



December 15, 2011

Mr. Ming-Tai Chao, P.E.
 Environmental Engineer II
 NC DENR - Division of Waste Management
 217 West Jones Street
 Raleigh, NC 27603

Permit No.	Date	Document ID No.
51-03	December 16, 2011	15771

RECEIVED
December 15, 2011 via an e-mail
 Solid Waste Section
 Raleigh Central Office

**Re: Johnston County Landfill (Permit No. 51-03)
 LFG Collection & Control System Expansion 2011
 Comments on Construction Documentation Report
 Response to Comment No. 9**

Dear Mr. Chao:

On behalf of Johnston County, Richardson Smith Gardner & Associates, Inc. (RSG) would like to respond to Comment No. 9 in your letter dated November 29, 2011 (see **attached**), as follows. The comment stated in your letter is repeated below in *italics* and our response follows in **bold**.

9. *In the February 18, 2011 letter (DOC ID 12976), the SWS has requested the County to submit the revised document including the modification of Operation Plan and Closure and Post-Closure Plan to the existing Permit Amendment Application, Johnston County MSW Landfill, Phase 4A, Cell 3, which was approved by the SWS in 2009. Via the February 28, 2011 e-mail message, the SWS has further agreed the County's consultant request that the above-mentioned document would be submitted to SWS within four (4) weeks after the LFGCCS starts. Since the Report and the report cover letter do not mention the schedule of submittal of the aforementioned document, please provide the firm submittal date.*

Please find attached a revised Operations Manual and Closure and Post-Closure Plan for the landfill. Note that the following modifications have been made in these documents:

<u>Document</u>	<u>Section/Table</u>	<u>Modification</u>
Operations Manual	Section 1.2	Updated contact information.
	Section 3.5	Replaced prior text; now references SWANA LFG O&M Manual of Practice.
	Section 3.6	Replaced prior text; now addresses LFG monitoring plan.
Closure and Post-Closure Plan	Section 2.4.7	Added description related to decommissioning activities.
	Table 2.1	General updates made.
	Section 3.4	Added description related to assessment and corrective action costs.
	Section 3 Tables	Updated/revised cost information as necessary (including LFG system related costs); Added Table 3.3.

Mr. Ming-Tai Chao, P.E.
December 15, 2011
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Please contact me at your earliest convenience with any questions or comments which you may have on this submittal.

Sincerely,
Richardson Smith Gardner & Associates, Inc.



Pieter K. Scheer, P.E.
Principal, Project Manager
pieter@rsgengineers.com



December 15, 2011

Attachments: NC DWM Letter - November 29, 2011
Revised Operations Manual
Revised Closure and Post-Closure Plan

cc: Rick Proctor, Johnston County



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

Beverly Eaves Perdue
Governor

Dexter R. Matthews
Director

Dee Freeman
Secretary

Solid Waste Section

November 29, 2011

Mr. Tim Broome, Director
Johnston County Public Utilities Department
Post Office Box 2263
Smithfield, NC 27577-2633

Re: Comments on Construction Documentation Report
Landfill Gas Collection and Control System Expansion 2011
Johnston County Landfill Facility, Johnston County, North Carolina
Permit No. 51-03, Document ID No. (Doc ID) 15642

Dear Mr. Broome:

On November 17, 2011, the Division of Waste Management (DWM), Solid Waste Section (SWS) received the following document:

- *Construction Documentation Report – Landfill Gas Collection and Control System Expansion 2011*, Johnston County Landfill (Permit # 51-03). Dated November 17, 2011. Prepared by C21 Methane Partners in New York, New York and SCS Engineers, PC (SCS) in Charlotte, North Carolina (Doc ID 15611).

After conducting a review, the SWS has comments on the Construction Documentation Report (Report) for the constructed landfill gas collection and control system (LFGCCS). Your responses to the following comments will expedite the review of the report:

1. The gas well EW-417 is likely removed from the proposed LFGCCS because no information of this well is provided in the Report. If this is correct, please add status of well EW-417 to the Report.
2. (Section 2.2 – Landfill Gas Extraction Wells)
 - i. As described in this sub-section the well borings were backfilled by a NC DOT No. 57 stone, bentonite seals, and soil which is consistent with the approved work plan (Doc ID 12972). However, the well logs in Appendix C described that # 4 washed aggregates were used as backfill around well screens/slots. Please clarify the discrepancy.
 - ii. The approved specification for a gas well (see Note 10 on the Drawing No. 4 of 6 of the approved work plan) requires the stone gradation in the ranges from ½ -inches to 1and1/2 – inches determined by ASTM Method D 421 at the testing frequency of one test per 250

cubic yards. Please provide the type and quantity of the stone used for this project and stone gradation testing results.

3. (Section 4 - Summary and Conclusion) The submitted final Report must be signed, sealed, and certified by a professional engineer registered in the State of North Carolina.
4. (Appendix B - SCS Daily Field Reports) The descriptions of well relocation in the field (EW-406, EW-408, EW-410, EW-411, EW-414, and EW-505) in the Daily Field Report are inconsistent with remarks made to the well logs in Appendix C. Please clarify.
5. (Appendix C – Landfill Gas Extraction Well Logs)
 - i. Please double check the consistency of the present data against the sketch of boring log. For example, the well log for EW-503, the total depth is noted 40 feet, but the boring log shown 41 feet.
 - ii. Well logs of EW-510 & EW-511 are incomplete. There is no “description” of excavated material / waste in the log.
 - iii. According to the data shown on the well logs for EW-509, EW-510, & EW-511 and the baseliner elevations at these two locations shown on the Drawing No. 4 of 6 in the approved work plan, **the wells have likely penetrated the landfill baseliner system.** The well logs indicated each “well was constructed at surveyed location and terminated at the specific depth.” However, the well depths do not terminate at the proposed depth or adjust according to the ground surface elevation provided by a surveyor. The County must provide the SWS solid information to demonstrate the landfill baseliner system is intact and not damaged by the well installation. Should the baseliner system have been damaged due to well installation, within 15 calendar days after receiving this comment letter, the County must submit a work plan to assess and restore the damaged landfill liner system in the areas surround the wells. The SWS will review the submitted plan, and the County shall not conduct any baseliner restoration activities prior to the SWS approval.
6. (Appendix D – Record Drawing No. 1 of 1)
 - i. The as-built drawing must be signed and sealed by a professional engineer or licensed surveyor registered in the State of North Carolina.
 - ii. Please provide the final well schedule (tabulated format) in consistent with the well logs on the as-built drawing. For example final data of the ground elevation, well depth, etc is based on survey results. Well EW-417 is removed from the project scope. Since many wells are relocated in the field, so the final northing & easting coordinates of these well must be provided in the record report.
7. (Appendix F – Leak Test Results) Air testing that was conducted at 14:00 p.m., June 25, 2011 through 07:00 a.m., June 26, 2011 on the 2-inch forcemain and 2 X 4 DC shown the pressure drop/ air loss ”1 lb.” Please explain why the test result is acceptable.
8. (Appendix G – Correspondence) The NCDHHS letter dated December 6, 2010 is a review/comment correspondence to inquire clarification and more information and not an

approval document. Please provide the documentation issued by NCDHHS that approved the asbestos-containing material/waste plan associated with the construction of LFGCCS.

9. In the February 18, 2011 letter (Doc ID 12976), the SWS has requested the County to submit the revised document including the modification of Operation Plan and Closure and Post-Closure Plan to the existing *Permit Amendment Application, Johnston County MSW Landfill, Phase 4A, Cell 3*, which was approved by the SWS in 2009. Via the February 28 2011 e-mail message, the SWS has further agreed the County's consultant request that the above-mentioned document would be submitted to SWS within four (4) weeks after the LFGCCS starts. Since the Report and the report cover letter do not mention the schedule of submittal of the aforementioned document, please provide the firm submittal date.

