Water Quality Monitoring Plan

Red Rock Disposal, LLC
C&D Landfill Facility
NC Solid Waste Permit Number 92-28

Prepared for:

Red Rock Disposal, LLC

Holly Springs, North Carolina

June 2011

RICHARDSON SMITH GARDNER
& ASSOCIATES
ENGINEERING & GEOLOGICAL
SERVICES

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RALEIGH, NORTH CAROLINA 27603

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RSG Project No. Red Rock-11-1

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RED ROCK DISPOSAL, LLC
WATER QUALITY MONITORING PLAN

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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 the following two (2) major elements; monitoring/sampling of the groundwater system and monitoring/sampling of the surface water.

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 implementation of this program, please contact the following:

1.2.1 Red Rock Disposal , LLC

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Holly Springs, North Carolina 27540
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Raleigh, North Carolina 27609
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1.2.2 North Carolina DENR

North Carolina DENR – Raleigh Central Office (RCO)
401 Oberlin Road, Suite 150
Raleigh, NC 27605
Phone: (919) 508-8400
Fax: (919) 715-3605

1.2.3 Division of Waste Management (DWM) – Solid Waste Section

Field Operations Branch Head:	Mark Poindexter (RCO)
Solid Waste Permit Engineer:	Geof Little (RCO)
Compliance Hydrogeologist:	Jaclynne Drummond (RCO)

1.3 SITE BACKGROUND

The Red Rock Disposal C&D landfill (Permit 92-28), located at 7130 New Landfill Drive, Holly Springs, NC, has been in operation since 1998. Initially the site was operated as an LCID landfill and was converted to a C&D landfill in 1999. The facility is located approximately 5 miles southwest of Holly Springs. Area development consists of a mix of residential and agricultural use with Progress Energy's Shearon Harris Nuclear Power Plant located nearby. In general, development in the area is primarily along the main roads. The site and monitoring locations are shown on **Figure 1**.

1.3.1 Site Geology

The site consists of Triassic-aged conglomeratic rocks deposited into the Durham basin during infilling of the basin (Hoffman and Gallagher, 1989 and Olson et al., 1991). The Durham basin, part of the regional Deep River basin system, is a northeast trending half-graben, bordered on the east by the Jonesboro fault, a west-dipping, stepped, high-angle normal fault (Bain and Brown, 1980; Olsen et al., 1991). Deposits in the site area are part of the conglomeratic member to the Chatham Group of the Newark Supergroup, are several hundreds of feet thick, and were deposited as an alluvial fan (Wooten, Clark, and Davis, 1996). Locally, the conglomeratic member is present to at least 60 feet, the maximum boring depth.

The site is covered with a thin veneer of saprolitic soils. These soils are up to 28 feet thick and generally consist of sandy clay and rock fragments.

1.3.2 Hydrogeology

The hydrogeology at this site has been investigated through numerous piezometers, groundwater monitoring wells, aquifer slug tests and aquifer pumping tests. The uppermost aquifer of the site is located within the saprolitic soils and bedrock. Groundwater flow within the site occurs primarily within the saprolitic soils and bedrock fractures. Recharge occurs over most of the site where water infiltrates into the saprolitic soils and then percolates into the bedrock fractures. Discharge occurs at the unnamed tributaries and into Jim and Cary Branches.

Hydraulic conductivity values for the saprolite/bedrock aquifer ranges from 0.0003 ft/day to 0.019 ft/day in the pump wells and from 0.15 ft/day to 7.42 ft/day from the slug tests. Corresponding groundwater velocities range from 0.0008 ft/day to 0.0162 ft/day from the pump tests to 0.16 ft/day to 3.81 ft/day from the slug tests. (The Hutchinson Group, 2001).

This Water Quality Monitoring Plan (WQMP) has been prepared to meet the field sampling and laboratory analysis requirements of ongoing monitoring at the site. The WQMP details field and laboratory protocols that must be followed to meet the data objectives of semi-annual groundwater monitoring.

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, Red Rock Disposal will monitor the groundwater quality on a semi-annual basis.

