Water Quality Monitoring Plan

Halifax County C&D Landfill – Area 2
Halifax County, North Carolina

Prepared for:

Halifax County Department of Public Utilities
Halifax, North Carolina

December 2012
REVISED July 2013

NC LIC. NO. C-0828 (ENGINEERING)

SMITH+GARDNER

14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577

PRINTED ON 100% RECYCLED PAPER

©2012 Smith Gardner, Inc.
This document may not be copied without the express written authorization of Smith Gardner, Inc.

This page intentionally left blank

Water Quality Monitoring Plan

Halifax County C&D Landfill – Area 2
Halifax County, North Carolina

Prepared For:

Halifax County Department of Public Utilities
Halifax, North Carolina

S+G Project No. Halifax 12-1

NORTH CAROLINA LICENSED SEAL 2275 GEOLOGIST MADELINE GERMAN 8/13/13

Madeline German, P.G.
Project Geologist

NORTH CAROLINA LICENSED SEAL 1369 GEOLOGIST JOAN A. SMYTH 8/16/13

Joan A. Smyth, P.G.
Senior Hydrogeologist

December 2012
REVISED July 2013

NCBE NO C-0828 (ENGINEERING)

SMITH+GARDNER

14 N. Boylan Avenue Raleigh NC 27603 | 919.828.0577

This page intentionally left blank.

Executive Summary

This Water Quality Monitoring Plan (WQMP) specifies the procedures and requirements to satisfy North Carolina Solid Waste Management Rule 15A NCAC 13B.0544 (b) and (c) for the proposed Area 2 Construction and Demolition (C&D) Debris Landfill. The WQMP addresses groundwater and surface water monitoring/sampling. Three ground water monitoring wells are proposed for this site. Monitoring well CDMW-1 serves as the up-gradient monitoring location, while monitoring wells CDMW-2 and CDMW-3 will be down-gradient of the C&D landfill footprint. Proposed monitoring wells will be positioned at the relevant point of compliance as approved by the Division of Waste Management (Division).

During monitoring well sampling, the static water level and total well depth will be measured and the well will be purged of 3-5 well volumes or until dry. After purging activities are complete, groundwater samples will be collected for laboratory analysis and field parameters (temperature, pH, and conductivity). For surface water samples temperature, pH, conductivity and turbidity can be measured prior to sample collection.

Samples will be placed in laboratory specified containers for the appropriate analysis and stored on ice, in coolers. The chain-of-custody will identify sample collection dates, times and responsible parties through the transit of the samples from the site to the laboratory. Water quality monitoring will be performed semi-annually and reports will be completed after receipt of laboratory analytical data.

This page intentionally left blank

.

Halifax County, C&D Landfill – Area 2
Halifax County, North Carolina

Water Quality Monitoring Plan

Table of Contents

Page

1.0 INTRODUCTION 1
1.1 Overview 1
1.2 Site Contact Information 2
1.2.1 Owner 2
1.2.2 Engineer 2
1.2.3 Solid Waste Regulatory Agency 2
1.3 Site Background 3
1.4 Geology 3
1.5 Site Hydrogeology 3
2.0 MONITORING PROGRAM 4
2.1 Overview 4
2.2 Monitoring Network and Analytical Parameters 4
2.3 Groundwater Sample Collection 4
2.3.1 Introduction 4
2.3.1.1 Guidance Documents 5
2.3.1.2 Fuel Powered Equipment 5
2.3.1.3 Equipment Decontamination 5
2.3.2 Water Level Measurements 6
2.3.2.1 Static Water Levels 6
2.3.2.2 Contamination Prevention 6
2.3.2.3 Equipment 7
2.3.3 Monitoring Well Evacuations 7
2.3.3.1 Description 7
2.3.3.2 Contamination Prevention 7
2.3.3.3 Calculations 8
2.3.3.4 Well Purging 8
2.3.3.5 Purge Rate 10
2.3.3.6 Purge Water Disposal 10
2.3.3.7 Non-Dedicated Equipment 11
2.3.4 Sample Collection 11
2.3.4.1 Field Parameters 12
2.3.4.2 Sample Equipment 12
2.3.4.3 Sample Transference 12
2.3.4.4 Order of Sample Collection 13
2.3.4.5 Decontamination 13
2.3.4.6 Sample Preservation 14

2.3.4.7 Field Quality Assurance 14
2.3.4.8 Sample Containers 14
2.4 Surface Water Sample Collection 15
2.4.1 Surface Water Level Observations 15
2.4.1.1 Monitoring Conditions 15
2.4.1.2 Monitoring Condition Modification 15
2.4.2 Sample Collection 16
2.4.2.1 Collection Procedure 16
2.4.2.2 Field Parameters 16
2.4.2.3 Observation 16
2.4.2.4 Decontamination 17
2.4.2.5 Sample Containers 17
3.0 FIELD QA/QC PROGRAM 18
3.1 Overview 18
3.1.1 Blank Samples 18
3.1.1.1 Trip Blanks 18
3.1.1.2 Equipment Blanks 18
3.1.2 Blank Concentrations 18
3.1.3 Field Instruments 19
4.0 SAMPLE PRESERVATION AND SHIPMENT 20
4.1 Overview 20
4.2 Sample Preservation 20
4.3 Storage/Transport Conditions 20
4.4 Sample Delivery 20
4.5 Chain of Custody 20
5.0 FIELD LOGBOOK 22
6.0 LABORATORY ANALYSIS 23
6.1 Overview 23
6.2 Laboratory Quality Assurance/Quality Control 23
6.3 Laboratory Quality Control Checks 23
6.4 Data Review 23
7.0 RECORD KEEPING AND REPORTING 24
7.1 Overview 24
7.2 Groundwater System Evaluations 24
7.3 Reporting 24
8.0 MONITORING PROGRAM MODIFICATIONS 26
8.1 Overview 26
8.2 Well Abandonment/Rehabilitation 26
8.3 Additional Well Installations 26
8.4 Implementation Schedule 26

Table of Contents - Continued

FIGURES

Figure 1	Proposed Monitoring Location Map

TABLES

Table 1	Monitoring Location Summary
Table 2	Proposed Monitoring Location Details
Table 3	Appendix I Analyte List with Field Parameters

APPENDICES

Appendix A	Environmental Monitoring Report Form

This page intentionally left blank.

1.0 INTRODUCTION

1.1 Overview

This Water Quality Monitoring Plan (WQMP) specifies the procedures and requirements to satisfy North Carolina Solid Waste Management Rule 15A NCAC 13B.0544 (b) and (c). The WQMP addresses two major elements; groundwater system monitoring/sampling and surface water monitoring/sampling.

The WQMP will meet the following requirements:

Represent the quality of the background groundwater that has not been affected by leakage from the unit (.0544 (b)(1)(A)).

Represent the quality of the groundwater passing the relevant point of compliance as approved by the Division (.0544 (b)(1)(B)).

The groundwater monitoring programs must include consistent sampling and analysis procedures that are designed to ensure monitoring results that provide an accurate representation of groundwater quality at the background and down-gradient wells (.0544 (b)(1)(C)).

Detection Groundwater monitoring program (.0544 (b)(1)(D)).

The sampling procedures and frequency must be protective of human health and the environment (.0544 (b)(1)(E)).

