as a hazardous waste.

Pre-clean equipment that is heavily contaminated with organic analytes. Use reagent grade acetone and hexane or other suitable solvents. Use pesticide grade methylene chloride when cleaning sample containers. Store all solvents away from potential sources of contamination.

c.) Analyte-Free Water Sources: Analyte-free water is water in which all analytes of interest and all interferences are below method detection limits. Maintain documentation (such as results from equipment blanks) to demonstrate the reliability and purity of analyte-free water source(s). The source of the water must meet the requirements of the analytical method and must be free from the analytes of interest. In general, the following water types are associated with specific analyte groups:

1. *Milli-Q (or equivalent polished water)*: suitable for all analyses.

2. *Organic-free*: suitable for volatile and extractable organics.
3. *Deionized water*: may not be suitable for volatile and extractable organics.
4. *Distilled water*: not suitable for volatile and extractable organics, metals or ultratrace metals.

Use analyte-free water for blank preparation and the final decontamination water rinse. In order to minimize long-term storage and potential leaching problems, obtain or purchase analyte-free water just prior to the sampling event. If obtained from a source (such as a laboratory), fill the transport containers and use the contents for a single sampling event. Empty the transport container(s) at the end of the sampling event. Discard any analyte-free water that is transferred to a dispensing container (such as a wash bottle or pump sprayer) at the end of each sampling day.

d.) Acids:

1. *Reagent Grade Nitric Acid*: 10 - 15% (one volume concentrated nitric acid and five volumes deionized water). Use for the acid rinse unless nitrogen components (e.g., nitrate, nitrite, etc.) are to be sampled. If sampling for ultra-trace levels of metals, use an ultra-pure grade acid.
2. *Reagent Grade Hydrochloric Acid*: 10% hydrochloric acid (one volume concentrated hydrochloric and three volumes deionized water). Use when nitrogen components are to be sampled.
3. If samples for both metals and the nitrogen-containing components are collected with the equipment, use the hydrochloric acid rinse, or thoroughly rinse with hydrochloric acid after a nitric acid rinse. If sampling for ultra trace levels of metals, use an ultra-pure grade acid.
4. Freshly prepared acid solutions may be recycled during the sampling event or cleaning process. Dispose of any unused acids according to local ordinances.

Reagent Storage Containers

The contents of all containers must be clearly marked.

a.) Detergents:

1. Store in the original container or in a HDPE or PP container.

b.) Solvents:

1. Store solvents to be used for cleaning or decontamination in the original container until use in the field. If transferred to another container for field use, use either a glass or Teflon container.
2. Use dispensing containers constructed of glass, Teflon or stainless steel. Note: If stainless steel sprayers are used, any gaskets that contact the solvents must be constructed of inert materials.

c.) Analyte-Free Water:

1. Transport in containers appropriate for the type of water stored. If the water is commercially purchased (e.g., grocery store), use the original containers when transporting the water to the field. Containers made of glass, Teflon, polypropylene or HDPE are acceptable.
2. Use glass or Teflon to transport organic-free sources of water on-site. Polypropylene or HDPE may be used, but are not recommended.

3. Dispense water from containers made of glass, Teflon, HDPE or polypropylene.
4. Do not store water in transport containers for more than three days before beginning a sampling event.
5. If working on a project that has oversight from EPA Region 4, use glass containers for the transport and storage of all water.
6. Store and dispense acids using containers made of glass, Teflon or plastic.

General Requirements

a.) Prior to use, clean/decontaminate all sampling equipment (pumps, tubing, lanyards, split spoons, etc.) that will be exposed to the sample.

b.) Before installing, clean (or obtain as certified pre-cleaned) all equipment that is dedicated to a single sampling point and remains in contact with the sample medium (e.g., permanently installed groundwater pump). If you use certified pre-cleaned equipment no cleaning is necessary.
   1. Clean this equipment any time it is removed for maintenance or repair.
   2. Replace dedicated tubing if discolored or damaged.

c.) Clean all equipment in a designated area having a controlled environment (house, laboratory, or base of field operations) and transport it to the field, pre-cleaned and ready to use, unless otherwise justified.

d.) Rinse all equipment with water after use, even if it is to be field-cleaned for other sites. Rinse equipment used at contaminated sites or used to collect in-process (e.g., untreated or partially treated wastewater) samples immediately with water.

e.) Whenever possible, transport sufficient clean equipment to the field so that an entire sampling event can be conducted without the need for cleaning equipment in the field.

f.) Segregate equipment that is only used once (i.e., not cleaned in the field) from clean equipment and return to the in-house cleaning facility to be cleaned in a controlled environment.

g.) Protect decontaminated field equipment from environmental contamination by securely wrapping and sealing with one of the following:
   1. Aluminum foil (commercial grade is acceptable)
   2. Untreated butcher paper
   3. Clean, untreated, disposable plastic bags. Plastic bags may be used for all analyte groups except volatile and extractable organics. Plastic bags may be used for volatile and extractable organics, if the equipment is first wrapped in foil or butcher paper, or if the equipment is completely dry.

Cleaning Sample Collection Equipment

a.) <u>On-Site/In-Field Cleaning</u> – Cleaning equipment on-site is not recommended because environmental conditions cannot be controlled and wastes (solvents and acids) must be containerized for proper disposal.
   1. Ambient temperature water may be substituted in the hot, sudsy water bath and hot water rinses.

NOTE: Properly dispose of all solvents and acids.

2. Rinse all equipment with water after use, even if it is to be field-cleaned for other sites.
3. Immediately rinse equipment used at contaminated sites or used to collect in-process (e.g., untreated or partially treated wastewater) samples with water.

b.) Heavily Contaminated Equipment - In order to avoid contaminating other samples, isolate heavily contaminated equipment from other equipment and thoroughly decontaminate the equipment before further use. Equipment is considered heavily contaminated if it:

1. Has been used to collect samples from a source known to contain significantly higher levels than background.
2. Has been used to collect free product.
3. Has been used to collect industrial products (e.g., pesticides or solvents) or their byproducts.

NOTE: *Cleaning heavily contaminated equipment in the field is not recommended.*

c.) On-Site Procedures:

1. Protect all other equipment, personnel and samples from exposure by isolating the equipment immediately after use.
2. At a minimum, place the equipment in a tightly sealed, untreated, plastic bag.
3. Do not store or ship the contaminated equipment next to clean, decontaminated equipment, unused sample containers, or filled sample containers.
4. Transport the equipment back to the base of operations for thorough decontamination.
5. If cleaning must occur in the field, document the effectiveness of the procedure, collect and analyze blanks on the cleaned equipment.

d.) Cleaning Procedures:

1. If organic contamination cannot be readily removed with scrubbing and a detergent solution, pre-rinse equipment by thoroughly rinsing or soaking the equipment in acetone.
2. Use hexane only if preceded and followed by acetone.
3. In extreme cases, it may be necessary to steam clean the field equipment before proceeding with routine cleaning procedures.
4. After the solvent rinses (and/or steam cleaning), use the appropriate cleaning procedure. Scrub, rather than soak, all equipment with sudsy water. If high levels of metals are suspected and the equipment cannot be cleaned without acid rinsing, soak the equipment in the appropriate acid. Since stainless steel equipment should not be exposed to acid rinses, do not use stainless steel equipment when heavy metal contamination is suspected or present.
5. If the field equipment cannot be cleaned utilizing these procedures, discard unless further cleaning with stronger solvents and/or oxidizing solutions is effective as evidenced by visual observation and blanks.
6. Clearly mark or disable all discarded equipment to discourage use.

e.) General Cleaning - Follow these procedures when cleaning equipment under controlled conditions. Check manufacturer's instructions for cleaning restrictions and/or recommendations.

1. *Procedure for Teflon, stainless steel and glass sampling equipment*: This procedure must be used when sampling for ALL analyte groups. (Extractable organics, metals, nutrients, etc. or if a single decontamination protocol is desired to clean all Teflon, stainless steel and glass equipment.) Rinse equipment with hot tap water. Soak equipment in a hot, sudsy water solution (Liqui-Nox or equivalent). If necessary, use a brush to remove particulate matter or surface film. Rinse thoroughly with hot tap water. If samples for trace metals or inorganic analytes will be collected with the equipment that is not stainless steel, thoroughly rinse (wet all surfaces) with the appropriate acid solution. Rinse thoroughly with analyte-free water. Make sure that all equipment surfaces are thoroughly flushed with water. If samples for volatile or extractable organics will be collected, rinse with isopropanol. Wet equipment surfaces thoroughly with free-flowing solvent. Rinse thoroughly with analyte-free water. Allow to air dry. Wrap and seal as soon as the equipment has air-dried. If isopropanol is used, the equipment may be air-dried without the final analyte-free water rinse; however, the equipment must be completely dry before wrapping or use. Wrap clean sampling equipment according to the procedure described above.
2. *General Cleaning Procedure for Plastic Sampling Equipment*: Rinse equipment with hot tap water. Soak equipment in a hot, sudsy water solution (Liqui-Nox or equivalent). If necessary, use a brush to remove particulate matter or surface film. Rinse thoroughly with hot tap water. Thoroughly rinse (wet all surfaces) with the appropriate acid solution. Check manufacturer's instructions for cleaning restrictions and/or recommendations. Rinse thoroughly with analyte-free water. Be sure that all equipment surfaces are thoroughly flushed. Allow to air dry as long as possible. Wrap clean sampling equipment according to the procedure described above.

Appendix B - Collecting Soil Samples

Soil samples are collected for a variety of purposes. A methodical sampling approach must be used to assure that sample collection activities provide reliable data. Sampling must begin with an evaluation of background information, historical data and site conditions.

Soil Field Screening Procedures

Field screening is the use of portable devices capable of detecting petroleum contaminants on a real-time basis or by a rapid field analytical technique. Field screening should be used to help assess locations where contamination is most likely to be present.