2.2 MONITORING NETWORK AND ANALYTICAL PARAMETERS

A review of historical water level data indicates that groundwater is flowing to the south at C&D landfill toward the discharge point of Jim Branch. There are 9 locations proposed for inclusion in the MSW landfill monitoring network. In general, these are similar to the previous Water Quality Monitoring Plan; however, modifications from prior monitoring events are discussed in detail in **Section 2.2.1**. The monitoring network is summarized in the table below.

MSW Landfill Monitoring Network

Well	Location	Analytical Parameters
MW-2T	Downgradient	Appendix I + Field + C&D
MW-3	Downgradient	Appendix I + Field + C&D
MW-4	Downgradient	Appendix I + Field + C&D
MW-5	Downgradient	Appendix I + Field + C&D
MW-6T	Cross-gradient	Appendix I + Field + C&D
MW-10	Upgradient	Appendix I + Field + C&D
MW-11	Upgradient	Appendix I + Field + C&D
MW-12	Upgradient	Water Levels Only
MW-14	Cross-gradient	Appendix I + Field + C&D
SW-2	Downgradient Trib.of Jim Branch	Appendix I + Field
SW-3	Downgradient in Jim Branch	Appendix I + Field

Note: Appendix I and C&D parameters are listed in **Table 1**.

The aforementioned wells are installed to monitor groundwater in the uppermost aquifer at the site. This monitoring system is shown on **Figure 1** and is adequate to detect any releases from the landfill unit.

2.2.1 Modifications from Previous Monitoring Network

In February 2011[1] RSG, on behalf of Red Rock Disposal, requested to abandon monitoring well MW-13 and change the monitoring of well MW-12 from sampling to water levels only. This request was approved on March 3rd, 2011 by NCDENR[2].

[1] Letter from Ms. Joan Smyth of Richardson Smith Gardner to Ms. Jaclynne Drummond of NCDENR dated February 7, 2011.
[2] Letter from Ms. Jaclynne Drummond of NCDENR to Ms. Joan Smyth of RSG approving request to abandon MW-13, March 3, 2011.

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, phases of work will proceed from the upgradient (background) wells to downgradient (compliance) wells.**

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 for pumps, must be situated away and downwind from all site activities (i.e. purging and sampling). If field conditions prevent such placement, then the fuel source must be placed as far away as possible from the sampling activities. The conditions of sampling 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

All non-dedicated equipment that will 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 nitrile 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 contamination of equipment during storage or transport.

It should be noted 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.

Sampling will be planned and conducted in such a way as to minimize the need for decontamination in the field through the use of dedicated sampling equipment, or a new disposable Teflon bailer at each well. Unclean equipment will be segregated from clean equipment during all field activities. All 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 any purging or sampling activities. Static water level and well depth measurements are necessary to calculate the volume of stagnant water 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 on the lip of the well riser from which all water level measurements will be taken. The elevation of the reference point will be established by a Registered Land Surveyor.

2.3.2.2 Contamination Prevention

Upon opening each well, new nitrile surgical gloves will be donned. Appropriate measures will be taken during all 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 will be used to accurately measure depth to groundwater in each well and/or piezometer. The electronic water level indicator will be constructed of inert materials such as stainless steel and Teflon. **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 detailed description of field notes to be collected):

- Depth to static water level (to the nearest 0.01 foot);
- Depth to well bottom (if purging will be completed using a bailer or other non-low flow methods);
- Height of water column in the riser (based upon measured depth of well);
- Condition of wellhead protective casing, base pad and riser; and
- Changes in condition of well and surroundings.

2.3.3 Well Monitor Evaluations

2.3.3.1 Description

Water accumulated in each well may be stagnant and unrepresentative of surrounding aquifer conditions and therefore must be removed to insure that fresh formation water is sampled. Each well will be purged of standing water in the well casing following the measurement of the static water level unless low-flow, micropurge sampling techniques are utilized. Monitoring well evacuation should be performed in upgradient wells first, and by systematically moving to downgradient well locations.