Responsibility of sample collection and analysis must be defined as a part of the monitoring plan (.0544 (c)(2)).

This WQMP also addresses the following procedures that will be implemented to ensure the integrity of each sampling event:

Sample preservation and shipment;

Laboratory analytical procedures;

Sample chain-of-custody control; and

Quality assurance/quality control programs.

The methods and procedures described in the WQMP are intended to facilitate the collection of true and representative samples and test data. Field procedures are presented in **Section 2.0** in their general order of implementation. Equipment requirements for each field task are presented within the applicable section. Laboratory

procedures, quality assurance methods and record keeping requirements are presented in **Sections 3.0 through 8.0.**

Strict adherence to the procedures stipulated in this plan is required. Any variations from these procedures should be thoroughly documented.

1.2 Site Contact Information

In case of emergencies, or if questions arise during the program implementation, please contact the following:

1.2.1 Owner

Halifax County Department of Public Utilites
P.O. Box 70
Halifax, North Carolina 27839
Phone: (252) 586-7516
Fax: (252) 586-2685

Mr. Larry Garriss – Solid Waste Manager
Email: solidwaste@embarqmail.com

1.2.2 Engineer

Smith Gardner, Inc.
14 N. Boylan Avenue
Raleigh, North Carolina 27603
Phone: (919) 828-0577

Ms. Joan A. Smyth, P.G., Senior Hydrogeologist
email: joan@rsgengineers.com
Mr. Pieter K. Scheer, P.E., Project Manager
Email: pieter@rsgengineers.com

1.2.3 Solid Waste Regulatory Agency

North Carolina Department of Environment and Natural Resources
Division of Waste Management:

Raleigh Central Office (RCO)
217 W Jones Street
Raleigh, North Carolina 27603
Phone: (919) 707-8200

Ms. Mary Whaley
Email: mary.whaley@ncdenr.gov

1.3 Site Background

The Halifax County Landfill, permit no.42-04, is located approximately 12 miles south of Roanoke Rapids, North Carolina. Area development is a mix of agriculture and rural residential. In general, development in the area is primarily along the main roads. The facility contains a closed unlined municipal solid waste (MSW) landfill, a closed construction & demolition (C&D) landfill, an operating ash monofill landfill and an operating C&D landfill located on top of the closed unlined MSW landfill. This Water Quality Monitoring Plan (WQMP) has been prepared to meet the field sampling and laboratory analysis requirements for the proposed C&D site. The WQMP details field and laboratory protocols that must be followed to meet the data objectives of the ground water monitoring program. The site and monitoring locations are shown on **Figure 1**.

1.4 Geology

According to the 1985 North Carolina Geological Map and Ground Water in the Halifax Area, North Carolina (Dept. of Conservation and Development Bulletin #51, 1946) the landfill is situated on the eastern edge of the Eastern Piedmont Physiographic Province; slightly west of the Coastal Plain overlap. Generally, Western Halifax County is underlain by felsic to intermediate, crystalline igneous and metamorphic rocks of early to late Paleozoic age. Eastern Piedmont rocks generally exhibit a northeastern strike and locally dip gently eastward due to regional metamorphism and folding that produced a broad plunging anticline. The area was simultaneously intruded by a number of felsic (granite) plutons. The granitic pluton underlying the landfill is the Butterwood Creek intrusion.

1.5 Site Hydrogeology

Ground water depths generally range from near surface level in the lowland areas along Brewer's Creek and its tributary up to 45 ft. below grade along the ridge east of the landfill. Ground water at the site flows generally west towards Brewer's Creek and its tributary. There are minor seasonal variations in the flow pattern, but overall flow direction is consistent.

2.0 MONITORING PROGRAM

2.1 Overview

This section of the Water Quality Monitoring Plan addresses each aspect of the monitoring program. As a minimum, the Halifax County Landfill will monitor the groundwater quality on a semi-annual basis.

2.2 Monitoring Network and Analytical Parameters

Three ground water monitoring wells are proposed for this site. Monitoring well CDMW-1 serves as the up-gradient monitoring location, while monitoring wells CDMW-2 and CDMW-3 will be down-gradient of the C&D landfill footprint. Proposed monitoring wells will be positioned at the relevant point of compliance as approved by the Division. Surface water will be monitored by the addition of one upstream sampling location. An existing surface water location (SW-3) located downstream of the proposed C&D landfill will serve as the downstream monitoring location.

The proposed monitoring network for the site is illustrated on **Figure 1**, monitoring location details for site locations are presented in **Table 1.** Newly proposed sampling locations are summarized below and in **Table 2**:

Proposed wells for the C&D Landfill Monitoring Network

Well	Location	Analytical Parameters
CDMW-1	Proposed Upgradient	Appendix I + Field
CDMW-2	Proposed Downgradient	Appendix I + Field
CDMW-3	Proposed Downgradient	Appendix I + Field
CDSW-1	Upstream Unnamed Tributary	Appendix I + Field
SW-3	Downstream Unnamed Tributary (existing location)	Appendix I + Field

2.3 Groundwater Sample Collection

2.3.1 Introduction

This section presents details of the procedures and equipment required to perform groundwater field measurements and sampling from monitoring wells during each monitoring event. **Where possible, sampling will proceed from the upgradient (background) wells to downgradient (compliance) wells or, when data is available, from least to most contaminated.**

2.3.1.1 Guidance Documents

Sampling, analysis and submittals shall be performed in accordance with this plan and the following guidance documents:

1. Groundwater, Surface Water and Soil Sampling for Landfills - NCDENR Guidance updated April 2008.

2. October 26, 2006 Memo from NCDENR entitled "New Guidelines for Electronic Submittal of Environmental Monitoring Data."

3. February 23, 2007 Memo from NCDENR entitled Addendum to October 27, 2006, North Carolina Solid Waste Section Memorandum Regarding New Guidelines for Electronic Submittal of Environmental Data.

4. October 16, 2007 Memo from NCDENR entitled Environmental Monitoring Data for North Carolina Solid Waste Management Facilities.

2.3.1.2 Fuel Powered Equipment

Fuel-powered equipment, such as generators or compressors for pumps, must be situated away and downwind from sampling activities. If field conditions prevent such placement, then the fuel source must be placed as far away as possible from the sampling activities. Sampling conditions must be described in detail in the field notes.

If fuel must be handled, it should be done the day before sampling. Effort should be made to avoid handling fuels on the day of sampling. If fuels must be dispensed during sampling activities, dispense fuel downwind and well away from any sampling locations. Wear gloves while working with fuel and dispose of the gloves away from sampling activities. Wash hands thoroughly after handling any fuels.

2.3.1.3 Equipment Decontamination

Non-dedicated equipment that may come in contact with the well casing and water will be decontaminated between wells. The procedure for decontaminating non-dedicated equipment is as follows:

1. Don new powder-free gloves.

2. Clean item with tap water and phosphate-free laboratory detergent Liqui-Nox or equivalent, using a brush if necessary to remove particulate matter and surface films.

3. Rinse thoroughly with pesticide grade isopropanol and allow to air dry.

4. Rinse with organic-free water (Milli-Q water or other ultra-pure water) and allow to air dry.

5. Wrap with commercial-grade aluminum foil, if necessary, to prevent equipment contamination during storage or transport.