Please respond the above-mentioned comments and provide the SWS one hard copy and an electronic copy (in the pdf format) of the revised Report. The Solid Waste Section appreciates your efforts and cooperation in this matter. If you have any questions or would like to schedule a meeting to discuss this matter further, please contact me at (919) 707-8251.

Sincerely,

Ming-Tai Chao, P.E.
Environmental Engineer II
Permitting Branch, Solid Waste Section

cc:

Steven C. Lamb, P.E., SCS
Donna Wilson, DWM
Mary Whaley, DWM

Ed Mussler, Permitting Branch Supervisor
Dennis Shackelford, DWM
Central Files

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Operations Manual

Johnston County Landfill Facility Smithfield, North Carolina

Prepared for:

Johnston County Department of Public Utilities
Smithfield, North Carolina

December 2011



14 N. BOYLAN AVENUE
RALEIGH, NORTH CAROLINA 27603
NC LIC. NO. C-0828 (ENGINEERING)

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**JOHNSTON COUNTY
JOHNSTON COUNTY LANDFILL FACILITY**

OPERATIONS MANUAL

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FIGURES

Figure 1	Existing and Proposed Landfill Units and Solid Waste Management Activities
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Appendix B	Waste Screening Form
Appendix C	Cell Activation Forms
Appendix D	Leachate Recirculation Plan
Appendix E	Irrigation of Reclaimed Wastewater

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SECTION 1.0 GENERAL FACILITY OPERATIONS

1.1 OVERVIEW

This Operations Manual was prepared for operations of the Johnston County Landfill facility (Permit No. 51-03) located off of Highway 210 on County Home Road near Smithfield. This document discusses the operation of the following landfill units and other solid waste management activities:

- Phase 4A Lined Subtitle D MSW Landfill Unit (Cell 3 - Proposed);
- Area 1 C&D Vertical Expansion;
- Area 2 Lined C&D Landfill Unit;
- Yard Waste Processing Area; and
- Convenience Center.

Refer to **Figure 1** for the location of existing and proposed landfill units and other solid waste management activities.

The information contained herein was prepared to provide landfill personnel with a clear understanding of how the Design Engineer assumed that the completed facility would be operated. While deviations from the operations outlined here may be acceptable, they should be reviewed and approved by the Design Engineer. Please refer to the appropriate permit application for a detailed discussion and calculations for the individual components of each landfill unit, including phasing plans.

1.2 CONTACT INFORMATION

All correspondence and questions concerning the operation of the Johnston County Landfill should be directed to the appropriate County and State personnel listed below. For fire or police emergencies dial 911.

1.2.1 Johnston County

Johnston County Department of Public Utilities
309 E. Market Street
P.O. Box 2263
Smithfield, NC 27577
Phone: (919) 209-8333
Fax: (919) 934-7174

Contacts: Tim Broome, P.E., Director

Johnston County Solid Waste Management Department
680 County Home Road
P.O. Box 2263
Smithfield, NC 27577
Phone: (919) 938-4750
Fax: (919) 989-7152

Contact: Rick Proctor, Solid Waste Manager

1.2.2 North Carolina Department of Environment and Natural Resources

North Carolina DENR - Raleigh Central Office (RCO)
217 West Jones Street
Raleigh, NC 27603
Phone: (919) 707-8200
Fax: (919) 707-8200

North Carolina DENR - Raleigh Regional Office (RRO)
3800 Barrett Drive
Raleigh, NC 27609
Phone: (919) 571-4700
Fax: (919) 571-4718

North Carolina DENR - Fayetteville Regional Office (FRO)
225 Green Street, Suite 714
Fayetteville, NC 28301
Phone: (910) 486-1541
Fax: (910) 486-0707

Division of Waste Management (DWM) - Solid Waste Section:

Field Operations Branch Head:	Mark Poindexter (RCO)
Eastern District Supervisor:	Dennis Shackelford (FRO)
Waste Management Specialist:	Mary Whaley ((919) 693-5023)

Division of Land Resources - Land Quality Section:

Regional Engineer:	John Holley, P.E. (RRO)
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1.3 ACCESS CONTROL

Limiting access to the landfill facility is important for the following reasons:

- Unauthorized and illegal dumping of waste materials is prevented.
- Trespassing, and injury resulting therefrom, is discouraged.
- The risk of vandalism is greatly reduced.

Access to active areas of the landfill will be controlled by a combination of fences and natural barriers, and strictly enforced operating hours. A landfill attendant will be on duty at all times when the facility is open for public use to enforce access restrictions.

1.3.1 Physical Restraints

The site will be accessed by the existing entrance on County Home Road. Scales and a scale house and office are provided at the entrance. All waste will have been weighed prior to being placed in the landfill. The entrances have gates which will be securely locked during non-operating hours.

1.3.2 Security

Frequent inspections of gates and fences will be performed by landfill personnel. The County will arrange for a random security patrol of the main gate to further discourage trespassing. Evidence of trespassing, vandalism, or illegal operation will be reported to the County Solid Waste Manager.

1.4 SIGNAGE

A prominent sign(s) containing the information required by the DWM will be placed at the landfill entrance. This sign(s) will provide information on operating hours, operating procedures, and acceptable wastes. Additional signage will be provided within the landfill complex to distinctly distinguish the roadway to the active landfill unit(s). Service and maintenance roads for use by operations personnel will be clearly marked and barriers (e.g., traffic cones, barrels, etc.) will be provided as required.

1.5 COMMUNICATIONS

Two way radio communication will be maintained between the active landfill unit(s) and the landfill scale house and office. The scale house and office have telephones in case of emergency and for the conduct of day-to-day business. Emergency telephone numbers are displayed in the scale house and office.

1.6 FIRE AND SAFETY

1.6.1 Fire Control

The possibility of fire within the landfill or a piece of equipment must be anticipated in the daily operation of the landfill. A combination of factory installed fire suppression systems and/or portable fire extinguishers will be operational on all heavy pieces of equipment at all times. For larger or more serious outbreaks, the local fire department will respond.

Fires within the landfill will be limited by the use of daily and intermediate cover as a

fire break and control of "hot" loads entering the landfill. Landfill personnel at the scale house will turn away all trucks containing waste that is suspected to be hot. If a hot load is placed on the working face, then the load will be spread as thin as possible and daily cover soil will be immediately placed on the waste to extinguish the fire.

In general, fires that break out close to the surface of the disposal area should be excavated and smothered with cover material. Deep fires should be smothered out by placing moist soil on the surface and by constructing soil barriers around the fire. Where the smothering technique fails, the burning material must be excavated and smothered or quenched with water once the burning material is brought to the surface. Water is usually not effective unless it can be directly applied to the burning material.

For the lined landfill unit(s), in the event a fire occurs in the first lift of waste immediately above the protective cover layer, the possibility of damage to geosynthetics and collection piping exists. Once the fire is extinguished, the residue must be removed to allow limited inspection of the geosynthetics and piping. Damaged sections of geosynthetics, piping, etc. must be removed and replaced with new items of the same or equal material. The new materials must be placed in accordance with the technical specifications and construction quality assurance (CQA) documents prepared for this facility.

The County will verbally notify the DWM (see **Section 1.2.2**) within 24 hours of discovery of a fire within any landfill disposal area. In addition, written documentation describing the fire, the actions carried out to extinguish the fire, and a strategy for preventing future occurrences will be provided to the DWM within 15 days following any such occurrence.

1.6.2 Safety

All aspects of the operation of the landfill facility were developed with the health and safety of the landfill's operating staff, customers, and neighbors in mind. Prior to commencement of operations in the new landfill phase/area, a member of the landfill operating staff will be designated site safety officer. This individual, together with the facility's management will modify the site safety and emergency response program to remain consistent with National Solid Waste Management Association and Occupational Safety and Health Administration (OSHA) guidance.