2.3.3.2 Contamination Prevention

New nitrile surgical gloves will be donned for all well purging and sampling activities and whenever handling decontaminated field equipment. Appropriate measures will be taken during all measurement, purging and sampling activities 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

Two options for well purging are used at this site including:

- Bailers; and
- Low Flow 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-clean 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).

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 so as to minimize the amount of aeration and turbidity. If the water table is above the top of the screened interval, the amount of drawdown 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 disturbance to the water column. 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. The minimum volume/time period is determined based on the stabilized flow rate and the amount of volume in the pump and the discharge tubing (alternatively, the volume of the flow cell can be used, provided it is greater than the volume of the pump and discharge tubing). Volume of the bladder pump should be obtained from the manufacturer. Volume of the discharge tubing is 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

Once the volume of the flow-cell or the pump and the discharge tubing has been calculated, the well purge will begin. The flow rate should be based on historical data for that 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 1 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 follows: pH (+/- 0.2 S.U.), conductance (+/- 5% of reading), temperature (+/- 10% of reading or 0.2^{o}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 the stabilization of the WQPM, and following the collection of the samples. 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.

Stabilization of the WQPM 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 the field book.

Each well is to be sampled immediately following stabilization of the WQPM. The sampling flow rate must be maintained at a rate that is 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 will also be taken to minimize disturbance to the well sidewalls and bottom which could result in the suspension of silt and fine particulate matter. The volume of water purged from each well and the relative rate of recharge will be documented in sampling field notes. 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 that is lowered into the well or which 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 de-ionized water. Detailed equipment decontamination procedures are detailed in **Section 2.3.1.3**.

2.3.4 Sample Collection

After purging activities are complete, groundwater samples will be collected for laboratory analysis. Sampling is undoubtedly 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, all 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.

Upon completion of the sample label, the label should be affixed to the sample bottle prior to sampling.

Sampling will occur within 24-hours of the purging of each well 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 of temperature, pH, and specific conductance will be made immediately prior to sampling each monitoring point. For all low-flow sampling, dissolved oxygen (DO) and oxidation reduction potential (ORP) shall also be collected. Additionally, turbidity measurements should also be collected for evaluation of any metals detected. The field test specimens will be collected with the sampling bailer and placed in a clean, non-conductive glass or plastic container for observation. The calibration of the pH, temperature, conductivity and turbidity meters 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, litmus paper or back-up meter will be available in case of meter malfunction.

2.3.4.2 Sample Equipment

Two options for sample collection are used at this site including:

- Teflon Bailers; and
- Low Flow Pumps.

Of these, Low Flow purging/sampling systems are the most prevalent as the Grundfos pumps are utilized for low flow purging/sampling. Low flow purging/sampling is recommended for this site wherever possible.

Teflon 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 – Upon completion of 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**.

2.3.4.3 Sample Transference

Samples will be transferred directly from the Teflon bailer 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, as part of routine monitoring, only purgeable organics, total metals and wet chemistry 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;
- Wet Chemistry Parameters;
- Microbiologicals; and
- Measurements of 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 all other parameters and withdraw the pump and tubing. Then collect the volatile and extractable organics.

All samples will be collected and analyzed in an **unfiltered** state during sampling events. Samples for dissolved metal analysis, 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

All 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, de-ionized 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

Upon completion of 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 quality of the samples. One set of field (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 quality of the samples. This sample will be collected using the same equipment utilized for well sampling. A duplicate groundwater sample may be collected from a single well as a check of laboratory accuracy. 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 rinsed with 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 details of 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. The scheduling of sampling events and the interpreted surface water data must take into account 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 the removal of surface and submerged debris, slightly deepening the station to allow sample container immersion, or channeling/piping to consolidate local discharge. When modifications are required, sufficient time will be allowed for settlement of suspended solids between the disturbance and sample collection. A minimum settling period of four hours prior to sampling will be observed.

2.4.2 Sample Collection

2.4.2.1 Collection Procedure

Surface water samples will be obtained from areas of minimal turbulence and aeration. Samples will only be collected if flowing water is observed during the sampling event. New nitrile surgical gloves will be donned prior to sample collection. The following procedure will be implemented regarding sampling of surface waters:

1. Put on new nitrile surgical gloves.

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

3. Push the sample container slowly into the water and tilt up towards the current to fill. A water depth of six inches is generally satisfactory. Care will be taken 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 mouth of the container pointing upstream.