Please note that Liqui-Nox detergent solutions will be stored in a clearly marked HDPE or PP container. Containers for pesticide-grade isopropanol will be made of inert materials such as Teflon, stainless steel, or glass.

Using dedicated sampling equipment or new disposable Teflon bailers at each well should minimize the need for decontamination in the field. Unclean equipment will be segregated from clean equipment during field activities. Clean equipment will remain in the manufacturer's packaging until use, or will be wrapped in commercial-grade aluminum foil or untreated butcher paper.

2.3.2 Water Level Measurements

2.3.2.1 Static Water Levels

Static water level and depth to the well bottom will be measured in each well prior to purging or sampling activities. Static water level and well depth measurements are necessary to calculate the static water volume in the well prior to purging. Additionally, these measurements provide a field check on well integrity, degree of siltation and are used to prepare potentiometric maps, calculate aquifer flow velocities and monitor changes in site hydrogeologic conditions.

Groundwater depths will be measured to a vertical accuracy of 0.01 feet relative to established wellhead elevations. Each well will have a permanent, easily identified reference point, established by a Registered Land Surveyor on the well riser lip from where measurements will be gauged.

2.3.2.2 Contamination Prevention

New, powder-free, surgical gloves will be donned for each sampling location. Appropriate measures will be implemented during measurement activities to prevent soils, decontamination supplies,

precipitation and other potential contaminants from entering the well or contacting clean equipment.

2.3.2.3 Equipment

An electronic water level indicator, constructed of inert materials such as stainless steel and Teflon, will be used to accurately measure depth to groundwater in each well and/or piezometer. **Between each well, the device will be thoroughly decontaminated by washing with non-phosphate (Liqui-Nox) soap and rinsing with organic-free water to prevent cross contamination from one well to another.**

The following measurements will be recorded in a dedicated field book prior to sample collection (see **Section 5.0** for a detailed description of field notes to be collected):

- Depth to static water level and well bottom (to the nearest 0.01 foot);
- Water column height in the riser (based on measured well depth);
- Condition of wellhead protective casing, base pad and riser; and
- Changes in local conditions, including well and surroundings.

2.3.3 Monitoring Well Evacuations

2.3.3.1 Description

Water accumulated in each well may be stagnant and unrepresentative of surrounding aquifer conditions; therefore, must be removed to insure that fresh formation water is sampled. Following static water level measurement the standing water in the well casing will be purged. Monitoring well evacuation should be performed in up-gradient wells first systematically moving to down-gradient well locations.

2.3.3.2 Contamination Prevention

New, non-powdered, surgical gloves will be donned for well purging and sampling activities and whenever handling decontaminated field equipment. Appropriate procedure during measurement, purging and sampling activities will be used to prevent surface soils, decontaminated supplies, precipitation and other potential contaminants from entering the well or contacting cleaned equipment.

2.3.3.3 Calculations

The volume of standing water in the well riser and screen will be calculated immediately before well evacuation during each monitoring event if standard purging techniques are utilized. A standing water volume will be calculated for each well using measured static water level, well depth and well casing diameter according to the following equation:

$$V = (TD - SWL) \times C$$

Where:

V = One well volume (gallons)
TD = Total depth of the well (in feet)
SWL = Static water level (in feet)
C = Volume constant for given well diameter (gallons/foot)
C = 0.163 gal/ft for two-inch wells.
C = 0.653 gal/ft for four-inch wells.

2.3.3.4 Well Purging

Equipment

Several options for well purging may be used at this site including:

- Bailers;
- Low Flow Pumps; and
- Grundfos Redi-flo Pumps.

Bailers – Where bailers are used, new, disposable bailers with either double or bottom check-valves will be used to purge each well. Disposable purge bailers will be constructed of fluorocarbon resin (Teflon) or inert plastic suitable for the well and ground conditions. Each bailer will be factory-cleaned and remain sealed in a plastic sleeve until use. A new Teflon-coated stainless steel, inert mono-filament line or nylon cord will be used for each well to retrieve the bailers. Where bailers are used, a minimum of three well volumes shall be purged unless the well runs dry.

Low Flow Pumps – Monitoring wells may be purged and sampled using the low-flow sampling method in accordance with the *Solid Waste Section Guidelines for Groundwater, Soil, and Surface Water Sampling* (NCDENR, 2008).

Grundfos Redi-Flo Pumps – Where Redi-Flo pumps are used, the same low flow techniques for sampling will be used. Please see above for detailed summary of purging/sampling techniques.

Technique

Depth-to-water measurements will be obtained using an electronic water level indicator capable of recording the depth to an accuracy of 0.01 foot. A determination of whether or not the water table is located within the screened interval of the well will be made. If the water table is not within the screened interval, the amount of drawdown that can be achieved before the screen is intersected will be calculated. If the water table is within the screened interval, total drawdown should not exceed 1 foot to minimize the aeration and turbidity. If the water table is above the screened interval, the drawdown amount should be minimized to keep the screen from being exposed.

If the purging equipment is non-dedicated, the equipment will be lowered into the well, taking care to minimize the water column disturbance. If conditions (i.e., water column height and well yield) allow, the pump will be placed in the uppermost portion of the water column (minimum of 18 inches of pump submergence is recommended).

The minimum volume/time period for obtaining independent Water Quality Parameter Measurements (WQPM) will be determined based on the stabilized flow rate, the volume in the pump and the discharge tubing (alternatively, the flow cell volume can be used, provided it is greater than the pump and discharge tubing volume). The bladder pump volume should be obtained from the manufacturer. Discharge tubing volumes are as follows:

3/8-inch inside diameter tubing:	20 milliliters per foot
1/4-inch inside diameter tubing:	10 milliliters per foot
3/16-inch inside diameter tubing:	5 milliliters per foot

Begin the well purge following calculations to determine the volume of the flow-cell or the pump and the discharge tubing. The flow rate should be based on historical data for each individual well (if available) and should not exceed 500 milliliters per minute. The initial round of WQPM should be recorded and the flow rate adjusted until drawdown in the well stabilizes. Water levels should be measured periodically to maintain a stabilized water level. The water level should not fall within one foot of the top of the well screen. If the purge rate has been reduced to 100 milliliters or less and the head level in the well continues to decline, the required water samples should be collected following stabilization of the WQPM, based on the criteria presented below.

If neither the head level nor the WQPM stabilize, a passive sample should be collected. Passive sampling is defined as sampling before WQMP have stabilized if the well yield is low enough that the well will purge dry at the lowest possible purge rate (generally 100 milliliters per minute or less).

WQPM stabilization is defined as: pH (+/- 0.2 S.U.), conductance (+/- 5% of reading), temperature (+/- 10% of reading or 0.2°C) and dissolved oxygen [+/- 20% of reading or 0.2 mg/L (whichever is greater)]. Oxidation reduction potential will be measured and ideally should also fall within +/- 10mV of reading; however, this is not a required parameter. At a minimum, turbidity measurements should also be recorded at the beginning of purging, following WQPM stabilization and following sample collection. The optimal turbidity range for micropurging is 25 Nephelometric Turbidity Units (NTU) or less. Turbidity measurements above 25 NTU are generally indicative of an excessive purge rate or natural conditions related to excessive fines in the aquifer matrix.

WQPM stabilization should occur in most wells within five to six rounds of measurements. If stabilization does not occur following the removal of a purge volume equal to three well volumes, a passive sample will be collected.