Safety equipment provided includes equipment rollover protective cabs, seat belts, audible reverse warning devices, hard hats, safety shoes, and first aid kits. Landfill personnel will be encouraged to complete the American Red Cross Basic First Aid Course. Other safety requirements as designated by the County will also be implemented.

1.7 SEVERE WEATHER CONDITIONS

Unusual weather conditions can directly affect the operation of the landfill facility. Some of these weather conditions and recommended operational responses are as follows.

1.7.1 Ice Storms

An ice storm can make access to the landfill dangerous, prevent movement or placement of daily cover, and, thus, may require closure of the landfill until the ice is removed or has melted.

1.7.2 Heavy Rains

Exposed soil surfaces can create a muddy situation in some portions of the landfill during rainy periods. The control of drainage and use of crushed stone on unpaved roads should provide all-weather access for the site and promote drainage away from critical areas. In areas where the aggregate surface is washed away or otherwise damaged, new aggregate should be used for repair.

Intense rains can affect newly constructed drainage structures such as swales, diversions, cover soils, and vegetation. After such a rain event, inspection by landfill personnel will be initiated and corrective measures taken to repair any damage found before the next rainfall.

1.7.3 Electrical Storms

The open area of a landfill is susceptible to the hazards of an electrical storm. If necessary, landfilling activities will be temporarily suspended during such an event. To guarantee the safety of all field personnel, refuge will be taken in the on-site buildings or in rubber-tired vehicles.

1.7.4 Windy Conditions

Landfill operations during a particularly windy period may require that the working face be temporarily shifted to a more sheltered area. When this is done, the previously exposed face will be immediately covered with daily cover.

1.7.5 Violent Storms

In the event of hurricane, tornado, or severe winter storm warning issued by the National Weather Service, landfill operations may be temporarily suspended until the warning is lifted. Daily cover will be placed on exposed waste and buildings and equipment will be properly secured.

1.8 EQUIPMENT REQUIREMENTS

The County will maintain on-site equipment required to perform the necessary landfill activities. Periodic maintenance of all landfilling equipment, and minor and major repair work will be performed at designated maintenance zones outside of the landfill.

1.9 PERSONNEL REQUIREMENTS

At least one member of the landfill supervisory staff will be certified as a Manager of Landfill Operations (MOLO) by the Solid Waste Association of North America (SWANA). Each landfill employee will go through an annual training course (led by supervisory staff) and is certified by SWANA as Landfill Operations personnel. As part of this training, personnel learn to recognize loads which may contain prohibited wastes.

1.10 UTILITIES

Electrical power, water, telephone, and restrooms are provided at the landfill scale house and/or office.

1.11 RECORD KEEPING PROGRAM

The County will maintain the following records in an operating record at the landfill:

- A. Waste inspection records (see **Section 2.4**);
- B. Daily tonnage records - including source of generation;
- C. Waste determination records;
- D. Quantity, location of disposal, generator, and special handling procedures for all special wastes disposed of at the site;
- E. List of generators and haulers that have attempted to dispose of restricted wastes;
- F. Employee training procedures and records of training completed;
- G. Documentation of cell activation (see **Section 2.5.2.2**)
- H. Leachate records (see **Section 3.3.3**);
- I. Gas monitoring results and remediation measures as required (see **Section 3.4.2**);
- J. All ground water monitoring and surface water quality information (See the current **Water Quality Monitoring Plan**) including:
 - 1. Monitoring well construction records;
 - 2. Sampling dates and results;
 - 3. Statistical analyses; and
 - 4. Results of inspections, repairs, etc.
- K. Annual landfill reports;
- L. All closure and post-closure information, where applicable, including:
 - 1. Testing;
 - 2. Certification; and
 - 3. Recording.
- M. Cost estimates or financial assurance documentation.

The operating record will be kept up to date by the Solid Waste Manager or his designee. It will be presented upon request to the DWM for inspection. A copy of this Operations Manual will be kept at the landfill and will be available for use at all times.

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SECTION 2.0 WASTE HANDLING OPERATIONS

2.1 OVERVIEW

This section describes the required waste handling operations for the Johnston County Landfill facility. In addition to the MSW and C&D waste disposed of at this facility, the County also processes recyclables, scrap tires, and white goods. These materials are stored at the landfill facility until there are sufficient quantities for pick up by various recycling contractors.

2.2 ACCEPTABLE WASTES

2.2.1 MSW Landfill Units

Only the waste as defined by NCGS 130A-290(a)(18a) generated within the approved service area may be disposed of in the MSW landfill units. In addition, the special wastes described in **Section 2.5.4** may also be disposed of in the MSW landfill units.

2.2.2 C&D Landfill Units

Only the following wastes generated within the approved service area may be disposed of in the C&D landfill unit:

- Construction and Demolition Debris: as defined in 15A NCAC 13B.0532(8) means solid waste resulting solely from construction, remodeling, repair, or demolition operations on pavement, buildings, or other structures. C&D waste does not include municipal and industrial waste that may be generated by on-going operations at buildings or structures.
- Land Clearing and Inert Debris Landfill: as defined in 15A NCAC 13B.0101(54) means a facility for the disposal of land-clearing waste, concrete, brick, concrete block, uncontaminated soil, gravel and rock, untreated and unpainted wood, and yard trash.
- Land Clearing Waste: as defined in 15A NCAC 13B.0101(53) means solid waste which is generated solely from land-clearing activities, limited to stumps, trees, limbs, brush, grass, and other naturally occurring vegetative material.
- Asphalt: in accordance with NCGS 130A-294(m).
- Other Wastes as Approved by the Solid Waste Section of the Division of Waste Management.

In addition, the special wastes (asbestos only) described in **Section 2.5.4** may also be disposed of in the C&D landfill units.

2.3 PROHIBITED WASTES

2.3.1 MSW Landfill Units

The following wastes are prohibited from disposal within the MSW landfill units:

- Whole Scrap Tires
- Used Oil
- White Goods
- Lead Acid Batteries
- Yard Waste
- Construction and Demolition Debris (C&D) (Except when allowed by the County)
- Aluminum Cans

In addition, operating criteria prohibit other materials from disposal within the MSW landfill units. These materials include:

- Hazardous waste as defined by NCGS 130A-290(a)(8), including hazardous waste from conditionally exempt small quantity generators.
- Polychlorinated biphenyls (PCB) wastes as defined in 40 CFR 761 with the exception of trace amounts found in materials such as consumer electronics.
- Bulk or non-containerized liquid wastes unless the waste is household waste other than septic waste and waste oil; or the waste is leachate or gas condensate derived from the MSW landfill unit. A liquid determination will be performed by the paint filter test (see **Appendix A** for apparatus and procedure).
- Containers holding liquid wastes unless the waste is household waste.

2.3.2 C&D Landfill Units

Only wastes, as defined in **Section 2.2.2** above may be accepted for disposal in the C&D landfill units. No other wastes may be accepted.

2.4 WASTE SCREENING PROGRAMS

In order to assure that prohibited wastes are not entering the landfill facility, screening programs have been implemented at the landfill. Waste received at both the scale house entrance and waste taken to the working face is inspected by trained personnel. These individuals have been trained to spot indications of suspicious wastes, including: hazardous placarding or markings, liquids, powders or dusts, sludges, bright or unusual colors, drums or commercial size containers, and "chemical" odors. Screening programs for visual and olfactory characteristics of prohibited wastes are an ongoing part of the landfill operation.

2.4.1 Waste Receiving and Inspection

All vehicles must stop at the scale house located at the entrance of the facility and visitors are required to sign-in. All waste transportation vehicles are weighed and the content of the load assessed. The scale attendant(s) requests from the driver of the vehicle a description of the waste it is carrying to ensure that unacceptable waste is not allowed into the landfill. The attendant(s) then visually checks the vehicle as it crosses the scale. Signs informing users of the acceptable and unacceptable types of waste are posted at the scale house. Once passing the scales, the vehicles are routed to the appropriate landfill unit or other area (convenience center, etc.) as appropriate.