2.4.2.2 Field Parameters

Temperature, pH, specific conductivity and turbidity will be taken at the start of sampling as a measure of field conditions and check on the stability of the water samples over time. Measurements of temperature, pH, specific conductivity and turbidity will be recorded for all surface water samples. The calibration of the pH, temperature, conductivity, and turbidity meters will be completed 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 volatilization sensitivity of the parameters as follows:

- 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.

All 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

All field meters which might contact surface water samples will be thoroughly decontaminated between stations by washing with non-phosphate soapy, de-ionized 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 trip blanks to verify that the handling process has not affected the quality of the samples. Any 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.

3.2 BLANK SAMPLES

3.2.1 Trip Blanks

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

3.2.2 Field Blanks

Where there are wells that are sampled with non-dedicated equipment, field blank samples shall be collected at a rate of one sample per day. To collect a field blank, a bailer shall be filled with non-organic (milli-Q) water. Handling the bailer in a manner identical to well sampling, the water is to be transferred into the sample collection jars specified for the field blanks. These samples are packed and sent to the laboratory with the other samples.

3.3 BLANK CONCENTRATIONS

The concentration levels of any contaminants found in the trip or field blank will be reported but will not be used to correct the 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.

3.4 FIELD INSTRUMENTS

All 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 measurement for each sample. The specific conductivity and pH meter shall be recalibrated utilizing two prepared solutions of known concentration in the range of anticipated values (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

Methods of sample preservation, shipment, and chain-of-custody procedures to be 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 in order to preserve the integrity of samples 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^{o} 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 period of time in person or using an overnight delivery service to insure holding times are not exceeded. If samples are not shipped the same day, the ice used to keep the samples cool shall be replenished in order to maintain the required temperature of 4^{o} C. Shipment and receipt of samples 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 concentrations of contaminants 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. Chain-of-Custody control procedures for all samples will 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 or site or picked up at the laboratory in sealed coolers.

2. Upon receipt of the sample kit, the sampler will inventory the container kit and check its consistency with number and types of containers indicated in the Chain-of-Custody forms and required for the sampling event.

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

4. Collected specimens will be placed in the iced coolers 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 can not be maintained by the field technician, the coolers will be temporarily sealed and placed in a secured area.

5. Upon delivery to the laboratory, samples will be given laboratory sample numbers and recorded into a logbook indicating client, well number, and date and time of delivery. 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 refrigeration of the samples is maintained.

6. Copies of the complete Chain-of-Custody forms will be placed in the laboratory's analytical project file and attached to the laboratory analysis report upon completion.

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

5.1 OVERVIEW

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
- Date and Time of Sampling
- Climatic Conditions During Sampling Event
- Sampling Point/Well Identification Number
- Well Static Water Level
- Height of Water Column in Well
- Purged Water Volume and Well Yield (High or Low)
- Presence of Immiscible Layers and Detection Method
- Observations on Purging and Sampling Event
- Time of Sample Collection
- Temperature, pH, Temperature, DO, ORP, Turbidity, and Conductivity Readings
- Signature of Field Technician
- 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 field indicators of water quality (pH, conductivity, temperature and turbidity) and those constituents listed in **Table 1**. All analytical methods are taken from Test Methods For Evaluating Solid Waste - Physical/Chemical Methods (SW-846) or Methods For the Chemical Analysis of Water and Wastes and will be consistent with the Division of Waste Management'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 owner/operator of the landfill is responsible for selecting a laboratory contractor and insuring that the laboratory is utilizing proper QA/QC procedures. The laboratory must have a QA/QC program based upon 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 all 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 the use of 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 (1) blank and three (3) 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 the precision of testing methods, and standard references shall be processed not less than monthly to assess the accuracy of analytical procedures. Method or procedural blanks and spiked or fortified samples shall be carried through all stages of sample preparation and measurement to validate the efficiency and accuracy of the analysis.