The direct-reading equipment used at each well will be calibrated in the field according to the manufacturer's specifications prior to each day's use and checked, at a minimum, at the end of each sampling day. Calibration information should be documented in the instrument's calibration logbook and field book/notes.

Each well is to be sampled immediately following WQMP stabilization. The sampling flow rate must be maintained at a rate less than or equal to the purging rate. For volatile organic compounds, lower sampling rates (100 - 200 milliliters/minute) should be used. Final field parameter readings should be recorded prior to and after sampling.

2.3.3.5 Purge Rate

Wells will be purged at a rate that will not cause recharge water to be excessively agitated or cascade through the screen. Care to minimize disturbance to the well sidewalls and bottom that could result in the suspension of silt and fine particulate matter. The purged water volume from each well and the relative recharge rate will be documented in sampling field notes/book. Wells which have very low recharge rates will be purged once until dry. Damaged, dry or low yielding and high turbidity wells will be documented for reconsideration before the next sampling event.

2.3.3.6 Purge Water Disposal

Purge water will be managed to prevent possible soil and surface water contamination. Well site management options may include temporary

containment and disposal as leachate or portable activated carbon filtration if warranted by field characteristics.

2.3.3.7 Non-Dedicated Equipment

Durable, non-dedicated equipment lowered into the well or that may come in contact with the water samples, will be thoroughly decontaminated before each use. Equipment shall be disassembled to the degree practical, washed with (non-phosphate) soapy potable tap water and triple rinsed using organic free water (Milli-Q or equivalent). Detailed equipment decontamination procedures are detailed in **Section 2.3.1.3**.

2.3.4 Sample Collection

After purging, groundwater samples will be collected for laboratory analysis. Sampling is the most critical stage and the focus of the water quality monitoring program. Samples should be collected from least contaminated location(s) first, followed by locations of increasing contamination across the site. Prior to sample collection, sample labels should be properly filled-out with permanent ink, such as Sharpie Pen. At a minimum, the label should identify the sample with the following information:

- Sample Location or Well Number;
- Sample Identification Number;
- Date and Time of Collection;
- Analysis Required;
- Sampler's Initials;
- Preservative Used (if any); and
- Other Pertinent Information as Necessary.

Filled-out sample labels should be affixed to the sample bottle prior to sampling.

Sampling will occur within 24-hours of well purging and as soon after well recovery as possible. Wells which fail to recharge or produce an adequate sample volume within 24 hours of purging will not be sampled.

2.3.4.1 Field Parameters

Field measurements to determine temperature, pH, and specific conductance will be recorded immediately prior to sampling each monitoring point. Turbidity measurements may be collected for metals evaluation. For low-flow sampling, dissolved oxygen (DO) and oxidation reduction potential (ORP) shall also be collected. The field test specimens will be collected with the sampling bailer and placed in a clean, non-conductive glass or plastic container for observation. Temperature, pH, conductivity and turbidity meter calibration will be completed according to the manufacturers' specifications and consistent with Test Methods for Evaluating Solid Waste -Physical/Chemical Methods (SW-846). A pocket thermometer and litmus paper will be available in case of meter malfunction.

2.3.4.2 Sample Equipment

Several options for sample collection are available for this site including:

- Disposable Bailers;
- Low Flow Pumps; and
- Grundfos Redi-flo Pumps.

These are each discussed in greater detail below.

Disposable Bailers – Where bailers are used, each well will be sampled using a new, factory-cleaned, disposable Teflon bailer with bottom check-valve and sample discharge mechanism. A new segment of Teflon-coated stainless steel wire, inert mono-filament line or nylon cord will be used to lower and retrieve each bailer. The bailer will be lowered into each well to the point of groundwater contact and then allowed to fill as it sinks below the water table. Bottom contact will be avoided in order to avoid suspending sediment in the samples. The bailer will be retrieved and emptied in a manner which minimizes sample agitation.

Low Flow Pumps – Following purging with the low flow pump systems, samples may be collected immediately from the pumping system. Samples are to be collected in the order outlined in **Section 2.3.4.4**.

Redi-Flo Pumps - Following purging of three well volumes, samples may be collected from the Redi-Flo pumps. Samples will be collected in the order outlined in **Section 2.3.4.4**.

2.3.4.3 Sample Transference

Samples will be transferred directly from the disposable bailer or pump discharge tubing into a sample container that has been specifically prepared for the preservation and storage of compatible parameters. A bottom emptying device provided will be used to transfer samples from bailer to sample container. The generation air bubbles and sample agitation will be minimized during bailer discharge. Groundwater samples will be collected and contained in the order of volatilization sensitivity.

2.3.4.4 Order of Sample Collection

Initially, purgeable organics and total metals samples will be collected for laboratory analysis. Subsequently, other analytical methods may be required. When collected, the following order of sampling will be observed:

- Volatile Organics and Volatile Inorganics;
- Extractable Organics, Petroleum Hydrocarbons, Aggregate Organics and Oil and Grease;
- Total Metals;
- Inorganic Nonmetallics, Physical and Aggregate Properties and Biologicals;
- Microbiologicals; and
- pH, Temperature, DO, ORP, Conductivity and Turbidity.

Note: If the pump used to collect groundwater samples is not suitable to collect volatile or extractable organics then collect other parameters and withdraw the pump and tubing, then collect the volatile and extractable organics.

Samples will be collected and analyzed in an **unfiltered** state. Dissolved metal analysis samples, if subsequently required, will be prepared by field filtration using a decontaminated peristaltic pump and a disposable 0.45 micron filter cartridge specifically manufactured for this purpose.

2.3.4.5 Decontamination

Reusable sampling equipment including water level probes, water quality meters, interface probes and filtering pumps which might contact aquifer water or samples will be thoroughly decontaminated between wells by washing with non-phosphate soapy, organic free water (Milli-Q or

equivalent) water and rinsing with isopropanol and organic-free water. Detailed equipment decontamination procedures are detailed in **Section 2.3.1.3**.

2.3.4.6 Sample Preservation

Following sampling at each location, the sample bottles will be placed in a cooler with ice for preservation.

2.3.4.7 Field Quality Assurance

Field and trip blanks will be prepared, handled and analyzed as groundwater samples to ensure cross-contamination has not occurred. One set of trip blanks, as described later in this document, will be prepared before leaving the laboratory to ensure that the sample containers or handling processes have not affected the sample quality. One set of equipment blanks will be created in the field at the time of sampling to ensure that the field conditions, equipment, and handling during sampling collection have not affected the sample quality. Equipment blanks are discussed in **Section 3.2.2**. A duplicate groundwater sample may be collected from a single well as a laboratory accuracy check. Blanks and duplicate containers, preservatives, handling and transport procedures for surface water samples will be identical to those noted for groundwater samples.

2.3.4.8 Sample Containers

Sample containers will be provided by the laboratory for each sampling event. Containers must be either new, factory-certified analytically clean by the manufacturer, or cleaned by the laboratory prior to shipment for sampling. Laboratory cleaning methods will be based on the bottle type and analyte of interest. Metal containers are thoroughly washed with non-phosphate detergent and tap water and rinsed with (1:1) nitric acid, tap water, (1:1) hydrochloric acid, tap water and non-organic water, in that order. Organic sample containers are thoroughly washed with non-phosphate detergent in hot water and rinsed with tap water, distilled water, acetone and pesticide quality hexane, in that order. Other sample containers are thoroughly washed with non-phosphate detergent and tap water, rinsed with tap water and non-organic water. The laboratory shall provide proper preservatives in the sample containers prior to shipment (see **Section 6.0**).