Vehicles are randomly selected for screening at a rate of approximately 1% of industrial, commercial, and institutional vehicles entering the landfill. However, if something suspicious is spotted in any waste load, that load is inspected further. The number of loads inspected is determined by the total vehicle count as per scales tickets. Each calendar year the number is recalculated (For example, for 2001, 1% was equal to 252 vehicles; 264 vehicles were actually inspected).

Vehicles selected for inspection are directed to an area of intermediate cover adjacent to the working face where the vehicle will be unloaded. Waste is carefully spread using suitable equipment. An attendant trained to identify wastes that are unacceptable at the landfill inspects the waste discharged at the screening site. If unacceptable waste is found, including wastes generated from outside of the service area, the load will be isolated and secured by berming off the area. For unacceptable wastes that are non-hazardous, the Solid Waste Manager will then notify officials of the DWM (see **Section 1.2.2**) within 24 hours of attempted disposal of any waste the landfill is not permitted to receive in order to determine the proper course of action. For unacceptable wastes that are hazardous, the Hazardous Waste Contingency Plan outlined in **Section 2.4.2** will be followed. The hauler is responsible for removing unacceptable waste from the landfill property.

If no unacceptable waste is found, the load will be pushed to the working face and incorporated into the daily waste cell. All random waste inspections will be documented by landfill staff using the waste screening form provided in **Appendix B**.

In addition to random waste screening described above, waste unloaded on the active face will be inspected by the equipment operators, trained to spot unacceptable wastes, before and during spreading and compaction. Any suspicious looking waste is reported immediately to the designated primary inspector for further evaluation.

2.4.2 Hazardous Waste Contingency Plan

In the event that identifiable hazardous waste or waste of questionable character is detected at the landfill, appropriate equipment, protective gear, personnel, and materials as necessary will be employed to isolate the wastes. The DWM will be notified immediately (see **Section 1.2.2**) that an attempt was made to dispose of hazardous waste

at the landfill. If the vehicle attempting disposal of such waste is known, all attempts will be made to prevent that vehicle from leaving the site or, if the vehicle has left the site, immediate notice will be served on the owner of the vehicle that hazardous waste, for which they have responsibility, has been disposed of at the landfill.

The County will assist the DWM as necessary and appropriate in the removal and disposition of the hazardous waste and in the prosecution of responsible parties. If needed, the hazardous waste will be covered with either on-site soils or other tarping material until such time when an appropriate method can be implemented to properly handle the waste. The cost of the removal and disposing of the hazardous waste will be charged to the owner of the vehicle involved. Any vehicle owner or operator who knowingly dumps hazardous waste in the landfill may be barred from using the landfill.

Should an incident where hazardous waste is found at the landfill occur, the event will be documented by landfill staff using the waste screening form provided in **Appendix B**.

Records of information gathered as part of the waste screening programs will be maintained at the landfill site during its active life and as long as required by the County and the DWM.

2.5 WASTE DISPOSAL

2.5.1 Access

Traffic will be clearly directed to the appropriate active access road. For the active lined landfill unit(s), all vehicles entering the unit will use the active ramp to avoid damaging the liner system. Traffic speed on the ramp should be less than 10 MPH. Rutting of gravel roadway surfaces must be repaired by placement of additional gravel on the roadway and not solely by grading the rut. This will maintain the separator geotextile placed below most gravel roadway surfaces.

The location of access roads during waste placement will be determined by operations personnel in order to reflect waste placement strategy.

2.5.2 General Procedures

For each active landfill unit, waste transportation vehicles will arrive at the working face at random intervals. There may be a number of vehicles unloading waste at the same time, while other vehicles are waiting. In order to maintain control over the unloading of waste, a certain number of vehicles will be allowed on the working face at a time. The actual number will be determined by the truck spotter. This procedure will be used in order to minimize the potential of unloading unacceptable waste and to control disposal activity. Operations at the working face will be conducted in a manner which will encourage the efficient movement of transportation vehicles to and from the working face, and to expedite the unloading of waste.

The approach to the working face will be maintained such that two or more vehicles may safely unload side by side. A vehicle turn-around area large enough to enable vehicles to arrive and turn around safely with reasonable speed will be provided adjacent to the unloading area. The vehicles will back to a vacant area near the working face to unload. Upon completion of the unloading operation, the transportation vehicles will immediately leave the working face area. Personnel will direct traffic necessary to expedite safe movement of vehicles.

Waste unloading at the landfill will be controlled to prevent disposal in locations other than those specified by site management. Such control will also be used to confine the working face to a minimum width, yet allow safe and efficient operations. The width and length of the working face will be maintained as small as practical in order to maintain the appearance of the site, control windblown waste, and minimize the amount of cover required each day. Normally, only one working face will be active on any given day, with all deposited waste in other areas covered by either daily/periodic, intermediate, or final cover, as appropriate.

The procedures for placement and compaction of solid waste include: unloading of vehicles, spreading of waste into 2 foot lifts, and compaction on relatively flat slopes (i.e. 5H:1V max.) using a landfill compactor and a minimum number of three full passes.

Wind screens adjacent to the working face may be used as required to control windblown waste.

The use of portable signs with directional arrows and portable traffic barricades will facilitate the unloading of wastes to the designated disposal locations. These signs and barricades will be placed along the access route to the working face of the landfill or other designated areas which may be established.

2.5.3 Waste Disposal - Lined (MSW or C&D) Landfill Units

2.5.3.1 Cell Operations and Phasing

Each lined landfill unit is divided into cells. Each cell will be filled in sequence until the entire footprint is covered with waste. Phasing drawings are presented in the appropriate permit application for each landfill unit.

It is advantageous to begin to establish final cover grades along the perimeter berms as soon as is possible. This will allow earlier construction of intermediate or final cover to promote "clean" runoff and to spread out final cover construction costs.

2.5.3.2 Cell Activation

Before placing waste in a particular area of any cell, that area must be connected to the leachate collection system (LCS) by removing (or suitably shredding by tracking with a dozer) geosynthetic rain cover (if any) and/or making any required piping connections such that all liquid collected in that area will flow to the sump. Next, just ahead of waste placement operations, the Type GT-S geotextile placed over the gravel columns is to be cut and removed such that waste will be placed in direct contact with the coarse aggregate.

Once an area has reached its effective capacity, operations will move to the next scheduled area. Prior to placing waste in a new area, it must be connected to the LCS as described above.

See **Appendix C** for cell activation forms to be used in the documentation of cell activation activities.

2.5.3.3 Placement of Initial Lift

During waste placement operations, the landfill liner system is most vulnerable during the placement of the first lift of waste. The first lift of waste should be comprised of select loads spread on top of the protective cover layer. These select loads must be free of long or large pieces of waste that may push through the protective cover layer and damage the liner system. Workers will be positioned near the working face to check for any waste which could possibly penetrate the protective cover layer. The first lift should be a minimum of four (4) feet thick and provide sufficient area for at least one day's operation without placing other areas of the liner in jeopardy.

The side slopes of the liner system are also vulnerable during placement of the first lift of waste. As with the bottom slopes, the first lift of waste against the side slopes should be comprised of select loads.

In the event that the landfill staff identifies any damage to any part of the landfill's liner system, they should immediately initiate its repair. Additionally, they should document the damage and the repair as a part of the operating record.

2.5.3.4 Equipment Operations Within the Landfill

Both the facility's operational vehicles and waste transportation vehicles must be restricted as follows within the lined landfill:

- Equipment operation directly on the protective cover will be limited to rubber-tired vehicles having a maximum ground contact, i.e., tire pressure, of less than 32 psi.
- A minimum vertical separation of 3 feet will be maintained between the

- geomembrane liner and all waste transportation vehicles.
• A minimum vertical separation of 5 feet will be maintained between the geomembrane liner and waste compactors.