When possible, field-screening samples should be collected directly from the excavation or from the excavation equipment's bucket. If field screening is conducted only from the equipment's bucket, then a minimum of one field screening sample should be collected from each 10 cubic yards of excavated soil. If instruments or other observations indicate contamination, soil should be separated into stockpiles based on apparent degrees of contamination. At a minimum, soil suspected of contamination must be segregated from soil observed to be free of contamination.

a.) Field screening devices – Many field screen instruments are available for detecting contaminants in the field on a rapid or real-time basis. Acceptable field screening instruments must be suitable for the contaminant being screened. The procdedure for field screening using photoionization detectors (PIDs) and flame ionization detectors (FIDs) is described below. If other instruments are used, a description of the instrument or method and its intended use must be provided to the Solid Waste Section. Whichever field screening method is chosen, its accuracy must be verified throughout the sampling process. Use appropriate standards that match the use intended for the data. Unless the Solid Waste Section indicates otherwise, wherever field screening is recommended in this document, instrumental or analytical methods of detection must be used, not olfactory or visual screening methods.

b.) Headspace analytical screening procedure for filed screening (semi-quantitative field screening) - The most commonly used field instruments for Solid Waste Section site assessments are FIDs and PIDs. When using FIDs and PIDs, use the following headspace screening procedure to obtain and analyze field-screening samples:

1. Partially fill (one-third to one-half) a clean jar or clean ziplock bag with the sample to be analyzed. The total capacity of the jar or bag may not be less than eight ounces (app. 250 ml), but the container should not be so large as to allow vapor diffusion and stratification effects to significantly affect the sample.
2. If the sample is collected from a spilt-spoon, it must be transferred to the jar or bag for headspace analysis immediately after opening the split-spoon. If the sample is collected from an excavation or soil pile, it must be collected from freshly uncovered soil.

3. If a jar is used, it must be quickly covered with clean aluminum foil or a jar lid; screw tops or thick rubber bands must be used to tightly seal the jar. If a zip lock bag is used, it must be quickly sealed shut.
4. Headspace vapors must be allowed to develop in the container for at least 10 minutes but no longer than one hour. Containers must be shaken or agitated for 15 seconds at the beginning and the end of the headspace development period to assist volatilization. Temperatures of the headspace must be warmed to at least 5° C (approximately 40° F) with instruments calibrated for the temperature used.
5. After headspace development, the instrument sampling probe must be inserted to a point about one-half the headspace depth. The container opening must be minimized and care must be taken to avoid the uptake of water droplets and soil particulates.
6. After probe insertion, the highest meter reading must be taken and recorded. This will normally occur between two and five seconds after probe insertion. If erratic meter response occurs at high organic vapor concentrations or conditions of elevated headspace moisture, a note to that effect must accompany the headspace data.
7. All field screening results must be documented in the field record or log book.

Soil Sample Collection Procedures for Laboratory Samples

The number and type of laboratory samples collected depends on the purpose of the sampling activity. Samples analyzed with field screening devices may not be substituted for required laboratory samples.

a.) General Sample Collection - When collecting samples from potentially contaminated soil, care should be taken to reduce contact with skin or other parts of the body. Disposable gloves should be worn by the sample collector and should be changed between samples to avoid cross-contamination. Soil samples should be collected in a manner that causes the least disturbance to the internal structure of the sample and reduces its exposure to heat, sunlight and open air. Likewise, care should be taken to keep the samples from being contaminated by other materials or other samples collected at the site. When sampling is to occur over an extended period of time, it is necessary to insure that the samples are collected in a comparable manner. All samples must be collected with disposable or clean tools that have been decontaminated. Disposable gloves must be worn and changed between sample collections. Sample containers must be filled quickly. Soil samples must be placed in containers in the order of volatility, for example, volatile organic aromatic samples must be taken first, organics next, then heavier range organics, and finally soil classification samples. Containers must be quickly and adequately sealed, and rims must be cleaned before tightening lids. Tape may be used only if known not to affect sample analysis. Sample containers must be clearly labeled. Containers must immediately be preserved according to procedures in this Section. Unless specified

otherwise, at a minimum, the samples must be immediately cooled to 4 ± 2°C and this temperature must be maintained throughout delivery to the laboratory.

b.) Surface Soil Sampling - Surface soil is generally classified as soil between the ground surface and 6-12 inches below ground surface. Remove leaves, grass and surface debris from the area to be sampled. Select an appropriate, pre-cleaned sampling device and collect the sample. Transfer the sample to the appropriate sample container. Clean the outside of the sample container to remove excess soil. Label the sample container, place on wet ice to preserve at 4°C, and complete the field notes.

c.) Subsurface Soil Sampling – The interval begins at approximately 12 inches below ground surface. Collect samples for volatile organic analyses. For other analyses, select an appropriate, pre-cleaned sampling device and collect the sample. Transfer the sample to the appropriate sample container. Clean the outside of the sample container to remove excess soil. Label the sample container, place on wet ice to preserve at 4°C, and complete field notes.

d.) Equipment for Reaching the Appropriate Soil Sampling Depth - Samples may be collected using a hollow stem soil auger, direct push, Shelby tube, split-spoon sampler, or core barrel. These sampling devices may be used as long as an effort is made to reduce the loss of contaminants through volatilization. In these situations, obtain a sufficient volume of so the samples can be collected without volatilization and disturbance to the internal structure of the samples. Samples should be collected from cores of the soil. Non-disposable sampling equipment must be decontaminated between each sample location. **NOTE:** *If a confining layer has been breached during sampling, grout the hole to land.*

e.) Equipment to Collect Soil Samples - Equipment and materials that may be used to collect soil samples include disposable plastic syringes and other “industry-standard” equipment and materials that are contaminant-free. Non-disposable sampling equipment must be decontaminated between each sample location.

Appendix C - Collecting Groundwater Samples

Groundwater samples are collected to identify, investigate, assess and monitor the concentration of dissolved contaminant constituents. To properly assess groundwater contamination, first install sampling points (monitoring wells, etc.) to collect groundwater samples and then perform specific laboratory analyses. All monitoring wells should be constructed in accordance with 15A NCAC 2C .0100 and sampled as outlined in this section. Groundwater monitoring is conducted using one of two methods:

1. Portable Monitoring: Monitoring that is conducted using sampling equipment that is discarded between sampling locations. Equipment used to collect a groundwater sample from a well such as bailers, tubing, gloves, and etc. are disposed of after sample collection. A new set of sampling equipment is used to collect a groundwater sample at the next monitor well.

2. Dedicated Monitoring: Monitoring that utilizes permanently affixed down-well and well head components that are capped after initial set-up. Most dedicated monitoring systems are comprised of an in-well submersible bladder pump, with air supply and sample discharge tubing, and an above-ground driver/controller for regulation of flow rates and volumes. The pump and all tubing housed within the well should be composed of Teflon or stainless steel components. This includes seals inside the pump, the pump body, and fittings used to connect tubing to the pump. Because ground water will not be in contact with incompatible constituents and because the well is sealed from the surface, virtually no contamination is possible from intrinsic sources during sampling and between sampling intervals. All dedicated monitoring systems must be approved by the Solid Waste Section before installation.

Groundwater samples may be collected from a number of different configurations. Each configuration is associated with a unique set of sampling equipment requirements and techniques:

1. Wells without Plumbing: These wells require equipment to be brought to the well to purge and sample unless dedicated equipment is placed in the well.

2. Wells with In-Place Plumbing: Wells with in-place plumbing do not require equipment to be brought to the well to purge and sample. In-place plumbing is generally considered permanent equipment routinely used for purposes other than purging and sampling, such as for water supply.

3. Air Strippers or Remedial Systems: These types of systems are installed as remediation devices.

Groundwater Sample Preparation

The type of sample containers used depends on the type of analysis performed. First, determine the type(s) of contaminants expected and the proper analytical method(s). Be sure to consult your selected laboratory for its specific needs and requirements prior to sampling.

Next, prepare the storage and transport containers (ice chest, etc.) before taking any samples so that each sample can be placed in a chilled environment immediately after collection.

Use groundwater purging and sampling equipment constructed of only non-reactive, non-leachable materials that are compatible with the environment and the selected analytes. In selecting groundwater purging and sampling equipment, give consideration to the depth of the well, the depth to groundwater, the volume of water to be evacuated, the sampling and purging technique, and the analytes of interest. Additional supplies, such as reagents and preservatives, may be necessary.

All sampling equipment (bailers, tubing, containers, etc.) must be selected based on its chemical compatibility with the source being sampled (e.g., water supply well, monitoring well) and the contaminants potentially present.

a.) Pumps - All pumps or pump tubing must be lowered and retrieved from the well slowly and carefully to minimize disturbance to the formation water. This is especially critical at the air/water interface.

1. *Above-Ground Pumps*
   - Variable Speed Peristaltic Pump: Use a variable speed peristaltic pump to purge groundwater from wells when the static water level in the well is no greater than 20- 25 feet below land surface (BLS). If the water levels are deeper than 18-20 feet BLS, the pumping velocity will decrease. A variable speed peristaltic pump can be used for normal purging and sampling, and sampling low permeability aquifers or formations. Most analyte groups can be sampled with a peristaltic pump if the tubing and pump configurations are appropriate.
   - Variable Speed Centrifugal Pump: A variable speed centrifugal pump can be used to purge groundwater from 2-inch and larger internal diameter wells. **Do not use** this type of pump to collect groundwater samples. When purging is complete, do not allow the water that remains in the tubing to fall back into the well. Install a check valve at the end of the purge tubing.
2. *Submersible Pumps*
   - Variable Speed Electric Submersible Pump: A variable speed submersible pump can be used to purge and sample groundwater from 2-inch and larger internal diameter wells. A variable speed submersible pump can be used for normal purging and sampling, and sampling low permeability aquifers or formations. The pump housing, fittings, check valves and associated hardware must be constructed of stainless steel. All other materials must be

compatible with the analytes of interest. Install a check valve at the output side of the pump to prevent backflow. If purging **and** sampling for organics, the entire length of the delivery tube must be Teflon, polyethylene or polypropylene (PP) tubing; the electrical cord must be sealed in Teflon, polyethylene or PP and any cabling must be sealed in Teflon, polyethylene or PP, or be constructed of stainless steel; and all interior components that contact the sample water (impeller, seals, gaskets, etc.) must be constructed of stainless steel or Teflon.