2.4 Surface Water Sample Collection

This section presents the procedures and equipment required to perform surface water field measurements and sampling from springs, streams and ponds during each monitoring event.

2.4.1 Surface Water Level Observations

Surface water quality analyses are particularly sensitive to site hydrologic conditions and recent precipitation events. Water levels may fluctuate significantly in comparison the groundwater table and may result in either diluting or increasing contaminant loadings. Sampling event scheduling and the interpreted surface water data should account for recent weather and sampling station conditions.

2.4.1.1 Monitoring Conditions

Surface water level and sampling station conditions may be observed one day prior to, and during each sampling event if warranted by site conditions. Surface water observations will include the flood stage in streams, seasonal base flow conditions and confirm location and timing for meaningful surface water quality sampling. The following objective observations will be recorded in a dedicated field book prior to sample collection:

- Relative stream water level;
- Surface water clarity; and
- Changes in surface monitoring station conditions and surroundings.

2.4.1.2 Monitoring Condition Modification

Modifications to surface sampling station conditions may be required prior to each sampling event. These modifications may include surface and submerged debris removal, slightly deepening the station to allow sample container immersion, or channeling/piping to consolidate local discharge. When modifications are necessary, sufficient time will be allowed for suspended solid settlement between the disturbance and sample collection. A minimum four hour settling period will be observed.

2.4.2 Sample Collection

2.4.2.1 Collection Procedure

Surface water samples will be obtained from locations with minimal turbulence and aeration. Samples will be collected if flowing water is observed during the sampling event. New, non-powdered, surgical gloves will be donned prior to sample collection. The following procedure will be implemented regarding surface water sampling:

1. Put on new, non-powered, surgical gloves.

2. Hold the bottle by the bottom with one hand and remove the cap with the other.

3. Push the sample container slowly into the water with the mouth tilted up towards the current to fill. A water depth of six inches is generally satisfactory. Procedure will be implemented to avoid breaching the surface or losing sample preservatives while filling the container.

4. If there is little current movement, the container should be moved slowly, in a lateral, side to side direction, with the container mouth pointing upstream.

2.4.2.2 Field Parameters

Temperature, pH, specific conductivity and turbidity will be measured prior to sampling to assess field conditions and check the water sample stability over time. Temperature, pH, specific conductivity and turbidity measurements will be recorded for surface water samples. Temperature, pH, conductivity and turbidity meters will be calibrated at the beginning of each sampling event, according to the manufacturers' specifications and consistent with Test Methods for Evaluating Solid Waste - Physical/Chemical Methods (SW-846).

2.4.2.3 Observation

Surface water samples will be collected and contained in the order of parameter volatilization sensitivity:

- Volatile Organics and Volatile Inorganics;

- Extractable Organics, Petroleum Hydrocarbons, Aggregate Organics and Oil and Grease;
- Total Metals;

- Inorganic Nonmetallics, Physical /Aggregate Properties, Biologicals;

- Microbiologicals; and

- Measurements of pH, Temperature, DO, ORP, Conductivity and Turbidity.

Surface water samples will be collected unfiltered. If future dissolved metal analysis is required, samples will be prepared by field filtration using a decontaminated peristaltic filtering pump (or equivalent) and a disposable 0.45 micron filter cartridge manufactured for this purpose.

Surface water samples will be collected from surface water monitoring points shown on the attached **Figure 1**. Samples will be collected directly from the station in the container that has been prepared for the preservation and storage of compatible parameters. Samples will be collected in a manner that assures minimum agitation. Additional blanks and duplicate samples will not be taken with the surface water samples.

2.4.2.4 Decontamination

Feld meters which might contact surface water samples will be thoroughly decontaminated between stations by washing with non-phosphate soapy, organic free water (Milli-Q or equivalent) water and rinsed with isopropanol and organic-free water. Detailed equipment decontamination procedures are detailed in **Section 2.3.1.3**.

2.4.2.5 Sample Containers

Sample containers shall be prepared and provided by the laboratory for each surface water sampling event. Each container's preparation and preservatives shall be the same as those utilized for groundwater sampling and addressed previously in **Section 2.3.4.8**.

3.0 FIELD QA/QC PROGRAM

3.1 Overview

Field Quality Assurance/Quality Control (QA/QC) requires the routine collection and analysis of blanks to verify that the handling process has not affected the sample quality. Contaminants found in the trip blanks could be attributed to:

1. Interaction between the sample and the container;
2. Contaminated source water; or
3. A handling procedure that alters the sample.

3.1.1 Blank Samples

3.1.1.1 Trip Blanks

The laboratory will prepare a trip blank by filling each sample bottle type with laboratory grade distilled or deionized water. Trip blanks will use bottles of the specific type required for the analyzed parameters from a bottle pack specifically assembled by the laboratory for each groundwater sampling event. Trip blanks are assembled in the laboratory, transported with the empty bottle packs, remain in the coolers throughout sampling and are transported back to the laboratory for analysis. Trip blanks will only be analyzed for volatile and purgeable organics.

3.1.1.2 Equipment Blanks

Where wells are sampled with non-dedicated equipment, equipment blank samples shall be collected at a rate of one sample per day. To collect an equipment blank, pour non-organic (milli-Q) water into a bailer; handling the bailer in a manner identical to well sampling, transfer the water into the specified "blank" sample collection jars specified. Equipment blank samples are packed and sent to the laboratory with the other samples.

3.1.2 Blank Concentrations

The contaminant concentration levels found in the trip or equipment blanks will be reported but will not be used to correct groundwater data. In the event that elevated parameter concentrations are found in a blank, the analysis will be flagged for future evaluation and possible re-sampling.

3.1.3 Field Instruments

Field instruments utilized to measure groundwater characteristics will be calibrated prior to entering the field and recalibrated in the field as required to insure accurate measurements for each sample. The specific conductivity and pH meter shall be recalibrated utilizing two prepared solutions of known concentrations in the anticipated value range (between 4 and 10). A permanent thermometer, calibrated against a National Bureau of Standards Certified thermometer, will be used for temperature meter calibration. Other field equipment should be calibrated at least daily using the manufacturer's recommended specifications.

4.0 SAMPLE PRESERVATION AND SHIPMENT

4.1 Overview

Sample preservation methods, shipment and chain-of-custody procedures observed between sampling and laboratory analysis are presented in the following sections.

4.2 Sample Preservation

Pre-measured chemical preservatives will be provided by the analytical laboratory. Hydrochloric acid will be used as a chemical stabilizer and preservative for volatile and purgeable organic specimens. Nitric acid will be used as the preservative for samples for metals analysis.

4.3 Storage/Transport Conditions

Proper storage and transport conditions must be maintained to preserve sample integrity between collection and analysis. Ice and chemical cold packs will be used to cool and preserve samples, as directed by the analytical laboratory. Samples will be maintained at a temperature of 4° C. **Dry ice is not to be used**. Samples will be packed and/or wrapped in plastic bubble wrap to inhibit breakage or accidental spills.