The operation of vehicles within those portions of the landfill not actively receiving waste should be restricted to activities associated with erosion and sedimentation control.

2.5.4 Special Waste Management

2.5.4.1 Asbestos Management (MSW or C&D Landfill Units)

The County may dispose of asbestos within either the MSW or C&D landfill units. Asbestos will only be accepted if it has been processed and packaged in accordance with State and Federal (40 CFR 61) regulations. Asbestos will arrive at the site in vehicles that contain only the asbestos waste and only after advance notification by the generator.

Once the hauler brings the asbestos to the landfill, the hauler will be directed to the designated asbestos disposal area by operations personnel. The designated disposal area will be prepared by operations personnel by leveling a small area using a dozer or loader. Prior to disposal, the landfill operators will stockpile cover soil near the designated asbestos disposal area. The volume of soil stockpiled will be sufficient to cover the waste and to provide any berms, etc. to maintain temporary separation from other landfill traffic.

Once placed in the prepared area, the asbestos waste will be covered with a minimum of 18 inches of cover soil placed in a single lift. The surface of the cover soil will be compacted and graded using a tracked dozer or loader. The landfill compactor will be prohibited from operating over asbestos disposal areas until at least 18 inches of cover are in-place.

The landfill staff will record the approximate location and elevation of the asbestos waste once cover is in-place. The Solid Waste Manager will then review pertinent disposal and location information to assure compliance with regulatory requirements and enter the information into the Operating Record.

Once disposal and recording for asbestos waste is completed, the disposal area may be covered with waste. No excavation into designated asbestos disposal areas will be permitted.

In general, for the lined landfill unit(s), no asbestos will be stored over gravel columns or over sump areas in order to minimize the potential for future disturbance.

2.5.4.2 Sewage Sludge Management (MSW Landfill Units)

Sewage sludge may be accepted for disposal within the MSW landfill units in accordance with Federal and State requirements. Sewage sludge will be co-disposed along with other wastes if the sludge passes the liquids restriction criteria (i.e., the Paint Filter Test) and has an acceptable Toxicity Characteristic Leaching Procedure (TCLP) test. Such testing will be the responsibility of the generator, but landfill staff may conduct spot testing.

In order to minimize the potential for clogging of the leachate collection and removal system, sewage sludge will not be placed within the first lift of waste. Sewage sludge may also be used as a soil conditioner incorporated into the vegetative soil layer of the final cover.

2.5.4.3 Spoiled Food and Animal Waste (MSW Landfill Units)

The disposal of spoiled foods, animal carcasses, and other animal wastes within the MSW landfill units will be handled as follows. The generator of the material must call in advance to the landfill, and a determination will be made as to whether or not the waste will be accepted. If the waste is approved, the generator will present the waste at a predetermined time. An area for disposal will already have been prepared and the waste will be covered immediately.

2.5.5 Daily or Periodic Cover

2.5.5.1 MSW Landfill Units

At the completion of waste placement each day, a 6 inch layer of earthen material or approved alternate daily cover (i.e. tarps (see **Section 2.5.5.3**), etc.) will be placed over the working face. This daily cover is intended to control vectors, fire, odors, and blowing litter. If the County should desire to use an alternate daily cover, a formal request and an appropriate demonstration will be made to the DWM.

2.5.5.2 C&D Landfill Units

At the completion of waste placement each week, or sooner if the area of exposed waste exceeds one acre in size, a 6-inch layer of earthen material or other material as approved by the DWM will be placed over the exposed waste. This periodic cover is intended to control vectors, fire, odors, and blowing debris.

2.5.5.3 Tarpomatic Alternative Daily Cover

The Tarpomatic apparatus consists of a 60' wide x 8' deep x 10' tall tubular steel support frame, a diesel engine, a hydraulic pump, stationary and remote control boxes, and a detachable 50 foot tarp spool. The frame has two carrier arms at the

top that will latch over the blade of a compactor (or dozer) allowing the apparatus to become mobile when needed. Each spool may carry three 40' x 100' tarps which provide up to 12,000 square feet of coverage. Tarps are made from a woven high density polyethylene fire retardant material with reinforced seams and edges and connecting straps on each end. Heavy steel chains are installed in pockets throughout the tarp to provide ballast to prevent wind uplift. Carrier arm adjustment, tarp spool drive, and spool locking levers are hydraulically controlled and are activated by the remote control box located inside the compactor cab.

To operate the Tarpomatic, the operator will drive the compactor up to the apparatus and align the blade with the carrier arms. The blade is then lifted upward into the carrier arms, raising the frame off the ground. Once the operator has positioned the compactor and Tarpomatic over the area of waste to be covered, each tarp is applied to the surface while backing over the waste. The tarp is unrolled at the same rate as the compactor movement so that it may be applied to the surface without pulling the tarp through the waste. Once the tarp is completely applied, the operator will detach the tarp straps and set the frame to the side. Tarps are rolled back onto the spool in the reverse order.

Typically, the Tarpomatic is used to cover over the daily working face only. As migration occurs throughout cell development, all traffic areas and side slopes are covered with daily or intermediate cover soil. Severe thunderstorms, high winds, or freezing precipitation may prohibit the use of the Tarpomatic. Daily or intermediate cover soil is used as cover every Friday or whenever inclement weather is forecasted.

Tarps that become damaged will be repaired or replaced as necessary. The County typically maintains 4 tarps on 2 spools and replaces tarps every 2 years.

2.5.6 Intermediate Cover

A 12 inch layer of soil cover should be placed on all waste surfaces that have not received waste in 30 days but are below final elevation. This intermediate cover should be seeded immediately and graded such that all precipitation run-off is channeled to the surface water systems.

2.5.7 Height Monitoring

Approximately every month, the landfill staff will monitor landfill top and side slope elevations with a level. When such elevations approach design grades, the final top-of-waste grades will be staked to limit over-placement of waste.

2.6 YARD WASTE PROCESSING AREA OPERATIONS

The operation of the yard waste processing area is as follows:

Acceptable wood and yard wastes are stockpiled to an approximate height of 10 feet over an area of approximately 1 acre (approximate weight of 1,500 to 2,000 lbs.). At that time a contractor is brought in to grind the waste. Once the waste is ground and becomes mulch, it is used either around the site, primarily for surface stabilization, or placed in windrows to be given to the public or otherwise used in the future. A full time attendant looks over both the yard waste processing area and the convenience center operations.

Adjacent to the yard waste processing area, there is approximately 14 acres available within two former borrow areas that are designated for use in the handling of debris from a natural disaster.

2.7 CONVENIENCE CENTER OPERATIONS

The operation of the citizen's convenience center is as follows:

The convenience center is set up with up to eight 40 yard roll-off containers for the collection of MSW (small loads) and recyclables. The County currently typically separately collects aluminum cans, newspaper, cardboard, mixed no. 1 and no. 2 plastics, and brown, green, and clear glass. The convenience center also includes collection facilities for white goods, used tires, waste oil, and batteries.

The white goods area currently occupies approximately a 50 foot by 100 foot area. County personnel remove the Freon, as necessary, and load the white goods into three to four 40 yard roll-off containers. Typically, every Wednesday, the County hauls the full containers to a local salvage yard, where the white goods can be recycled.

Used tires are collected at the convenience center in up to three tire trailers. Once one or more trailers are full, the used tires are taken to a tire recycler for recycling.

A full time attendant looks over both the convenience center and yard waste processing area operations.

SECTION 3.0 ENVIRONMENTAL MANAGEMENT

3.1 OVERVIEW

This section reviews the overall environmental management tasks required for the successful operation of the landfill facility. Emphasis is given to the supplemental tasks required for the lined landfill units.

3.2 SURFACE WATER CONTROL

As used herein, the definition of “surface water” is water which results from precipitation or site run-on that has not contacted the waste.