3. *Variable Speed Bladder Pump*: A variable speed, positive displacement, bladder pump can be used to purge and sample groundwater from 3/4-inch and larger internal diameter wells.
    - A variable speed bladder pump can be used for normal purging and sampling, and sampling low permeability aquifers or formations.
    - The bladder pump system is composed of the pump, the compressed air tubing, the water discharge tubing, the controller and a compressor, or a compressed gas supply.
    - The pump consists of a bladder and an exterior casing or pump body that surrounds the bladder and two (2) check valves. These parts can be composed of various materials, usually combinations of polyvinyl chloride (PVC), Teflon, polyethylene, PP and stainless steel. Other materials must be compatible with the analytes of interest.
    - If purging and sampling for organics, the pump body must be constructed of stainless steel. The valves and bladder must be Teflon, polyethylene or PP; the entire length of the delivery tube must be Teflon, polyethylene or PP; and any cabling must be sealed in Teflon, polyethylene or PP, or be constructed of stainless steel.
    - Permanently installed pumps may have a PVC pump body as long as the pump remains in contact with the water in the well.

b.) <u>Bailers</u>

1. *Purging*: Bailers must be used with caution because improper bailing can cause changes in the chemistry of the water due to aeration and loosening particulate matter in the space around the well screen. Use a bailer if there is non-aqueous phase liquid (free product) in the well or if non-aqueous phase liquid is suspected to be in the well.
2. *Sampling*: Bailers must be used with caution.
3. *Construction and Type*: Bailers must be constructed of materials compatible with the analytes of interest. Stainless steel, Teflon, rigid medical grade PVC, polyethylene and PP bailers may be used to sample all analytes. Use disposable bailers when sampling grossly contaminated sample sources. NCDENR recommends using dual check valve bailers when collecting samples. Use bailers with a controlled flow bottom to collect volatile organic samples.

4. *Contamination Prevention*: Keep the bailer wrapped (foil, butcher paper, etc.) until just before use. Use protective gloves to handle the bailer once it is removed from its wrapping. Handle the bailer by the lanyard to minimize contact with the bailer surface.

c.) Lanyards

1. Lanyards must be made of non-reactive, non-leachable material. They may be cotton twine, nylon, stainless steel, or may be coated with Teflon, polyethylene or PP.
2. Discard cotton twine, nylon, and non-stainless steel braided lanyards after sampling each monitoring well.
3. Decontaminate stainless steel, coated Teflon, polyethylene and PP lanyards between monitoring wells. They do not need to be decontaminated between purging and sampling operations.

Water Level and Purge Volume Determination

The amount of water that must be purged from a well is determined by the volume of water and/or field parameter stabilization.

a.) General Equipment Considerations - Selection of appropriate purging equipment depends on the analytes of interest, the well diameter, transmissivity of the aquifer, the depth to groundwater, and other site conditions.

1. Use of a pump to purge the well is recommended unless no other equipment can be used or there is non-aqueous phase liquid in the well, or non-aqueous phase liquid is suspected to be in the well.
2. Bailers must be used with caution because improper bailing:
    - Introduces atmospheric oxygen, which may precipitate metals (i.e., iron) or cause other changes in the chemistry of the water in the sample (i.e., pH).
    - Agitates groundwater, which may bias volatile and semi-volatile organic analyses due to volatilization.
    - Agitates the water in the aquifer and resuspends fine particulate matter.
    - Surges the well, loosening particulate matter in the annular space around the well screen.
    - May introduce dirt into the water column if the sides of the casing wall are scraped.

NOTE: *It is critical for bailers to be slowly and gently immersed into the top of the water column, particularly during the final stages of purging. This minimizes turbidity and disturbance of volatile organic constituents.*

b.) Initial Inspection

1. Remove the well cover and remove all standing water around the top of the well casing (manhole) before opening the well.
2. Inspect the exterior protective casing of the monitoring well for damage. Document the results of the inspection if there is a problem.
3. It is recommended that you place a protective covering around the well head. Replace the covering if it becomes soiled or ripped.

4. Inspect the well lock and determine whether the cap fits tightly. Replace the cap if necessary.

c.) Water Level Measurements - Use an electronic probe or chalked tape to determine the water level. Decontaminate all equipment before use. Measure the depth to groundwater from the top of the well casing to the nearest 0.01 foot. Always measure from the same reference point or survey mark on the well casing. Record the measurement.

1. *Electronic Probe*: Decontaminate all equipment before use. Follow the manufacturer's instructions for use. Record the measurement.
2. *Chalked Line Method*: Decontaminate all equipment before use. Lower chalked tape into the well until the lower end is in the water. This is usually determined by the sound of the weight hitting the water. Record the length of the tape relative to the reference point. Remove the tape and note the length of the wetted portion. Record the length. Determine the depth to water by subtracting the length of the wetted portion from the total length. Record the result.

d.) Water Column Determination - To determine the length of the water column, subtract the depth to the top of the water column from the total well depth (or gauged well depth if silting has occurred). The total well depth depends on the well construction. If gauged well depth is used due to silting, report total well depth also. Some wells may be drilled in areas of sinkhole, karst formations or rock leaving an open borehole. Attempt to find the total borehole depth in cases where there is an open borehole below the cased portion.

e.) Well Water Volume - Calculate the total volume of water, in gallons, in the well using the following equation:

$$V = (0.041)d \times d \times h$$

Where:

V = volume in gallons
d = well diameter in inches
h = height of the water column in feet

The total volume of water in the well may also be determined with the following equation by using a casing volume per foot factor (Gallons per Foot of Water) for the appropriate diameter well:

$$V = [\text{Gallons per Foot of Water}] \times h$$

Where:

V = volume in gallons
h = height of the water column in feet

Record all measurements and calculations in the field records.

f.) Purging Equipment Volume - Calculate the total volume of the pump, associated tubing and flow cell (if used), using the following equation:

$$V = p + ((0.041)d \times d \times l) + fc$$

Where:

V = volume in gallons
p = volume of pump in gallons
d = tubing diameter in inches
l = length of tubing in feet

fc = volume of flow cell in gallons

g.) If the groundwater elevation data are to be used to construct groundwater elevation contour maps, all water level measurements must be taken within the same 24 hour time interval when collecting samples from multiple wells on a site, unless a shorter time period is required. If the site is tidally influenced, complete the water level measurements within the time frame of an incoming or outgoing tide.

Well Purging Techniques

The selection of the purging technique and equipment is dependent on the hydrogeologic properties of the aquifer, especially depth to groundwater and hydraulic conductivity.

a.) Measuring the Purge Volume - The volume of water that is removed during purging must be recorded. Therefore, you must measure the volume during the purging operation.

1. Collect the water in a graduated container and multiply the number of times the container was emptied by the volume of the container, OR
2. Estimate the volume based on pumping rate. This technique may be used only if the pumping rate is constant. Determine the pumping rate by measuring the amount of water that is pumped for a fixed period of time, or use a flow meter.
    - Calculate the amount of water that is discharged per minute: D = Measured Amount/Total Time In Minutes
    - Calculate the time needed to purge one (1) well volume or one (1) purging equipment volume: Time = V/D
      Where: V = well volume or purging equipment volume
      D = discharge rate
    - Make new measurements each time the pumping rate is changed.
3. Use a totalizing flow meter.
    - Record the reading on the totalizer prior to purging.
    - Record the reading on the totalizer at the end of purging.
    - To obtain the volume purged, subtract the reading on the totalizer prior to purging from the reading on the totalizer at the end of purging.
    - Record the times that purging begins and ends in the field records.

b.) Purging Measurement Frequency - When purging a well that has the well screen fully submerged and the pump or intake tubing is placed within the well casing above the well screen or open hole, purge a minimum of one (1) well volume prior to collecting measurements of the field parameters. Allow at least one quarter (1/4) well volume to purge between subsequent measurements. When purging a well that has the pump or intake tubing placed within a fully submerged well screen or open hole, purge until the water level has stabilized (well recovery rate equals the purge rate), then purge a minimum of one (1) volume of the pump, associated tubing and flow cell (if used) prior to collecting measurements of the field parameters. Take measurements of the field parameters no sooner than two (2) to three (3) minutes apart. Purge at least

three (3) volumes of the pump, associated tubing and flow cell, if used, prior to collecting a sample. When purging a well that has a partially submerged well screen, purge a minimum of one (1) well volume prior to collecting measurements of the field parameters. Take measurements of the field parameters no sooner than two (2) to three (3) minutes apart.

c.) Purging Completion - Wells must be adequately purged prior to sample collection to ensure representation of the aquifer formation water, rather than stagnant well water. This may be achieved by purging three volumes from the well or by satisfying any one of the following three purge completion criteria:

1.) Three (3) consecutive measurements in which the three (3) parameters listed below are within the stated limits, dissolved oxygen is no greater than 20 percent of saturation at the field measured temperature, and turbidity is no greater than 20 Nephelometric Turbidity Units (NTUs).

- Temperature: + 0.2° C
- pH: + 0.2 Standard Units
- Specific Conductance: + 5.0% of reading

Document and report the following, as applicable. The last four items only need to be submitted once:

- Purging rate.
- Drawdown in the well, if any.
- A description of the process and the data used to design the well.
- The equipment and procedure used to install the well.
- The well development procedure.
- Pertinent lithologic or hydrogeologic information.