Chain-of-Custody control documents will be placed in a waterproof pouch and sealed inside the cooler with the samples for shipping. Tape and/or custody seals shall be placed on the outside of the shipping coolers, in a manner to prevent and detect tampering with the samples.

4.4 Sample Delivery

Samples shall be delivered to the analytical laboratory within a reasonable time period in person or using an overnight delivery service to insure holding time compliance. If samples are not shipped the same day, the ice used to keep the samples cool shall be replenished to maintain the required 4° C temperature. Sample shipment and delivery will be coordinated with the laboratory. Do NOT store or ship highly contaminated samples (concentrated wastes, free product, etc.) or samples suspected of containing high contaminant concentrations in the same cooler or shipping container with other environmental samples.

4.5 Chain of Custody

Chain-of-Custody control will be maintained from sampling through analysis to prevent tampering with analytical specimens. Sample Chain-of-Custody control procedures consist of the following:

1. Chain-of-Custody will originate at the laboratory with the shipment of prepared sample bottles and a sealed trip blank. Identical container kits will be shipped by

express carrier to the sampler, site, or will be picked up at the laboratory in sealed coolers.

2. After sample kit delivery but prior to sampling, the sampler will inventory the container kit checking consistency between the number and type of containers present with what is indicated in the Chain-of-Custody forms and that required for the sampling event.

3. Labels for individual sample containers will be completed in the field, indicating the site, sampling time, sampling date, sample location/well number, and preservation methods used for the sample.

4. Collected specimens will be placed in the coolers on ice, and will remain in the continuous possession of the field technician until shipment or transferal as provided by the Chain-of-Custody form has occurred. If continuous possession cannot be maintained by the field technician, the coolers will be temporarily sealed and placed in a secure area.

Once delivered to the laboratory, samples will be issued laboratory sample numbers recorded into a logbook indicating client, well number and delivery date and time. The laboratory director or his designee will sign the Chain-of-Custody control forms and formally receive the samples. The field technician, project manager and the laboratory director will work together to insure that proper sample temperature is maintained.

Complete Chain-of-Custody form copies will be placed in the laboratory's analytical project file and attached to the laboratory analysis report.

Chain-of-Custody forms will be used to transfer direct deliveries from the sampler to the laboratory. A coded, express delivery shipping bill shall constitute the Chain-of Custody between the sampler and laboratory for overnight courier deliveries.

5.0 FIELD LOGBOOK

The field technician will keep an up-to-date logbook documenting important information pertaining to the technician's field activities. The field logbook will document the following:

- Site Name and Location
- Sampling Date and Time
- Climatic Conditions During Sampling Event
- Sampling Point/Well Identification Number
- Well Static Water Level
- Water Column Height in Well
- Purged Water Volume and Well Yield (High or Low)
- Presence of Immiscible Layers and Detection Method
- Observations on Purging and Sampling Event
- Sample Collection Time
- Temperature, pH, Temperature, DO, ORP, Turbidity, and Conductivity Readings
- Field Technician Signature
- Relative stream water level
- Surface water clarity
- Changes in surface monitoring station conditions and surroundings

6.0 LABORATORY ANALYSIS

6.1 Overview

The ground and surface water parameters will be analyzed for parameters specified by DWM for detection monitoring purposes including field indicators of water quality (pH, conductivity, temperature and turbidity) and those constituents listed in **Table 3**. Analytical methods from Test Methods For Evaluating Solid Waste - Physical/Chemical Methods (SW-846) or Methods For the Chemical Analysis of Water and Wastes will be consistent with the Division's policies regarding analytical methods and reporting limits. Analysis will be performed by a laboratory certified by the North Carolina DENR for the analyzed parameters.

6.2 Laboratory Quality Assurance/Quality Control

Formal environmental laboratory Quality Assurance/Quality Control (QA/QC) procedures are to be utilized at all times. The landfill owner/operator is responsible for selecting the laboratory contractor and insuring that the laboratory is utilizing proper QA/QC procedures. The laboratory must have a QA/QC program based on specific routine procedures outlined in a written laboratory Quality Assurance/Quality Control Manual. The QA/QC procedures listed in the manual shall provide the lab with the necessary assurances and documentation that accuracy and precision goals are achieved in analytical determinations. Internal quality control checks shall be undertaken regularly by the lab to assess the precision and accuracy of analytical procedures.

6.3 Laboratory Quality Control Checks

The internal quality control checks include calibration standards, standard references, duplicate samples and spiked or fortified samples. Calibration standards shall be verified against a standard reference obtained from a second (alternate) source. For most analytical methods, calibration curves shall be developed using at least one blank and three standards. Samples shall be diluted, if necessary, to ensure that analytical measurements fall within the linear portion of the calibration curve. Where required, duplicate samples shall be processed at an average frequency of 10 percent to assess testing methods precision, and standard references shall be processed not less than monthly to assess the analytical procedure accuracy. Method or procedural blanks and spiked or fortified samples shall be carried through the full procedure for sample preparation and measurement to validate analysis efficiency and accuracy.

6.4 Data Review

During the course of analyses, quality control data and sample data shall be reviewed by the laboratory manager to identify questionable data and determine if the necessary QA/QC requirements are being followed. If a portion of the lab work is subcontracted, it is the contracted laboratories responsibility to verify the subcontracted work is performed by certified laboratories, using identical QA/QC procedures.

7.0 RECORD KEEPING AND REPORTING

7.1 Overview

This section addresses the documentation and reporting requirements associated with the WQMP implementation.

7.2 Groundwater System Evaluations

After each monitoring event, the potentiometric surface will be evaluated to determine whether the monitoring system remains adequate and to determine the groundwater flow rate and direction at the site. The groundwater flow direction will be determined by comparing groundwater surface elevations across the site with a potentiometric surface map constructed from data collected each event. Groundwater flow rates will be determined using the following equation:

$$V=KI/n$$

Where:

V = Velocity (feet/day)
K = Hydraulic Conductivity (feet/day)
I = Hydraulic Gradient (foot/foot)
n = Effective Porosity of aquifer soils (unit less)

If these evaluations indicate the groundwater monitoring system is insufficient in meeting the rule requirements, the monitoring system will be modified accordingly and a work plan will be submitted to NCDENR for review prior to modifications to enhance the monitoring system.

7.3 Reporting

Laboratory analytical data copies will be forwarded to the Division within 90 calendar days of consultant received laboratory data. The analytical data submitted will specify the sample collection date, the sampling point identification and include a sampling location map. Should a significant contaminant concentration be detected in ground and surface water, as defined in North Carolina Solid Waste Rules, Groundwater Quality Standards, or Surface Water Quality Standards, the landfill owner/operator shall notify the Division and will place a notice in the landfill records as to which constituents were detected.

Monitoring reports will be submitted with the following:

1. An potentiometric surface evaluation
2. Analytical laboratory reports and summary tables
3. A Solid Waste Environmental Monitoring Data Form (included in Appendix A)

4. Laboratory Data submitted in accordance with the Electronic Data Deliverable Template.

Monitoring reports may be submitted electronically by e-mail or in paper copy form. Copies of laboratory results and water quality reports for the Halifax County Landfill will be kept at the landfill office. Reports summarizing groundwater quality results and data evaluation will be submitted to the Division for each sampling event. Depending on the analytical results received, graphical analyses may be performed to evaluate plume movement and contaminant trends over time.