Proper control of surface water at the landfill will accomplish the following goals:

- Prevent the run-on of surface water into the lined landfill unit(s) or the active face(s);
- Prevent the run-off of surface water that has come into contact with the waste (i.e. leachate);
- Limit the erosion caused by surface waters;
- Limit sediments carried off-site by surface waters; and
- Maximize the SEPARATION of SURFACE water from LEACHATE.

Separate erosion and sedimentation control plans have been provided for the various landfill units. These plans describe both short and long term engineered features and practices for preventing erosion and controlling sedimentation at this site. The following is a brief discussion of some of these features and practices, focusing more on the landfill units.

3.2.1 Surface Water Run-On Control

The perimeter berms and/or perimeter channels around the landfill unit(s) are designed to prevent the run-on of surface water from adjacent land into the landfill. Additional structures such as diversion berms, channels, down pipes, etc. carry surface water away from the landfill.

3.2.2 Active Face Run-Off Control - MSW Landfill Units

Particular care is required to ensure that surface water coming from the active face, e.g. having potential contact with the waste, is captured by the leachate collection system (LCS). Only run-off from waste surfaces that have received adequate cover is not considered leachate and should be directed to the stormwater drainage system where

practical.

3.2.3 Erosion Control

The serviceability of the landfill relies heavily on soil berms, barrier layers, and agricultural layers that are readily eroded by flowing water. Erosion control provisions incorporated in the landfill include the following:

- The slope of the working face must be no steeper than 5H:1V where practical to limit erosion of the daily cover.
- Intermediate cover that has been exposed for more than 30 days must be seeded immediately and repaired when erosion features are identified.
- Drainage breaks (diversion berms, rain gutters, etc.) are provided on the final cover to limit the flow length of run-off.
- Water collected by each drainage break is routed to stormwater drainage channels or down pipes so that the run-off volume does not accumulate going down the slope.
- The vegetative soil layer placed over the final cover must be seeded immediately.

Additional erosion control measures have been taken within the drainage channels and at points of stormwater discharge. All final cover should be inspected regularly for erosion damage and promptly repaired.

3.2.4 Sedimentation Control

Stormwater run-off from the landfill unit(s) is conveyed to one of the on site sediment basins and/or traps. These basins and/or traps should be inspected regularly for sediment build-up or erosion damage. The basins and/or traps should be cleaned out when sediments fill the lower half of the basin.

3.2.5 Separation of Stormwater/Leachate - Lined (MSW and C&D) Landfill Units

The stormwater separation system is accomplished by dividing the lined landfill units into separate cells to reduce the volume of leachate generated and minimize the impoundment of stormwater within the landfill. The separation system allows stormwater in cells which have not yet received waste to be pumped out of the landfill to perimeter drainage features. During activation of a cell, the Owner will connect the cell to the LCS as discussed in **Section 2.5.3.2**.

3.3 LEACHATE MANAGEMENT - LINED (MSW AND C&D) LANDFILL UNITS

The leachate management system for the existing and proposed lined landfill units consists of the LCS, the leachate discharge piping, pumps, valve boxes, valves, and the existing leachate storage lagoon.

Leachate from the lined landfill units is collected in the leachate sumps at the low end(s) of each unit. Leachate collected in each sump is pumped to the leachate storage lagoon via a HDPE force main (except for Phase 5 which drains via a HDPE gravity main). From the storage lagoon, the leachate is pumped via force main to a County-owned wastewater treatment plant (WWTP) or back into the Phase 5 MSW landfill unit as part of an approved leachate recirculation plan (See **Appendix D**). Refer to the appropriate permit application for a detailed discussion and details of the leachate management system for each lined landfill unit.

The County has approval to modify the existing leachate storage lagoon for use as an equalization basin for raw wastewater. These modifications are described in **Section 3.3.6**.

3.3.1 Leachate Collection System (LCS)

A blanket drainage layer (either natural and/or geosynthetic drainage media) covers the liner system to collect and remove leachate draining from the waste. In addition, a large flow capacity network of perforated pipe and gravel drains is constructed in the blanket drain. The LCS is designed to remove inflow from a 25-year, 24-hour rainstorm. As such, its capacity is very large compared to that required to accommodate routine leachate generation rates once waste covers the landfill footprint.

The LCS has been designed to minimize the impact of long-term biological clogging as follows:

- Cleanouts are provided on the major perforated leachate collection pipes;
- No geotextiles will be used between the waste and the gravel columns; and
- The use of coarse aggregate around collection pipes (gravel columns) allows hydro-washing of the pipe and aggregate to remove biological growth.

3.3.1.1 Gravel Column Maintenance

The exposed surface of the drainage aggregate should be inspected monthly and after each large rain storm to check for buildup of sediment on the aggregate. Sediment buildup must be periodically removed carefully with a backhoe. Aggregate that is removed must be replaced with new clean material. Per **Section 2.5.3.2**, the Type GT-S geotextile overlying the gravel columns must be removed just prior to the placement of waste over that portion of gravel column.

3.3.1.2 Collection Pipe Cleanout

Remote camera inspection and flushing (if necessary) of all leachate collection piping accessible with a cleanout port will be performed every 3 years or earlier if an abnormal reduction in leachate production is observed. An abnormal reduction is defined as a drop in monthly leachate production of 30% or more as compared to the monthly average over the prior 6 month period and which does not appear to be the result of a reduction in rainfall, the covering of new cell areas, etc. If piping is mostly clean at the initial 3 year inspection, the County may petition the DWM to increase the inspection frequency to 5 year intervals.

The locations of the collection system that have sediment or biological growth buildup will be cleaned using high pressure water jetting equipment. The water jetting system should generate greater than 2,000 psi water pressure. Use of the high pressure water jetting equipment should be limited to only those portions of the piping system with buildup.

3.3.1.3 Leachate Removal

As constructed, leachate is collected in one or more sumps at the low points of the landfill and is removed from the landfill via a side riser pump or through a gravity penetration. The leachate is routed to the leachate storage lagoon via a HDPE force main or gravity main.

Under normal conditions, the County will remove (via forcemain) leachate from the storage lagoon at a rate to maintain a typical volume of 3,500,000 gallons (approximate 6.5 foot depth), or less, of leachate in the lagoon (see also **Section 3.3.6**). This allows ample volume in the lagoon to handle the anticipated “surge” event caused by a design storm and minimizes the potential for ponding within the landfill. Additional draw-down of the lagoon will be performed in advance of predicted heavy rainfall (tropical storm, hurricane, etc.).

3.3.1.4 Operation and Maintenance of Leachate Pumps and Storage Lagoon

Operation and maintenance of leachate pumps shall be in accordance with the appropriate manufacturer’s recommendations. If required, the leachate storage lagoon may require cleanout of sediment and/or maintenance of aerators. The County Solid Waste Manager or his designee will be responsible for following and documenting, as required, these activities.

3.3.2 Leak Detection System - Phase 4A MSW Landfill Unit

A leak detection system (LDS) is part of the Phase 4A MSW landfill unit. The purpose of the LDS is to provide rapid detection of a major breach in the primary liner system and to limit the head on the secondary liner to less than the thickness of the LDS.

For Phase 4A, the LDS consists of a layer of drainage geocomposite directly overlying the secondary LLDPE geomembrane and a series of four leak detection trenches. Flow that is collected in the leak detection trenches is routed through 4 inch diameter HDPE piping to a pump station. The LDS pump station consists of a prefabricated HDPE manhole, valving, and submersible pumps. Leachate collected in the LDS pump station is pumped to the existing leachate storage lagoon via the same force main as leachate collected in the LCS described above.

The LDS has been designed with an Action Leakage Rate (ALR) of 3,000 gallons per day. Should leakage collected in the LDS exceed the ALR based on routine flowmeter readings from the LDS pump station, the County will take steps (placement of soil cover, tarps, etc.) to limit leachate generation from in-place waste.