2.) If it is impossible to get dissolved oxygen at or below 20 percent of saturation at the field measured temperature or turbidity at or below 20 NTUs, then three (3) consecutive measurements of temperature, pH, specific conductance and the parameter(s) dissolved oxygen and/or turbidity that do not meet the requirements above must be within the limits below. The measurements are:

- Temperature: + 0.2° C
- pH: + 0.2 Standard Units
- Specific Conductance: + 5.0% of reading
- Dissolved Oxygen: + 0.2 mg/L or 10%, whichever is greater
- Turbidity: + 5 NTUs or 10%, whichever is greater

Additionally, document and report the following, as applicable, except that the last four(4) items only need to be submitted once:

- Purging rate.
- Drawdown in the well, if any.
- A description of conditions at the site that may cause the dissolved oxygen to be high and/or dissolved oxygen measurements made within the screened or open hole portion of the well with a downhole dissolved oxygen probe.

- A description of conditions at the site that may cause the turbidity to be high and any procedures that will be used to minimize turbidity in the future.
- A description of the process and the data used to design the well.
- The equipment and procedure used to install the well.
- The well development procedure.
- Pertinent lithologic or hydrogeologic information.

3.) If after five (5) well volumes, three (3) consecutive measurements of the field parameters temperature, pH, specific conductance, dissolved oxygen, and turbidity are not within the limits stated above, check the instrument condition and calibration, purging flow rate and all tubing connections to determine if they might be affecting the ability to achieve stable measurements. It is at the discretion of the consultant/contractor whether or not to collect a sample or to continue purging. Further, the report in which the data are submitted must include the following, as applicable. The last four (4) items only need to be submitted once.

- Purging rate.
- Drawdown in the well, if any.
- A description of conditions at the site that may cause the Dissolved Oxygen to be high and/or Dissolved Oxygen measurements made within the screened or open hole portion of the well with a downhole dissolved oxygen probe.
- A description of conditions at the site that may cause the turbidity to be high and any procedures that will be used to minimize turbidity in the future.
- A description of the process and the data used to design the well.
- The equipment and procedure used to install the well.
- The well development procedure.
- Pertinent lithologic or hydrogeologic information.

If wells have previously and consistently purged dry, and the current depth to groundwater indicates that the well will purge dry during the current sampling event, minimize the amount of water removed from the well by using the same pump to purge and collect the sample:

- Place the pump or tubing intake within the well screened interval.
- Use very small diameter Teflon, polyethylene or PP tubing and the smallest possible pump chamber volume. This will minimize the total volume of water pumped from the well and reduce drawdown.
- Select tubing that is thick enough to minimize oxygen transfer through the tubing walls while pumping.

- Pump at the lowest possible rate (100 mL/minute or less) to reduce drawdown to a minimum.
- Purge at least two (2) volumes of the pumping system (pump, tubing and flow cell, if used).
- Measure pH, specific conductance, temperature, dissolved oxygen and turbidity, then begin to collect the samples.

Collect samples immediately after purging is complete. The time period between completing the purge and sampling cannot exceed six hours. If sample collection does not occur within one hour of purging completion, re-measure the five field parameters: temperature, pH, specific conductance, dissolved oxygen and turbidity, just prior to collecting the sample. If the measured values are not within 10 percent of the previous measurements, re-purge the well. The exception is "dry" wells.

d.) Lanyards

1. Securely fasten lanyards, if used, to any downhole equipment (bailers, pumps, etc.).
2. Use bailer lanyards in such a way that they do not touch the ground surface.

Wells Without Plumbing

a.) Tubing/Pump Placement

1. If attempting to minimize the volume of purge water, position the intake hose or pump at the midpoint of the screened or open hole interval.
2. If monitoring well conditions do not allow minimizing of the purge water volume, position the pump or intake hose near the top of the water column. This will ensure that all stagnant water in the casing is removed.
3. If the well screen or borehole is partially submerged, and the pump will be used for both purging and sampling, position the pump midway between the measured water level and the bottom of the screen. Otherwise, position the pump or intake hose near the top of the water column.

b.) Non-dedicated (portable) pumps

1. *Variable Speed Peristaltic Pump*
    - Wear sampling gloves to position the decontaminated pump and tubing.
    - Attach a short section of tubing to the discharge side of the pump and into a graduated container.
    - Attach one end of a length of new or precleaned tubing to the pump head flexible hose.
    - Place the tubing as described in one of the options listed above.
    - Change gloves before beginning to purge.
    - Measure the depth to groundwater at frequent intervals.
    - Record these measurements.
    - Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.

- If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdrawal rate with the recharge rate.
- If the water table continues to drop during pumping, lower the tubing at the approximate rate of drawdown so that water is removed from the top of the water column.
- Record the purging rate each time the rate changes.
- Measure the purge volume.
- Record this measurement.
- Decontaminate the pump and tubing between wells (see Appendix C) or if precleaned tubing is used for each well, only the pump.

2. *Variable Speed Centrifugal Pump*
    - Position fuel powered equipment downwind and at least 10 feet from the well head. Make sure that the exhaust faces downwind.
    - Wear sampling gloves to position the decontaminated pump and tubing.
    - Place the decontaminated suction hose so that water is always pumped from the top of the water column.
    - Change gloves before beginning to purge.
    - Equip the suction hose with a foot valve to prevent purge water from re-entering the well.
    - Measure the depth to groundwater at frequent intervals.
    - Record these measurements.
    - To minimize drawdown, adjust the purging rate so that it is equivalent to the well recovery rate.
    - If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdrawal rate with the recharge rate.
    - If the water table continues to drop during pumping, lower the tubing at the approximate rate of drawdown so that the water is removed from the top of the water column.
    - Record the purging rate each time the rate changes.
    - Measure the purge volume.
    - Record this measurement.
    - Decontaminate the pump and tubing between wells or if precleaned tubing is used for each well, only the pump.
3. *Variable Speed Electric Submersible Pump*
    - Position fuel powered equipment downwind and at least 10 feet from the well head. Make sure that the exhaust faces downwind.
    - Wear sampling gloves to position the decontaminated pump and tubing.
    - Carefully position the decontaminated pump.

- Change gloves before beginning to purge.
- Measure the depth to groundwater at frequent intervals.
- Record these measurements.
- To minimize drawdown, adjust the purging rate so that it is equivalent to the well recovery rate.
- If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdrawal rate with the recharge rate.
- If the water table continues to drop during pumping, lower the tubing or pump at the approximate rate of drawdown so that water is removed from the top of the water column.
- Record the purging rate each time the rate changes.
- Measure the purge volume.
- Record this measurement.
- Decontaminate the pump and tubing between wells or only the pump if precleaned tubing is used for each well.

4. *Variable Speed Bladder Pump*

- Position fuel powered equipment downwind and at least 10 feet from the well head. Make sure that the exhaust faces downwind.
- Wear sampling gloves to position the decontaminated pump and tubing.
- Attach the tubing and carefully position the pump.
- Change gloves before beginning purging.
- Measure the depth to groundwater at frequent intervals.
- Record these measurements.
- To minimize drawdown, adjust the purging rate so that it is equivalent to the well recovery rate.
- If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdrawal rate with the recharge rate.
- If the water table continues to drop during pumping, lower the tubing or pump at the approximate rate of drawdown so that water is removed from the top of the water column.
- Record the purging rate each time the rate changes.
- Measure the purge volume.
- Record this measurement.
- Decontaminate the pump and tubing between wells or if precleaned tubing is used for each well, only the pump.

c.) <u>Dedicated Portable Pumps</u>

1. *Variable Speed Electric Submersible Pump*

- Position fuel powered equipment downwind and at least 10 feet from the well head. Make sure that the exhaust faces downwind.
- Wear sampling gloves.

- Measure the depth to groundwater at frequent intervals.
- Record these measurements.
- Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.
- If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdraw with the recharge rate.
- Record the purging rate each time the rate changes.
- Measure the purge volume.
- Record this measurement.

2. *Variable Speed Bladder Pump*
    - Position fuel powered equipment downwind and at least 10 feet from the well head. Make sure that the exhaust faces downwind.
    - Wear sampling gloves.
    - Measure the depth to groundwater at frequent intervals.
    - Record these measurements.
    - Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.
    - If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdraw with the recharge rate.
    - Record the purging rate each time the rate changes.
    - Measure the purge volume.
    - Record this measurement.
3. *Bailers* - Using bailers for purging is not recommended unless care is taken to use proper bailing technique, or if free product is present in the well or suspected to be in the well.
    - Minimize handling the bailer as much as possible.
    - Wear sampling gloves.
    - Remove the bailer from its protective wrapping just before use.
    - Attach a lanyard of appropriate material.
    - Use the lanyard to move and position the bailer.
    - Lower and retrieve the bailer slowly and smoothly.
    - Lower the bailer carefully into the well to a depth approximately a foot above the water column.
    - When the bailer is in position, lower the bailer into the water column at a rate of 2 cm/sec until the desired depth is reached.
    - Do not lower the top of the bailer more than one (1) foot below the top of the water table so that water is removed from the top of the water column.
    - Allow time for the bailer to fill with aquifer water as it descends into the water column.

- Carefully raise the bailer. Retrieve the bailer at the same rate of 2 cm/sec until the bottom of the bailer has cleared to top of the water column.
- Measure the purge volume.
- Record the volume of the bailer.
- Continue to carefully lower and retrieve the bailer as described above until the purging is considered complete, based on either the removal of 3 well volumes.
- Remove at least one (1) well volume before collecting measurements of the field parameters. Take each subsequent set of measurements after removing at least one quarter (1/4) well volume between measurements.

Groundwater Sampling Techniques

a.) Purge wells.

b.) Replace protective covering around the well if it is soiled or torn after completing purging operations.

c.) Equipment Considerations

1. The following pumps are approved to collect volatile organic samples:
    - Stainless steel and Teflon variable speed submersible pumps
    - Stainless steel and Teflon or polyethylene variable speed bladder pumps
    - Permanently installed PVC bodied pumps (As long as the pump remains in contact with the water in the well at all times)
2. Collect sample from the sampling device and store in sample container. Do not use intermediate containers.
3. To avoid contamination or loss of analytes from the sample, handle sampling equipment as little as possible and minimize equipment exposure to the sample.
4. To reduce chances of cross-contamination, use dedicated equipment whenever possible. "Dedicated" is defined as equipment that is to be used solely for one location for the life of that equipment (e.g., permanently mounted pump). Purchase dedicated equipment with the most sensitive analyte of interest in mind.
    - Clean or make sure dedicated pumps are clean before installation. They do not need to be cleaned prior to each use, but must be cleaned if they are withdrawn for repair or servicing.
    - Clean or make sure any permanently mounted tubing is clean before installation.
    - Change or clean tubing when the pump is withdrawn for servicing.
    - Clean any replaceable or temporary parts.