8.0 MONITORING PROGRAM MODIFICATIONS

8.1 Overview

This section addresses the procedures that should be followed with respect to water quality program modifications.

8.2 Well Abandonment/Rehabilitation

After each groundwater monitoring event, the potentiometric surface will be evaluated to determine whether the monitoring system remains adequate and to determine the groundwater flow rate and direction at the site.

Should wells become irreversibly damaged or require rehabilitation, the Division shall be notified. If monitoring wells and/or piezometers are damaged irreversibly they shall be abandoned under Division direction following 15A NCAC 02C .0113. The abandonment procedure in unconsolidated materials involves over-drilling and/or pulling the well casing and plugging the well with an impermeable, chemically-inert sealant such as neat cement grout and/or bentonite clay. For bedrock well completions the abandonment encompasses plugging the interior well riser and screen with an impermeable neat cement grout and/or bentonite clay sealant.

8.3 Additional Well Installations

Additional well installations will be carried out in accordance with Division directives. If the potentiometric maps reveal the depths, locations, or well number is insufficient to monitor for a potential releases of solid waste constituents from the solid waste management area, new well locations and depths will be submitted to the Division for approval.

Monitoring wells shall be installed under the supervision of a geologist or engineer who is registered in North Carolina and who will certify to the Division that the installation complies with the North Carolina Regulations. For future well installation, the documentation for well construction will be submitted by the registered geologist or engineer within 30 days after well construction.

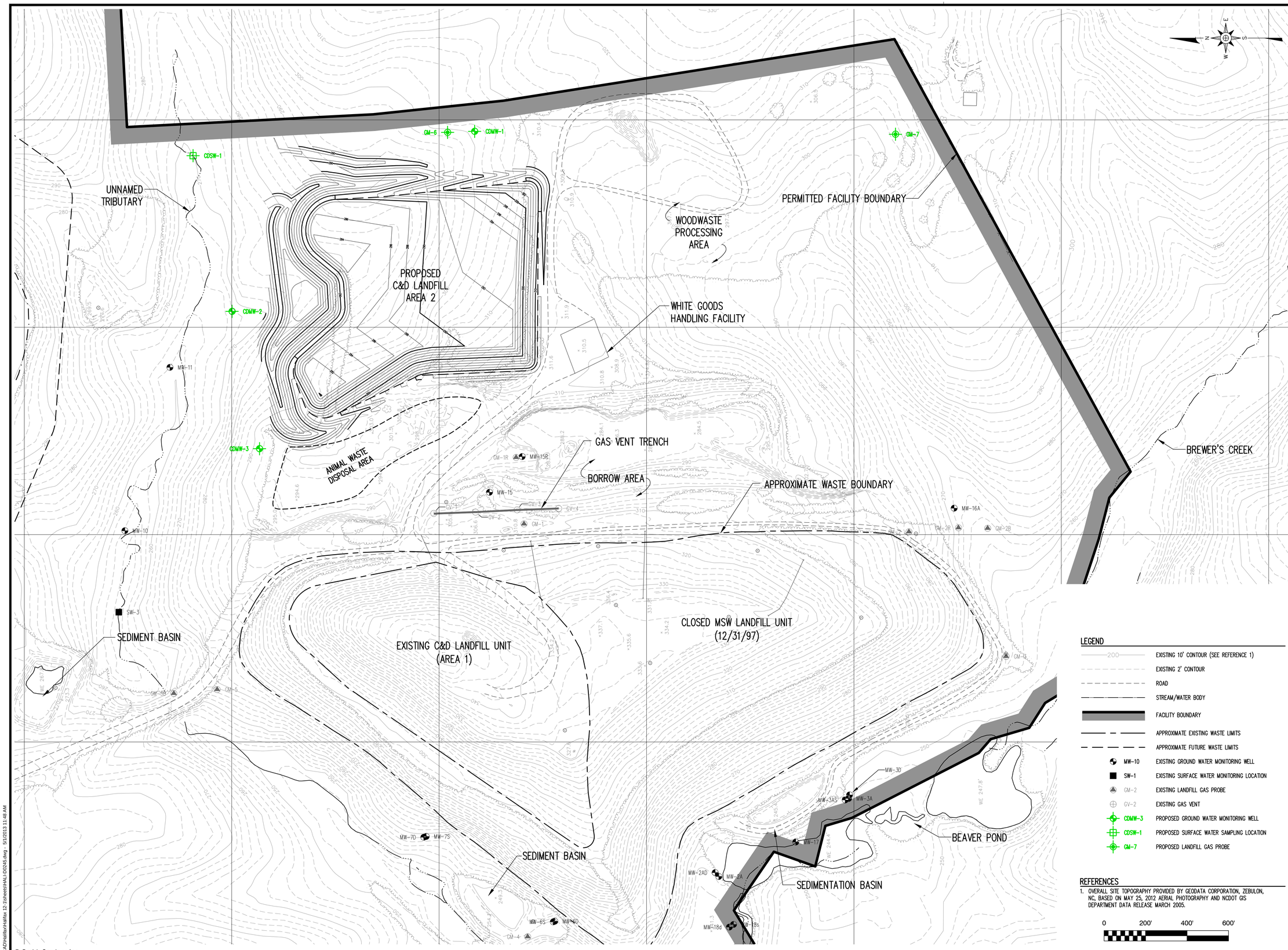
8.4 Implementation Schedule

This Monitoring Program will be implemented following Water Quality Monitoring Plan approval.

FIGURES

Water Quality Monitoring Plan
Halifax County Landfill Facility
Halifax County, North Carolina

This page intentionally left blank.



LEGEND

200	EXISTING 10' CONTOUR (SEE REFERENCE 1)
	EXISTING 2' CONTOUR
	ROAD
	STREAM/WATER BODY
	FACILITY BOUNDARY
	APPROXIMATE EXISTING WASTE LIMITS
	APPROXIMATE FUTURE WASTE LIMITS
MW-10	EXISTING GROUND WATER MONITORING WELL
SW-1	EXISTING SURFACE WATER MONITORING LOCATION
GM-2	EXISTING LANDFILL GAS PROBE
GV-2	EXISTING GAS VENT
CDMW-3	PROPOSED GROUND WATER MONITORING WELL
CDSW-1	PROPOSED SURFACE WATER SAMPLING LOCATION
GM-7	PROPOSED LANDFILL GAS PROBE

REFERENCES

1. OVERALL SITE TOPOGRAPHY PROVIDED BY GEODATA CORPORATION, ZEBULON, NC, BASED ON MAY 25, 2012 AERIAL PHOTOGRAPHY AND NCDOT GIS DEPARTMENT DATA RELEASE MARCH 2005.

0 200' 400' 600'

PREPARED FOR:

DEPARTMENT OF PUBLIC WORKS

PREPARED BY:

NC LIC. NO. C-0828 (ENGINEERING)

SMITH+ GARDNER ENGINEERS

14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577

SEAL

SEAL

REV.	DATE	DESCRIPTION

Electronic files are instruments of service provided by Smith Gardner, Inc. for the convenience of the intended recipient(s), and no warranty is either expressed or implied. Any reuse or redistribution of this document in whole or part without the written authorization of Smith Gardner, Inc., will be at the sole risk of the recipient. If there is a discrepancy between the electronic files and the signed and sealed hard copies, the hard copies shall govern. Use of any electronic files generated or provided by Smith Gardner, Inc., constitutes an acceptance of these terms and conditions.