3.3.3 Leachate Quality Sampling

Semi-annual leachate quality sampling and analysis will be performed during operation of the lined landfill units. Samples will be recovered as grab samples from the following locations:

- MSW Phase 5: Sample from existing gravity line in leachate manhole;
- MSW Phase 4A (Leachate Collection System): Sample from side risers;
- MSW Phase 4A (Leak Detection System): Sample from leak detection pump station; and
- C&D Area 2: Sample from side risers.

The parameters to be analyzed will include BOD, COD, temperature, conductivity, pH, ammonia, suspended solids, Appendix I constituents, sulfates, and nitrates.

3.3.4 Record Keeping

Accurate records for the following will be maintained at the landfill in accordance with **Section 1.11**.

Leachate Generation (Monthly):

- Phase 5 (Leachate storage lagoon pump station flowmeters minus flow from Phase 4A);
- Phase 4A (Leachate collection system flowmeter); and
- Phase 4A (Leak detection system pump station flowmeter).

Leachate Quality (Quarterly and/or Semi-Annual):

- Phase 5 (Quarterly during active leachate recirculation);
- Phase 4A (Leachate Collection System); and
- Phase 4A (Leak Detection System).

3.3.5 Leachate Contingency Plan

In the unlikely event that leachate levels within the existing leachate storage lagoon approach the freeboard capacity, due to unforeseen events, the DWM will be verbally notified (see **Section 1.2.2**) and the leachate flow will be valved off and temporarily stored in the landfill until the level of leachate in the lagoon can be lowered by direct pumping. Written documentation describing the unforeseen events, the actions carried out to remove the stored leachate, and a strategy for preventing future occurrences will be provided to the DWM within 30 days following any such occurrence.

3.3.6 Modification of Leachate Pond as an Equalization Basin

The existing leachate storage lagoon (pond) has an approximate capacity of 4.2M gallons with 2 feet of freeboard. Due to the large size of the pond and typical leachate generation at the site (between 1.26M and 3.05M gallons per year based on 2004 and 2005 data), the capacity of this pond has been very much underutilized. The County received approval in October 2008 to modify the existing leachate storage lagoon for use as an equalization basin for raw wastewater. Most of the proposed modifications will be on the southwest side of the existing leachate pond.

The maximum water level in the modified pond will be maintained at approximately elevation 151 to 152. With a top of pond elevation of approximately 155, this will provide a volume of at least 1 foot (approximately 650,000 gallons) below the required 2 feet of freeboard under typical conditions. This capacity is much greater than the anticipated surge volume from a newly operational landfill unit. Additionally, considering the very large pumping capacity (two 1,300 GPM pumps) of the existing raw sewage pump station which will be connected to the pond, the ability to handle leachate generation at the site is very high.

The modified capacity and/or operation of the leachate pond as an equalization basin will not affect the County's ability to draw-down the basin in advance of predicted heavy rainfall (tropical storm, hurricane, etc.).

3.4 WATER QUALITY MONITORING

The monitoring program and procedures outlined in the current Water Quality Monitoring Plan will be followed for the monitoring of site groundwater monitoring wells and surface water monitoring locations. The results of the water quality monitoring program will be placed in the facility operating record as described in **Section 1.11**.

3.5 LANDFILL GAS (LFG) MANAGEMENT

3.5.1 MSW Landfill Units

A landfill gas (LFG) management system is included as part of the design of the MSW landfill units. Refer to the appropriate permit application for a detailed discussion and details of the LFG management system for each landfill unit.

As the operation and maintenance of this system involves contact with explosive gases, operational staff involved with the operation and maintenance of this system should be specifically trained in the management and response for situations such as fire or explosion, confined space, drilling, and overhead hazards, or any other mechanical hazards addressed by the equipment Manufacturer's literature. Although this manual does not address the operation of the LFG management system, reference is made to the Landfill Gas Operation and Maintenance Manual of Practice prepared by the Solid Waste Association of North America (SWANA)¹, which provides a general body of knowledge concerning the operation and maintenance of these systems.

3.5.2 C&D Landfill Units

Landfill gas (LFG) generated from the C&D landfill unit will be vented using passive vents placed at the time of closure. Refer to the appropriate permit application for details of these vents.

3.6 LANDFILL GAS (LFG) MONITORING PLAN

The County will implement a routine landfill gas (LFG) monitoring program for both MSW and C&D landfill units to ensure that methane concentrations do not exceed 25 percent of the lower explosive limit (LEL) (1.25% methane (CH₄)) in facility structures, or 100 percent of the LEL (5% CH₄) at property boundaries. LFG monitoring activities and remedial actions for concentrations exceeding these requirements will be in accordance with each unit's current landfill gas monitoring plan.

3.6.1 Record Keeping

Results of LFG monitoring and description of any remedial measures will be placed in the facility operating record as described in **Section 1.11**.

¹ SWANA (1997), Landfill Gas Operation and Maintenance Manual of Practice, SR-430-23070, Solid Waste Association of North America, Silver Spring, MD, March 1997.

3.7 VECTOR CONTROL

3.7.1 MSW Landfill Units

Control of insects, rodents, and birds will be accomplished by compaction of the waste and the use of daily cover. Spilled or wind-blown debris along the access road will be cleaned up daily and placed in the landfill. If vector control becomes a problem, additional measures will be taken to ensure the protection of human health.

3.7.2 C&D Landfill Units

Due to the nature of the waste disposed in the C&D landfill units, vector control is not anticipated to be of concern. Note that the use of periodic cover will discourage animals from nesting in the waste.

3.8 ODOR CONTROL

3.8.1 MSW Landfill Units

Odororous or potentially odororous materials will be covered as soon as possible to avoid odor problems. If odor control becomes a problem, additional measures will be taken to ensure odor control.

3.8.2 C&D Landfill Units

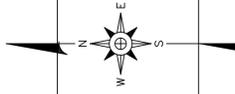
Due to the nature of the waste disposed in the C&D landfill units, odor control is not anticipated to be of concern.

3.9 DUST CONTROL

Dust related to waste hauler traffic on the access roads will be minimized by using a water truck to limit dust on the gravel portion of the road. Dust generated by excavation of cover soil will be limited by watering the cut soil areas if accessible to the water truck.