- Collect equipment blanks on dedicated pumping systems when the tubing is cleaned or replaced.
- Clean or make sure dedicated bailers are clean before placing them into the well.
- Collect an equipment blank on dedicated bailers before introducing them into the water column.
- Suspend dedicated bailers above the water column if they are stored in the well.

Sampling Wells Without Plumbing

a.) Sampling with Pumps – The following pumps may be used to sample for organics:

- Peristaltic pumps
- Stainless steel, Teflon or polyethylene bladder pumps
- Variable speed stainless steel and Tefloṇ submersible pumps

1. *Peristaltic Pump*

- Volatile Organics: One of three methods may be used.
  - Remove the drop tubing from the inlet side of the pump; submerge the drop tubing into the water column; prevent the water in the tubing from flowing back into the well; remove the drop tubing from the well; carefully allow the groundwater to drain into the sample vials; avoid turbulence; do not aerate the sample; repeat steps until enough vials are filled. OR
  - Use the pump to fill the drop tubing; quickly remove the tubing from the pump; prevent the water in the tubing from flowing back into the well; remove the drop tubing from the well; carefully allow the groundwater to drain into the sample vials; avoid turbulence; do not aerate the sample; repeat steps until enough vials are filled. OR
  - Use the pump to fill the drop tubing; withdraw the tubing from the well; reverse the flow on the peristaltic pumps to deliver the sample into the vials at a slow, steady rate; repeat steps until enough vials are filled.
- Extractable Organics: If delivery tubing is not polyethylene or PP, or is not Teflon lined, use pump and vacuum trap method. Connect the outflow tubing from the container to the influent side of the peristaltic pump. Turn pump on and reduce flow until smooth and even. Discard a

small portion of the sample to allow for air space. Preserve (if required), label, and complete field notes.

- Inorganic samples: These samples may be collected from the effluent tubing. If samples are collected from the pump, decontaminate all tubing (including the tubing in the head) or change it between wells. Preserve (if required), label, and complete field notes.

2. *Variable Speed Bladder Pump*
    - If sampling for organics, the pump body must be constructed of stainless steel and the valves and bladder must be Teflon. All tubing must be Teflon, polyethylene, or PP and any cabling must be sealed in Teflon, polyethylene or PP, or made of stainless steel.
    - After purging to a smooth even flow, reduce the flow rate.
    - When sampling for volatile organic compounds, reduce the flow rate to 100-200mL/minute, if possible.
3. *Variable Speed Submersible Pump*
    - The housing must be stainless steel.
    - If sampling for organics, the internal impellers, seals and gaskets must be constructed of stainless steel, Teflon, polyethylene or PP. The delivery tubing must be Teflon, polyethylene or PP; the electrical cord must be sealed in Teflon; any cabling must be sealed in Teflon or constructed of stainless steel.
    - After purging to a smooth even flow, reduce the flow rate.
    - When sampling for volatile organic compounds, reduce the flow rate to 100-200mL/minute, if possible.

b.) Sampling with Bailers - A high degree of skill and coordination are necessary to collect representative samples with a bailer.

1. *General Considerations*
    - Minimize handling of bailer as much as possible.
    - Wear sampling gloves.
    - Remove bailer from protective wrapping just before use.
    - Attach a lanyard of appropriate material.
    - Use the lanyard to move and position the bailers.
    - Do not allow bailer or lanyard to touch the ground.
    - If bailer is certified precleaned, no rinsing is necessary.
    - If both a pump and a bailer are to be used to collect samples, rinse the exterior and interior of the bailer with sample water from the pump before removing the pump.
    - If the purge pump is not appropriate for collecting samples (e.g., non-inert components), rinse the bailer by collecting a single bailer of the groundwater to be sampled.
    - Discard the water appropriately.

- Do not rinse the bailer if Oil and Grease samples are to be collected.

2. *Bailing Technique*
    - Collect all samples that are required to be collected with a pump before collecting samples with the bailer.
    - Raise and lower the bailer gently to minimize stirring up particulate matter in the well and the water column, which can increase sample turbidity.
    - Lower the bailer carefully into the well to a depth approximately a foot above the water column. When the bailer is in position, lower the bailer into the water column at a rate of 2 cm/sec until the desired depth is reached.
    - Do not lower the top of the bailer more than one foot below the top of the water table, so that water is removed from the top of the water column.
    - Allow time for the bailer to fill with aquifer water as it descends into the water column.
    - Do not allow the bailer to touch the bottom of the well or particulate matter will be incorporated into the sample. Carefully raise the bailer. Retrieve the bailer at the same rate of 2 cm/sec until the bottom of the bailer has cleared to top of the water column.
    - Lower the bailer to approximately the same depth each time.
    - Collect the sample. Install a device to control the flow from the bottom of the bailer and discard the first few inches of water. Fill the appropriate sample containers by allowing the sample to slowly flow down the side of the container. Discard the last few inches of water in the bailer.
    - Repeat steps for additional samples.
    - As a final step measure the DO, pH, temperature, turbidity and specific conductance after the final sample has been collected. Record all measurements and note the time that sampling was completed.

c.) <u>Sampling Low Permeability Aquifers or Wells that have Purged Dry</u>

1. Collect the sample(s) after the well has been purged. Minimize the amount of water removed from the well by using the same pump to purge and collect the sample. If the well has purged dry, collect samples as soon as sufficient sample water is available.
2. Measure the five field parameters temperature, pH, specific conductance, dissolved oxygen and turbidity at the time of sample collection.
3. Advise the analytical laboratory and the client that the usual amount of sample for analysis may not be available.

Appendix D - Collecting Samples from Wells with Plumbing in Place

In-place plumbing is generally considered permanent equipment routinely used for purposes other than purging and sampling, such as for water supply.

a.) Air Strippers or Remedial Systems - These types of systems are installed as remediation devices. Collect influent and effluent samples from air stripping units as described below.

1. Remove any tubing from the sampling port and flush for one to two minutes.
2. Remove all hoses, aerators and filters (if possible).
3. Open the spigot and purge sufficient volume to flush the spigot and lines and until the purging completion criteria have been met.
4. Reduce the flow rate to approximately 500 mL/minute (a 1/8" stream) or approximately 0.1 gal/minute before collecting samples.
5. Follow procedures for collecting samples from water supply wells as outlined below.

b.) Water Supply Wells – Water supply wells with in-place plumbing do not require equipment to be brought to the well to purge and sample. Water supply wells at UST facilities must be sampled for volatile organic compounds (VOCs) and semivolatile compounds (SVOCs).

1. *Procedures for Sampling Water Supply Wells*
   - Label sample containers prior to sample collection.
   - Prepare the storage and transport containers (ice chest, etc.) before taking any samples so each collected sample can be placed in a chilled environment immediately after collection.
   - You must choose the tap closest to the well, preferably at the wellhead. The tap must be before any holding or pressurization tank, water softener, ion exchange, disinfection process or before the water line enters the residence, office or building. If no tap fits the above conditions, a new tap that does must be installed.
   - The well pump must not be lubricated with oil, as that may contaminate the samples.
   - The sampling tap must be protected from exterior contamination associated with being too close to a sink bottom or to the ground. If the tap is too close to the ground for direct collection into the appropriate container, it is acceptable to use a smaller (clean) container to transfer the sample to a larger container.
   - Leaking taps that allow water to discharge from around the valve stem handle and down the outside of the faucet, or taps in which water tends to run up on the outside of the lip, are to be avoided as sampling locations.

- Disconnect any hoses, filters, or aerators attached to the tap before sampling.
- Do not sample from a tap close to a gas pump. The gas fumes could contaminate the sample.

2. *Collecting Volatile Organic Samples*
    - Equipment Needed: VOC sample vials [40 milliliters, glass, may contain 3 to 4 drops of hydrochloric acid (HCl) as preservative]; Disposable gloves and protective goggles; Ice chest/cooler; Ice; Packing materials (sealable plastic bags, bubble wrap, etc.); and Lab forms.
    - Sampling Procedure: Run water from the well for at least 15 minutes. If the well is deep, run water longer (purging three well volumes is best). If tap or spigot is located directly before a holding tank, open a tap after the holding tank to prevent any backflow into the tap where you will take your sample. This will ensure that the water you collect is "fresh" from the well and not from the holding tank. After running the water for at least 15 minutes, reduce the flow of water. The flow should be reduced to a trickle but not so slow that it begins to drip. A smooth flow of water will make collection easier and more accurate. Remove the cap of a VOC vial and hold the vial under the stream of water to fill it. Be careful not to spill any acid that is in the vial. For best results use a low flow of water and angle the vial slightly so that the water runs down the inside of the vial. This will help keep the sample from being agitated, aerated or splashed out of the vial. It will also increase the accuracy of the sample. As the vial fills and is almost full, turn the vial until it is straight up and down so the water won't spill out. Fill the vial until the water is just about to spill over the lip of the vial. The surface of the water sample should become mounded. It is a good idea not to overfill the vial, especially if an acid preservative is present in the vial. Carefully replace and screw the cap onto the vial. Some water may overflow as the cap is put on. After the cap is secure, turn the vial upside down and gently tap the vial to see if any bubbles are present. If bubbles are present in the vial, remove the cap, add more water and check again to see if bubbles are present. Repeat as necessary. After two samples without bubbles have been collected, the samples should be labeled and prepared for shipment. Store samples at 4° C.