PROJECT TITLE:

HALIFAX COUNTY, NORTH CAROLINA C&D LANDFILL - AREA 2 WATER QUALITY MONITORING REPORT

DRAWING TITLE:

PROPOSED GROUNDWATER MONITORING NETWORK

DESIGNED: JAS	PROJECT NO: HALIFAX 12-1
DRAWN: JAL	SCALE: AS SHOWN
APPROVED:	DATE: OCT. 2012
FILENAME: HALI-D0245	
SHEET NUMBER:	DRAWING NUMBER: FIG. 1

G:\CAD\Halifax\Halifax 12-1\sheets\HALI-D0245.dwg - 5/1/2013 11:48 AM

© Smith Gardner Inc.

THIS PAGE INTENTIONALLY LEFT BLANK

TABLES

Water Quality Monitoring Plan
Halifax County Landfill Facility
Halifax County, North Carolina

This page intentionally left blank.

SMITH+GARDNER

Table 1
Monitoring Location Summary

By: MG
Date: 7/19/2013

Monitoring Wells					
ID	**Depth (ft bgs)**	**Screen Interval (Feet)**	**Screen Lithology**	**Network**	**Status**
CDMW-1 (BP-7)	20	15 -20	silt	C&D	proposed
CDMW-2	~30	TBD	TBD	C&D	proposed
CDMW-3	~30	TBD	TBD	C&D	proposed
MW-1*	42.5	32 - 42	NA	MSW	existing
MW-2A	16	4 - 14	sand	MSW	existing
MW-2AD	40	30 - 40	PWR	MSW	existing
MW-3AS	21	9 - 19	clayey silt/silty sand	MSW	existing
MW-3AD	20	9 - 19	NA	MSW	existing
MW-6S	23	8 - 23	silty sand	MSW	NM
MW-6D	41	25 - 40	sandy silt	MSW	existing
MW-7S	17.5	2.5 - 17.5.	sand	MSW	existing
MW-7D	40	25 - 40	sandy silt	MSW	existing
MW-10	16.5	5 - 15	PWR	Coal Ash	existing
MW-11	20	4 - 19	clayey silt	Coal Ash	existing
MW-15	50	34.5 - 49.5	sand	MSW	NM
MW-15R	43	33 - 43	sandy clayey silt	MSW	existing
MW-16A	16	4 - 15	clayey sand	MSW	existing
MW-17	25	15 - 25	saprolite	MSW	existing
MW-18S	19	8 - 18	saprolite/clayey silty sand	MSW	existing
MW-18D	52	47 - 52	granite	MSW	existing

Surface Water			
ID	**Location**	**Network**	**Status**
CDSW-1	upstream - unnamed tributary	C&D	proposed
SW-1	downstream - unnamed tributary	MSW	existing
SW-2	downstream - unnamed tributary	MSW	existing
SW-3	downstream - unnamed tributary	C&D + MSW	existing

Note:
* Boring Log not located, information estimated from Environment 1 Laboratory Report.
TBD = To Be Determined
NM = Not Monitored
NA = Not Available

SMITH+GARDNER

Table 2
Proposed Monitoring Location Details

By: MG
Date: 9/17/2012

Monitring Well	Top of Casing Elevation	Depth to Well Bottom	Screened Interval	Upgradient/ Downgradient
CDM-1 (BP-7)	303.91	20	15' - 20'	Upgradient
CDMW-2	TBD	~30	~20' - 30'	Downgradient
CDMW-3	TBD	~30	~20' - 30'	Downgradient

NOTE: TBD = To Be Determined

Surface Water	Location	Upgradient/ Downgradient
SWCD-1	Unnamed Tributary	Upstream of C&D landfill
SWCD-2	Unnamed Tributary	Downstream of C&D landfill

Table 3
Appendix I Analyte List with Field Parameters

Appendix I Constituents	Groundwater Standard	EPA Method	Synonyms
Antimony		7041	
Arsenic		7060/7061	
Barium		7080/6010	
Beryllium		7091	
Cadmium		7131	
Chromium		7191	
Cobalt		7201	
Copper		7210/6010	
Lead		7421	
Nickel		7520/6010	
Selenium		7740/7741	
Silver		7761	
Thallium		7841	
Vanadium		7911	
Zinc		7950/6010	
Temperature		Field	
pH		Field	
Turbidity		Field	
Specific Conductance		Field	
Acetone		8260	2-Propanone
Acrylonitrile		8260	2-Propenenitrile
Benzene		8260	
Bromochloromethane		8260	Chlorobromomethane
Bromodichloromethane		8260	Dibromochloromethane
Bromoform		8260	Tribromomethane
Carbon Disulfide		8260	
Carbon Tetrachloride		8260	Tetrachloromethane
Chlorobenzene		8260	
Chloroethane		8260	Ethyl chloride
Chloroform		8260	Trichloromethane
Dibromochloromethane		8260	Chlorodibromomethane
1,2-Dibromo-3-chloropropane		8260	DBCP
1,2-Dibromoethane		8260	Ethylene dibromide, EDB
1,2-Dichlorobenzene		8260	o-Dichlorobenzene
1,4-Dichlorobenzene		8260	p-Dichlorobenzene
trans-1,4-Dichloro-2-butene		8260	
1,1-Dichloroethane		8260	Ethyldidene chloride
1,2-Dichloroethane		8260	Ethylene dichloride
1,1-Dichloroethylene		8260	Vinylidene chloride
cis-1,2-Dichloroethylene		8260	
trans-1,2-Dichloroethylene		8260	
1,2-Dichloropropane		8260	Propylene dichloride
cis-1,3-Dichloropropene		8260	
trans-1,3-Dichloropropene		8260	
Ethylbenzene		8260	
2-Hexanone		8260	Methyl butyl ketone
Methyl bromide		8260	Bromomethane
Methyl chloride		8260	Chloromethane
Methyl ethyl ketone		8260	2-Butanone
Methyl iodide		8260	Iodomethane
4-Methyl-2-pentanone		8260	Methyl isobutyl ketone
Methylene bromide		8260	Dibromomethane
Methylene chloride		8260	Dichloromethane
Styrene		8260	Ethenylbenzene
1,1,1,2-Tetrachloroethane		8260	
1,1,2,2-Tetrachloroethane		8260	
Tetrachloroethylene		8260	Perchloroethylene
Toluene		8260	Methyl benzene
1,1,1-Trichloroethane		8260	Methyl chloroform
1,1,2-Trichloroethane		8260	
Trichloroethylene		8260	
Trichloroflouromethane		8260	CFC-11
1,2,3-Trichloropropane		8260	
Vinyl acetate		8260	Acetic acid, ethenyl ester
Vinyl chloride		8260	Choroethene
Xylenes		8260	Dimethyl benzene

Note: Most recent version of EPA method for analysis should be used.

This page intentionally left blank.

APPENDIX A

Water Quality Monitoring Plan
Halifax County Lanfill Facility
Halifax County, North Carolina

This page intentionally left blank.

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

This page intentionally left blank.