6.4 DATA REVIEW

During the course of the 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 responsibility of the contracted laboratory to verify that all subcontracted work is completed 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 implementation of the WQMP.

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 rate and direction of groundwater flow at the site. The direction of groundwater flow will be determined by a comparison of groundwater surface elevations across the site through the construction of a potentiometric surface map. Groundwater flow rate will be determined using the following equation:

$$\mathbf{V=KI/n}$$

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 requirements of the rules, 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 RESULT REPORTING

Copies of all laboratory analytical data will be forwarded to the SWS within 120 calendar days of the receipt of laboratory data. The analytical data submitted will specify the date of sample collection, the sampling point identification and include a map of sampling locations. Should a significant concentration of contaminants be detected in ground and surface water, as defined in North Carolina Solid Waste Rules, Groundwater Quality Standards, or Surface Water Quality Standards, the owner/operator of the landfill shall notify the SWS and will place a notice in the landfill records as to which constituents were detected.

All monitoring reports will be submitted with the following:

1. An evaluation of potentiometric surface
2. Analytical laboratory reports and summary tables
3. A Solid Waste Environmental Monitoring Reporting Form (included in **Attachment 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 all laboratory results and water quality reports for Red Rock Disposal will be kept at the RDD office. Reports summarizing all groundwater quality results and data evaluation will be submitted to the Division of Waste Management for each sampling event. Depending upon the analytical results received, graphical analyses may be performed to evaluate long term trends.

8.0 MONITORING PROGRAM MODIFICATIONS

8.1 OVERVIEW

This section addresses the procedures that should be followed with respect to any 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 rate and direction of groundwater flow at the site.

Should wells become irreversibly damaged or require rehabilitation, the Solid Waste Section (SWS) shall be notified. If monitoring wells and/or piezometers are damaged irreversibly they shall be abandoned under the direction of the SWS. The abandonment procedure in unconsolidated materials will consist of 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 will consist of plugging the interior well riser and screen with an impermeable neat cement grout and/or bentonite clay sealant.

8.3 ADDITIONAL WELL INSTALLATIONS

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

All 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 SWS that the installation complies with the North Carolina Regulations. Upon installation of future wells the documentation for the construction of each well 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 upon approval of this Water Quality Monitoring Plan.

Figure

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LEGEND

⊕ MONITORING WELL

△ SURFACE WATER MONITORING LOCATION

REFERENCES:

1. PHOTOGRAPHY FROM AN AERIAL SURVEY DATED FEBRUARY 11, 2010 BY GEODATA CORPORATION, ZEBULON, NC.

0 400 800 Feet

RICHARDSON SMITH GARDNER & ASSOCIATES
ENGINEERING & GEOLOGICAL SERVICES

FIGURE NO.	1
SCALE:	AS SHOWN
CHECKED BY:	J.A.S.
DRAWN BY:	C.T.J.
FILE NAME	REDROCK-B0109
PROJECT NO.	RED ROCK 11-1
DATE:	JUNE 2011

TITLE:

RED ROCK DISPOSAL, LLC
C&D LANDFILL
GROUNDWATER FLOW DIRECTION

G:\CAD\Red Rock\Red Rock 11-1\sheets\REDROCK-B0109.mxd

Table

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RICHARDSON SMITH GARDNER & ASSOCIATES
ENGINEERING & GEOLOGICAL SERVICES
14 N. BOYLAN AVENUE
RALEIGH, NORTH CAROLINA 27603
NC. LIC. NO. C0828 (ENGINEERING)

By: JAS
Date: 3/31/11

Table 1
Appendix I Analyte List with Field Parameters C&D Landfill Analytes

Appendix I Constituents	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	
Dissolved Oxygen	Field	
ORP	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
Additional Parameters for C&D Landfill		
Alkalinity	SM2320B	
Chloride	SM4500 CLB	
Manganese	200.7	
Mercury	245.1	
Sulfate	SM4500	
Iron	7300	
Total Dissolved Solids	SM2540C	

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

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Attachment 1

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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

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