3. *Collecting Extractable Organic and/or Metals Samples*

- Equipment Needed: SVOC sample bottle [1 liter, amber glass] and/or Metals sample bottle [0.5 liter, polyethylene or glass, 5 milliliters of nitric acid (HNO3) preservative]; Disposable gloves and protective goggles; Ice Chest/Cooler; Ice; Packing materials (sealable plastic bags, bubble wrap, etc.); and Lab forms.
- Sampling Procedure: Run water from the well for at least 15 minutes. If the well is deep, run the water longer (purging three well volumes is best). If tap or spigot is located directly before a holding tank, open a tap after the holding tank to prevent any backflow into the tap where you will take your sample. This will ensure that the water you collect is "fresh" from the well and not from the holding tank. After running the water for at least 15 minutes, reduce the flow. Low water flow makes collection easier and more accurate. Remove the cap of a SVOC or metals bottle and hold it under the stream of water to fill it. The bottle does not have to be completely filled (i.e., you can leave an inch or so of headspace in the bottle). After filling, screw on the cap, label the bottle and prepare for shipment. Store samples at 4° C.

Appendix E - Collecting Surface Water Samples

The following topics include 1.) acceptable equipment selection and equipment construction materials and 2.) standard grab, depth-specific and depth-composited surface water sampling techniques.

Facilities which contain or border small rivers, streams or branches should include surface water sampling as part of the monitoring program for each sampling event. A simple procedure for selecting surface water monitoring sites is to locate a point on a stream where drainage leaves the site. This provides detection of contamination through, and possibly downstream of, site via discharge of surface waters. The sampling points selected should be downstream from any waste areas. An upstream sample should be obtained in order to determine water quality upstream of the influence of the site.

a.) General Cautions
    1. When using watercraft take samples near the bow away and upwind from any gasoline outboard engine. Orient watercraft so that bow is positioned in the upstream direction.
    2. When wading, collect samples upstream from the body. Avoid disturbing sediments in the immediate area of sample collection.
    3. Collect water samples prior to taking sediment samples when obtaining both from the same area (site).
    4. Unless dictated by permit, program or order, sampling at or near man-made structures (e.g., dams, weirs or bridges) may not provide representative data because of unnatural flow patterns.
    5. Collect surface water samples from downstream towards upstream.

b.) Equipment and Supplies - Select equipment based on the analytes of interest, specific use, and availability.

c.) Surface Water Sampling Techniques - Adhere to all general protocols applicable to aqueous sampling when following the surface water sampling procedures addressed below.
    1. *Manual Sampling*: Use manual sampling for collecting grab samples for immediate in-situ field analyses. Use manual sampling in lieu of automatic equipment over extended periods of time for composite sampling, especially when it is necessary to observe and/or note unusual conditions.
        - Surface Grab Samples - Do not use sample containers containing premeasured amounts of preservatives to collect grab samples. If the sample matrix is homogeneous, then the grab method is a simple and effective technique for collection purposes. If homogeneity is not apparent, based on flow or vertical variations (and should never be assumed), then use other collection protocols. Where practical, use the actual sample container submitted to the laboratory for collecting samples to be analyzed for oil and grease, volatile organic compounds (VOCs), and microbiological samples. This procedure eliminates the possibility of contaminating the sample with an intermediate collection container. The use of

unpreserved sample containers as direct grab samplers is encouraged since the same container can be submitted for laboratory analysis after appropriate preservation. This procedure reduces sample handling and eliminates potential contamination from other sources (e.g., additional sampling equipment, environment, etc.).

1. Grab directly into sample container.
2. Slowly submerge the container, opening neck first, into the water.
3. Invert the bottle so the neck is upright and pointing towards the direction of water flow (if applicable). Allow water to run slowly into the container until filled.
4. Return the filled container quickly to the surface.
5. Pour out a few mL of sample away from and downstream of the sampling location. This procedure allows for the addition of preservatives and sample expansion. Do not use this step for volatile organics or other analytes where headspace is not allowed in the sample container.
6. Add preservatives, securely cap container, label, and complete field notes. If sample containers are attached to a pole via a clamp, submerge the container and follow steps 3 – 5 but omit steps 1 and 2.

- <u>Sampling with an Intermediate Vessel or Container</u>: If the sample cannot be collected directly into the sample container to be submitted to the laboratory, or if the laboratory provides prepreserved sample containers, use an unpreserved sample container or an intermediate vessel (e.g., beakers, buckets or dippers) to obtain the sample. These vessels must be constructed appropriately, including any poles or extension arms used to access the sample location.
    1. Rinse the intermediate vessel with ample amounts of site water prior to collecting the first sample.
    2. Collect the sample as outlined above using the intermediate vessel.
    3. Use pole mounted containers of appropriate construction to sample at distances away from shore, boat, etc. Follow the protocols above to collect samples.
- <u>Peristaltic Pump and Tubing</u>: The most portable pump for this technique is a 12 volt peristaltic pump. Use appropriately precleaned, silastic tubing in the pump head and attach polyethylene, Tygon, etc. tubing to the pump. This technique is not acceptable for Oil and Grease, EPH, VPH or VOCs. Extractable organics can be collected through the pump if flexible interior-wall Teflon, polyethylene or PP tubing is used in the pump head or if used with the organic trap setup.

1. Lower appropriately precleaned tubing to a depth of 6 – 12 inches below water surface, where possible.
2. Pump 3 – 5 tube volumes through the system to acclimate the tubing before collecting the first sample.
3. Fill individual sample bottles via the discharge tubing. Be careful not to remove the inlet tubing from the water.
4. Add preservatives, securely cap container, label, and complete field notes.

- Mid-Depth Grab Samples: Mid-depth samples or samples taken at a specific depth can approximate the conditions throughout the entire water column. The equipment that may be used for this type of sampling consists of the following depth-specific sampling devices: Kemmerer, Niskin, Van Dorn type, etc. You may also use pumps with tubing or double check-valve bailers. Certain construction material details may preclude its use for certain analytes. Many Kemmerer samplers are constructed of plastic and rubber that preclude their use for all volatile and extractable organic sampling. Some newer devices are constructed of stainless steel or are all Teflon or Teflon-coated. These are acceptable for all analyte groups without restriction.
    1. Measure the water column to determine maximum depth and sampling depth prior to lowering the sampling device.
    2. Mark the line attached to the sampler with depth increments so that the sampling depth can be accurately recorded.
    3. Lower the sampler slowly to the appropriate sampling depth, taking care not to disturb the sediments.
    4. At the desired depth, send the messenger weight down to trip the closure mechanism.
    5. Retrieve the sampler slowly.
    6. Rinse the sampling device with ample amounts of site water prior to collecting the first sample. Discard rinsate away from and downstream of the sampling location.
    7. Fill the individual sample bottles via the discharge tube.
- Double Check-Valve Bailers: Collect samples using double check-valve bailers if the data requirements do not necessitate a sample from a strictly discrete interval of the water column. Bailers with an upper and lower check-valve can be lowered through the water column. Water will continually be displaced through the bailer until the desired depth is reached, at which point the bailer is retrieved. Sampling with this type of bailer must follow the same protocols outlined above, except that a messenger weight is not applicable. Although not designed specifically for this kind of sampling, a bailer is acceptable when a mid-depth sample is required

1. As the bailer is dropped through the water column, water is displaced through the body of the bailer. The degree of displacement depends upon the check-valve ball movement to allow water to flow freely through the bailer body.
2. Slowly lower the bailer to the appropriate depth. Upon retrieval, the two check valves seat, preventing water from escaping or entering the bailer.
3. Rinse the sampling device with ample amounts of site water prior to collecting the first sample.
4. Fill the individual sample bottles via the discharge tube. Sample bottles must be handled as described above.

- Peristaltic Pump and Tubing: The most portable pump for this technique is a 12 volt peristaltic pump. Use appropriately precleaned, silastic tubing in the pump head and attach HDPE, Tygon, etc. tubing to the pump. This technique is not acceptable for Oil and Grease, EPH, VPH or VOCs. Extractable organics can be collected through the pump if flexible interior-wall Teflon, polyethylene or PP tubing is used in the pump head, or if used with an organic trap setup.
    1. Measure the water column to determine the maximum depth and the sampling depth.
    2. Tubing will need to be tied to a stiff pole or be weighted down so the tubing placement will be secure. Do not use a lead weight. Any dense, non-contaminating, non-interfering material will work (brick, stainless steel weight, etc.). Tie the weight with a lanyard (braided or monofilament nylon, etc.) so that it is located below the inlet of the tubing.
    3. Turn the pump on and allow several tubing volumes of water to be discharged before collecting the first sample.
    4. Fill the individual sample bottles via the discharge tube. Sample bottles must be handled as described above.

Leachate Sampling and Analysis

To maintain sample quality, leachate samples are to be taken as close to the sump as possible. Because of dubious results, pond and storage tank samples should be avoided. The leachate data is to be submitted with the semi-annual monitoring report. Leachate is to be analyzed for the Appendix I list of constituents plus the following required additional parameters: 1) biological oxygen demand (BOD), 2) chemical oxygen demand (COD), 3) phosphate, 4) nitrate, 5) sulfate, and 6) pH. Based upon sample results, compliance history and waste screening practices, additional parameters may be required.

DENR USE ONLY: ☐ Paper Report ☐ Electronic Data - Email CD (data loaded: Yes / No) Doc/Event #:

NC DENR
Division of Waste Management - Solid Waste

Environmental Monitoring Reporting Form

Notice: This form and any information attached to it are "Public Records" as defined in NC General Statute 132-1. As such, these documents are available for inspection and examination by any person upon request (NC General Statute 132-6).

Instructions:

- **Prepare one form for each individually monitored unit.**
- **Please type or print legibly.**
- Attach a notification table with values that attain or exceed NC 2L groundwater standards or NC 2B surface water standards. The notification must include a preliminary analysis of the cause and significance of each value. (e.g. naturally occurring, off-site source, pre-existing condition, etc.).
- Attach a notification table of any groundwater or surface water values that equal or exceed the reporting limits.
- Attach a notification table of any methane gas values that attain or exceed explosive gas levels. This includes any structures on or nearby the facility (NCAC 13B .1629 (4)(a)(i).
- Send the original signed and sealed form, any tables, and Electronic Data Deliverable to: Compliance Unit, NCDENR-DWM, Solid Waste Section, 1646 Mail Service Center, Raleigh, NC 27699-1646.

Solid Waste Monitoring Data Submittal Information

Name of entity submitting data (laboratory, consultant, facility owner):

Contact for questions about data formatting. Include data preparer's name, telephone number and E-mail address:

Name: _____ Phone: _____

E-mail: _____

Facility name:	Facility Address:	Facility Permit #	NC Landfill Rule: (.0500 or .1600)	Actual sampling dates (e.g., October 20-24, 2006)

Environmental Status: (Check all that apply)

☐ Initial/Background Monitoring ☐ Detection Monitoring ☐ Assessment Monitoring ☐ Corrective Action

Type of data submitted: (Check all that apply)

☐ Groundwater monitoring data from monitoring wells
☐ Groundwater monitoring data from private water supply wells
☐ Leachate monitoring data
☐ Surface water monitoring data
☐ Methane gas monitoring data
☐ Corrective action data (specify) _____
☐ Other(specify) _____

Notification attached?

☐ No. No groundwater or surface water standards were exceeded.
☐ Yes, a notification of values exceeding a groundwater or surface water standard is attached. It includes a list of groundwater and surface water monitoring points, dates, analytical values, NC 2L groundwater standard, NC 2B surface water standard or NC Solid Waste GWPS and preliminary analysis of the cause and significance of any concentration.
☐ Yes, a notification of values exceeding an explosive methane gas limit is attached. It includes the methane monitoring points, dates, sample values and explosive methane gas limits.

Certification

To the best of my knowledge, the information reported and statements made on this data submittal and attachments are true and correct. Furthermore, I have attached complete notification of any sampling values meeting or exceeding groundwater standards or explosive gas levels, and a preliminary analysis of the cause and significance of concentrations exceeding groundwater standards. I am aware that there are significant penalties for making any false statement, representation, or certification including the possibility of a fine and imprisonment.

Facility Representative Name (Print) Title (Area Code) Telephone Number

Affix NC Licensed/ Professional Geologist Seal

Signature Date

Facility Representative Address

NC PE Firm License Number (if applicable effective May 1, 2009)

Revised 6/2009

Electronic Data need to be in the following format such that they can be uploaded into the Solid Waste Section database.
Please see the "Data Format Explanation" tab at the bottom of this sheet for an explanation of each column.

FACILITY PERMIT	WELL ID	CAS Number	SWS ID	PARAMETER	RESULT	UNITS	QUALIFIER	METHOD	MDL	MRL	SWSL	DILUTION FACTOR	COLLECT DATE	EXTRACTION DATE	ANALYSIS DATE	NC LABORATORY CERTIFICATION NUMBER
12-34	1234-MW3A	74-87-3	137	Chloromethane	0.18	ug/L	U	SW846 8260B	0.18	1	1	1	08/03/2009	08/04/2009	08/05/2009	123
12-34	1234-MW3A		325	Temperature	19.1	oC							08/03/2009			
12-34	1234-MW5	74-83-9	136	Bromomethane	35	ug/L		SW846 8260B	0.26	1	10	1	08/03/2009	08/04/2009	08/05/2009	123
12-34	1234-MW5	7440-39-3	15	Barium	50	ug/L	J	SW846 6020	0.04	10	100	1	08/03/2009		08/05/2009	123
12-34	1234-MW5		411	Total Well Depth	54.3	ft							08/03/2009			

ALL DATA SHOULD INCLUDE THE PERMIT NUMBER. If unsure, contact the operator/owner of the facility.
The unit of concentration should be ug/L for ALL constituents.

North Carolina Department of Environment and Natural Resources

Dexter R. Matthews, Director | Division of Waste Management | Michael F. Easley, Governor
William G. Ross Jr., Secretary

October 16, 2007

MEMORANDUM

To: Solid Waste Directors, Landfill Operators, North Carolina Certified Laboratories, and Consultants

From: North Carolina Division of Waste Management, Solid Waste Section

Re: **Environmental Monitoring Data for North Carolina Solid Waste Management Facilities**

The purpose of this memorandum is to provide a reiteration of the use of the Solid Waste Section Limits (SWSLs), provide new information on the Groundwater Protection Standards, and provide a reminder of formats for environmental monitoring data submittals.

The updated guidelines are in large part due to questions and concerns from laboratories, consultants, and the regulated community regarding the detection of constituents in groundwater at levels below the previous Practical Quantitation Limits (PQLs). The North Carolina Solid Waste Section solicited feedback from the regulated community, and, in conjunction with the regulated community, developed new limits. The primary purpose of these changes was to improve the protection of public health and the environment.

Data must be reported to the laboratory specific method detection limits and must be quantifiable at or below the SWSLs. The SWSLs must be used for both groundwater and surface water data reported to the North Carolina Solid Waste Section. The PQLs will no longer be used.

In June 2007, we received new information regarding changes to the Groundwater Protection Standards. If a North Carolina 2L Groundwater Standard does not exist, then a designated Groundwater Protection Standard is used pursuant to 15A NCAC 13B .1634. Toxicologists with the North Carolina Department of Health and Human Services calculated these new Groundwater Protection Standards. Questions regarding how the standards were calculated can be directed to the North Carolina Department of Health and Human Services.

1646 Mail Service Center, Raleigh, North Carolina 27699-1646
Phone 919-508-8400 \ FAX 919-715-3605 \ Internet http://wastenotnc.org

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We have reviewed the new results from the North Carolina Department of Public Health and have updated our webpage accordingly. The list of Groundwater Protection Standards, North Carolina 2L Standards and SWSLs are subject to change and will be reviewed every year or sooner if new scientific and toxicological data become available. Please review our website periodically for any changes to the 2L NC Standards, Groundwater Protection Standards, or SWSLs. Specific updates will be noted on our website.

http://www.wastenotnc.org/sw/swenvmonitoringlist.asp

In addition, the following should be included with environmental monitoring data submittals:

1. Environmental Monitoring Data Form as a cover sheet:
http://www.wastenotnc.org/swhome/EnvMonitoring/NCEnvMonRptForm.pdf
2. Copy of original laboratory results.
3. Table of detections and discussion of 2L exceedances.
4. Electronic files on CD or sent by email. These files should include the written report as a Portable Document Format (PDF) file and the laboratory data as an excel file following the format of the updated Electronic Data Deliverable (EDD) template on our website:
http://www.wastenotnc.org/swhome/enviro_monitoring.asp

If you have any questions or concerns, please feel free to contact Donald Herndon (919-508-8502), Ervin Lane (919-508-8520) or Jaclynne Drummond (919-508-8500).

Thank you for your continued cooperation with these matters.

North Carolina Department of Environment and Natural Resources
Dexter R. Matthews, Director
Division of Waste Management
Michael F. Easley, Governor
William G. Ross Jr., Secretary

October 27, 2006

To: SW Director/County Manager/Consultant/Laboratory

From: NC DENR-DWM, Solid Waste Section

Re: New Guidelines for Electronic Submittal of Environmental Monitoring Data

The Solid Waste Section receives and reviews a wide variety of environmental monitoring data from permitted solid waste management facilities, including the results from groundwater and surface water analyses, leachate samples, methane gas readings, potentiometric measurements, and corrective action data. We are in the process of developing a database to capture the large volume of data submitted by facilities.

To maintain the integrity of the database, it is critical that facilities, consultants, and laboratories work with the Solid Waste Section to ensure that environmental samples are collected and analyzed properly with the resulting data transferred to the Solid Waste Section in an accurate manner.

In order to better serve the public and to expedite our review process, the Solid Waste Section is requesting specific formatting for environmental monitoring data submittals for all solid waste management facilities.

Effective, December 1, 2006, please submit a Solid Waste Environmental Monitoring Data Form in addition to your environmental monitoring data report. This form will be sent in lieu of your current cover letter to the Solid Waste Section. The Solid Waste Environmental Monitoring Data Form must be filled out completely, signed, and stamped with a Board Certified North Carolina Geologist License Seal.

The solid waste environmental monitoring data form will include the following:

1. Contact Information
2. Facility Name
3. Facility Permit Number
4. Facility Address
5. Monitoring Event Date (MM/DD/YYYY)
6. Water Quality Status: Monitoring, Detection Monitoring, or Assessment Monitoring
7. Type of Data Submitted: Groundwater Monitoring Wells, Groundwater Potable Wells, Leachate, Methane Gas, or Corrective Action Data
8. Notification of Exceedance of Groundwater, Surface Water, or Methane Gas (in table form)
9. Signature
10. North Carolina Geologist Seal

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Most of these criteria are already being included or can be added with little effort. The Solid Waste Environmental Monitoring Data Form can be downloaded from our website: http://www.wastenotnc.org/swhome/enviro_monitoring.asp.

The Solid Waste Section is also requesting a new format for monitoring wells, potable wells, surface water sampling locations, and methane probes. This format is essential in the development and maintenance of the database. The Solid Waste Section is requesting that each sampling location at all North Carolina solid waste management facilities have its own unique identification number. We are simply asking for the permit number to be placed directly in front of the sampling location number (example: 9901-MW1 = Permit Number 99-01 and Monitoring Well MW-1). No changes will need to be made to the well tags, etc. This unique identification system will enable us to accurately report data not only to NCDENR, but to the public as well. We understand that this new identification system will take some time to implement, but we feel that this will be beneficial to everyone involved in the long term.

Additionally, effective December 1, 2006, the Practical Quantitation Limits (PQLs) established in 1994 will change. The Solid Waste Section is requiring that all solid waste management facilities use the new Solid Waste Reporting Limits (SWRL) for all groundwater analyses by a North Carolina Certified Laboratory. Laboratories must also report any detection of a constituent even it is detected below the new SWRL (e.g., J values where the constituent was detected above the detection limit, but below the quantitation limit).

PQLs are technology-based analytical levels that are considered achievable using the referenced analytical method. The PQL is considered the lowest concentration of a contaminant that the lab can accurately detect and quantify. PQLs provided consistency and available numbers that were achievable by the given analytical method. However, PQLs are not health-based, and analytical instruments have improved over the years resulting in lower achievable PQLs for many of the constituents. As a result, the Solid Waste Section has established the SWRLs as the new reporting limits eliminating the use of the PQLs.

We would also like to take this opportunity to encourage electronic submittal of the reports. This option is intended to save resources for both the public and private sectors. The Solid Waste Section will accept the entire report including narrative text, figures, tables, and maps on CD-ROM. The CD-ROM submittal shall contain a CD-ROM case and both CD-ROM and the case shall be labeled with the site name, site address, permit number, and the monitoring event date (MM/DD/YYYY). The files may be a .pdf, .txt, .csv, .xls, or .doc type. Also, analytical lab data should be reported in an .xls file. We have a template for analytical lab data available on the web at the address listed above.

If you have any questions or concerns, please call (919) 508-8400. Thank you for your anticipated cooperation in this matter.

North Carolina Department of Environment and Natural Resources

Dexter R. Matthews, Director | Division of Waste Management | Michael F. Easley, Governor
William G. Ross Jr., Secretary

February 23, 2007

MEMORANDUM

To: Solid Waste Directors, Landfill Operators, North Carolina Certified Laboratories, and Consultants

From: North Carolina Division of Waste Management, Solid Waste Section

Re: Addendum to October 27, 2006, North Carolina Solid Waste Section Memorandum Regarding New Guidelines for Electronic Submittal of Environmental Data.

The purpose of this addendum memorandum is to provide further clarification to the October 27, 2006, North Carolina Solid Waste Section memo titled, "New Guidelines for Electronic Submittal of Environmental Data."

The updated guidelines is in large part due to questions and concerns from laboratories, consultants, and the regulated community regarding the detection of constituents in groundwater at levels below the previous practical quantitation limits (PQLs). The North Carolina Solid Waste Section solicited feedback from the regulated community, and, in conjunction with the regulated community, developed new limits. The primary purpose of these changes was to improve the protection of public health and the environment. The North Carolina Solid Waste Section is concerned about analytical data at these low levels because the earliest possible detection of toxic or potentially carcinogenic chemicals in the environment is paramount in the North Carolina Solid Waste Section's mission to protect human health and the environment. Low level analytical data are critical for making the correct choices when designing site remediation strategies, alerting the public to health threats, and protecting the environment from toxic contaminants. The revised limits were updated based on readily available laboratory analytical methodology and current health-based groundwater protection standards.

Definitions

Many definitions relating to detection limits and quantitation limits are used in the literature and by government agencies, and commonly accepted procedures for calculating these limits exist. Except for the Solid Waste Section Limit and the North Carolina 2L Standards, the definitions listed below are referenced from the Environmental Protection Agency (EPA). The definitions are also an attempt to clarify the meaning of these terms as used by the North Carolina Solid Waste Section.

Method Detection Limit (MDL) is the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero.

Method Reporting Limit or Method Quantitation Limit (MRL or MQL) is the minimum concentration of a target analyte that can be accurately determined by the referenced method.

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Practical Quantitation Limit (PQL) is a quantitation limit that represents a practical and routinely achievable quantitation limit with a high degree of certainty (>99.9% confidence) in the results. Per EPA Publication Number SW-846, the PQL is the lowest concentration that can be reliably measured within specified limits of precision and accuracy for a specific laboratory analytical method during routine laboratory operating conditions in accordance with "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods. The PQL appears in older NCDENR literature; however, it is no longer being used by the North Carolina Solid Waste Section.

Solid Waste Section Limit (SWSL) is the lowest amount of analyte in a sample that can be quantitatively determined with suitable precision and accuracy. The SWSL is the concentration below which reported analytical results must be qualified as estimated. *The SWSL is the updated version of the PQL that appears in older North Carolina Solid Waste Section literature. The SWSL is the limit established by the laboratory survey conducted by the North Carolina Solid Waste Section. The nomenclature of the SWRL described in the October 27, 2006, memorandum has changed to the SWSL.*

North Carolina 2L Standards (2L) are water quality standards for the protection of groundwaters of North Carolina as specified in 15A NCAC 2L .0200, Classifications and Water Quality Standards Applicable to the Groundwaters of North Carolina.

Method Detection Limits (MDLs)

Clarification of detection limits referenced in the October 27, 2006, memorandum needed to be addressed because of concerns raised by the regulated community. The North Carolina Solid Waste Section is now requiring laboratories to report to the method detection limit.

Method detection limits are statistically determined values that define the concentration at which measurements of a substance by a specific analytical protocol can be distinguished from measurements of a blank (background noise). Method detection limits are matrix-specific and require a well defined analytical method. In the course of routine operations, laboratories generally report the highest method detection limit for all the instruments used for a specific method.

In many instances, the North Carolina Solid Waste Section gathers data from many sources prior to evaluating the data or making a compliance decision. Standardization in data reporting significantly enhances the ability to interpret and review data because the reporting formats are comparable. Reporting a method detection limit alerts data users of the known uncertainties and limitations associated with using the data. Data users must understand these limitations in order to minimize the risk of making poor environmental decisions. Censoring data below unspecified or non-statistical reporting limits severely biases data sets and restricts their usefulness.

Solid Waste Section Limits (SWSLs)

Due to comments from the regulated community, the North Carolina Solid Waste Section has changed the nomenclature of the new limits referenced on Page 2 of the October 27, 2006, memorandum, from the North Carolina Solid Waste Reporting Limits (SWRL) to the Solid Waste Section Limits (SWSL). Data must be reported to the laboratory specific method detection limits and must be quantifiable at or below the SWSL. The SWSLs must be used for both groundwater and surface water data reported to the North Carolina Solid Waste Section. The PQLs will no longer be used.

The North Carolina Solid Waste Section has considered further feedback from laboratories and the regulated community and has made some additional changes to the values of the SWSLs. These changes may be viewed on our webpage:
http://www.wastenotnc.org/sw/swenvmonitoringlist.asp

Analytical Data Reporting Requirements

The strategy for implementing the new analytical data reporting requirements involves reporting the actual laboratory method detection limit with all analytical laboratory results along with the following requirements:

1) Any analyte detected at a concentration greater than the MDL but less than the SWSL is known to be present, but the uncertainty in the value is higher than a value reported above the SWSL. As a result, the actual concentration is estimated. The estimated concentration is reported along with a qualifier ("J" flag) to alert data users that the result is between the MDL and the SWSL. Any analytical data below quantifiable levels should be examined closely to evaluate whether the analytical data should be included in any statistical analysis. A statistician should make this determination. If an analyte is detected below the North Carolina 2L Standards, even if it is a quantifiable concentration, compliance action may not be taken unless it is statistically significant increase over background.

These analytical results may require additional confirmation.

2) Any analyte detected at a concentration greater than the SWSL is present, and the quantitated value can be reported with a high degree of confidence. These analytes are reported without estimated qualification. The laboratory's MDL and SWSL must be included in the analytical laboratory report. Any reported concentration of an organic or inorganic constituent at or above the North Carolina 2L Standards will be used for compliance purposes, unless the inorganic constituent is not statistically significant). Exceedance of the North Carolina 2L Standards or a statistically significant increase over background concentrations define when a violation has occurred. Any reported concentration of an organic or inorganic constituent at or above the SWSL that is not above an North Carolina 2L Standard will be used as a tool to assess the integrity of the landfill system and predict the possibility that a constituent concentration may exceed the North Carolina 2L Standards in the future.

These analytical results may be used for compliance without further confirmation.

Failure to comply with the requirements described in the October 27, 2006, memorandum and this addendum to the October 27, 2006, memorandum will constitute a violation of 15A NCAC 13B .0601, .0602, or .1632(b), and the analytical data will be returned and deemed unacceptable. Submittal of unacceptable data may lead to enforcement action.

Electronic Data Deliverable (EDD) Submittal

The North Carolina Solid Waste Section would also like to take this opportunity to encourage electronic submittal of the reports in addition to the analytical laboratory data. This option is intended to save resources for both the public and private sectors.

The North Carolina Solid Waste Section will accept the entire report including narrative text, figures, tables, and maps on CD-ROM. Please separate the figures and tables from the report when saving in order to keep the

size of the files smaller. The CD-ROM submittal shall contain a CD-ROM case and both CD-ROM and the case shall be labeled with the site name, site address, permit number, and the monitoring event date (MM/DD/YYYY). The reporting files may be submitted as a .pdf, .txt, .csv, .xls,. or .doc type.

Also, analytical lab data and field data should be reported in .xls files. The North Carolina Solid Waste Section has a template for analytical lab data and field data. This template is available on our webpage: http://www.wastenotnc.org/swhome/enviro_monitoring.asp. Methane monitoring data may also be submitted electronically in this format.

Pursuant to the October 27, 2006, memorandum, please remember to submit a Solid Waste Section Environmental Monitoring Reporting Form in addition to your environmental monitoring data report. This form should be sealed by a geologist or engineer licensed in North Carolina if hydrogeologic or geologic calculations, maps, or interpretations are included with the report. Otherwise, any representative that the facility owner chooses may sign and submit the form. Also, if the concentration of methane generated by the facility exceeds 100% of the lower explosive limits (LEL) at the property boundary or exceeds 25% of the LEL in facility structures (excluding gas control or recovery system components), include the exceedance(s) on the North Carolina Solid Waste Section Environmental Monitoring Reporting Form.

If you have any questions or concerns, please feel free to contact Jaclynne Drummond (919-508-8500) or Ervin Lane (919-508-8520).

Thank you for your continued cooperation with this matter.