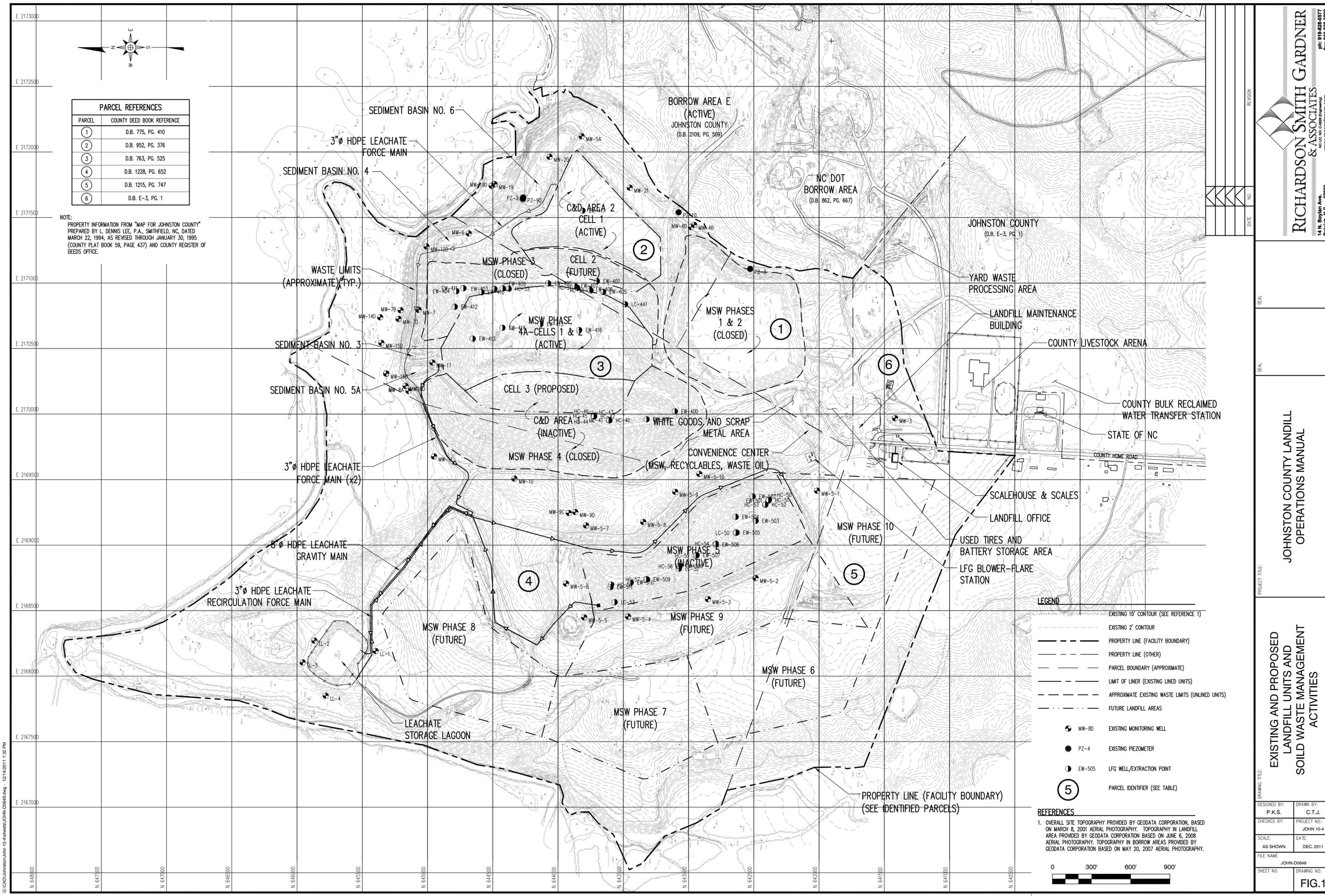
3.10 IRRIGATION OF RECLAIMED WASTEWATER

The County is approved to spray irrigate reclaimed wastewater at the landfill. The operation of the spray irrigation system will be as described in **Appendix E**. The operation of the system will also follow the requirements of the current permit issued by the NC Division of Water Quality.



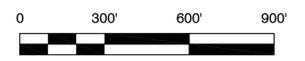
PARCEL REFERENCES	
PARCEL	COUNTY DEED BOOK REFERENCE
1	D.B. 775, PG. 410
2	D.B. 952, PG. 376
3	D.B. 763, PG. 525
4	D.B. 1228, PG. 652
5	D.B. 1215, PG. 747
6	D.B. E-3, PG. 1

NOTE:
PROPERTY INFORMATION FROM "MAP FOR JOHNSTON COUNTY"
PREPARED BY L. DENNIS LEE, P.A., SMITHFIELD, NC, DATED
MARCH 22, 1994, AS REVISED THROUGH JANUARY 30, 1995
(COUNTY PLAT BOOK 59, PAGE 437) AND COUNTY REGISTER OF
DEEDS OFFICE.



LEGEND	
	EXISTING 10' CONTOUR (SEE REFERENCE 1)
	EXISTING 2' CONTOUR
	PROPERTY LINE (FACILITY BOUNDARY)
	PROPERTY LINE (OTHER)
	PARCEL BOUNDARY (APPROXIMATE)
	LIMIT OF LINER (EXISTING LINED UNITS)
	APPROXIMATE EXISTING WASTE LIMITS (UNLINED UNITS)
	FUTURE LANDFILL AREAS
	MW-80 EXISTING MONITORING WELL
	PZ-4 EXISTING PIEZOMETER
	EW-505 LFG WELL/EXTRACTION POINT
	PARCEL IDENTIFIER (SEE TABLE)

REFERENCES
1. OVERALL SITE TOPOGRAPHY PROVIDED BY GEODATA CORPORATION, BASED ON MARCH 8, 2001 AERIAL PHOTOGRAPHY. TOPOGRAPHY IN LANDFILL AREA PROVIDED BY GEODATA CORPORATION BASED ON JUNE 6, 2008 AERIAL PHOTOGRAPHY. TOPOGRAPHY IN BORROW AREAS PROVIDED BY GEODATA CORPORATION BASED ON MAY 20, 2007 AERIAL PHOTOGRAPHY.



G:\CAD\Johnston\John 10-16\sheet\JOHN-D0649.dwg - 12/14/2011 1:32 PM

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JOHNSTON COUNTY LANDFILL OPERATIONS MANUAL

EXISTING AND PROPOSED LANDFILL UNITS AND SOILD WASTE MANAGEMENT ACTIVITIES

DESIGNED BY: P.K.S.	DRAWN BY: C.T.J.
CHECKED BY:	PROJECT NO.: JOHN 10-4
SCALE: AS SHOWN	DATE: DEC. 2011
FILE NAME: JOHN-D0649	
SHEET NO.:	DRAWING NO.:
	FIG. 1

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Appendix A

EPA Method 9095

Paint Filter Liquids Test

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METHOD 9095
PAINT FILTER LIQUIDS TEST
From EPA SW-846

1.0 SCOPE AND APPLICATION

- 1.1 This method is used to determine the presence of free liquids in a representative sample of waste.
- 1.2 The method is used to determine compliance with 40 CFR 264.314 and 265.314.

2.0 SUMMARY OF METHOD

- 2.1 A predetermined amount of material is placed in a paint filter. If any portion of the material passes through and drops from the filter within the 5 minute test period, the material is deemed to contain free liquids.

3.0 INTERFERENCES

- 3.1 Filter media were observed to separate from the filter cone on exposure to alkaline materials. This development causes no problem if the sample is not disturbed.

4.0 APPARATUS AND MATERIALS

- 4.1 Conical paint filter: Mesh number 60 (fine meshed size). Available at local paint stores such as Sherwin-Williams and Glidden for an approximate cost of \$0.07 each.
- 4.2 Glass funnel: If the paint filter, with the waste, cannot sustain its weight on the ring stand, then a fluted glass funnel or glass funnel with a mouth large enough to allow at least 1 inch of the filter mesh to protrude should be used to support the filter. The funnel is to be fluted or have a large open mouth in order to support the paint filter yet not interfere with the movement, to the graduated cylinder, of the liquid that passes through the filter mesh.
- 4.3 Ring stand and ring or tripod.
- 4.4 Graduated cylinder or beaker: 100-mL.

5.0 REAGENTS

- 5.1 None.

6.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

- 6.1 All samples must be collected according to the directions in Chapter Nine of EPA SW-846.
- 6.2 A 100 mL or 100 g representative sample is required for the test. If it is not possible to obtain a sample of 100 mL or 100 g that is sufficiently representative of the waste, the analyst may use larger size samples in multiples of 100 mL or 100 g, i.e., 200, 300, 400 mL or g. However, when larger samples are used, analysts shall divide the sample into 100-mL or 100-g portions and test each portion separately. If any portion contains free liquids, the entire sample is considered to have free liquids.

7.0 PROCEDURE

- 7.1 Assemble test apparatus as shown in Figure 1.
- 7.2 Place sample in the filter. A funnel may be used to provide support for the paint filter.
- 7.3 Allow sample to drain for 5 minutes into the graduated cylinder.
- 7.4 If any portion of the test material collects in the graduated cylinder in the 5-min. period, then the material is deemed to contain free liquids for purposes of 40 CFR 264.314 and 265.314.

8.0 QUALITY CONTROL

- 8.1 Duplicate samples should be analyzed on a routine basis.

9.0 METHOD PERFORMANCE

- 9.1 No data provided.

10.0 REFERENCES

- 10.1 None required.

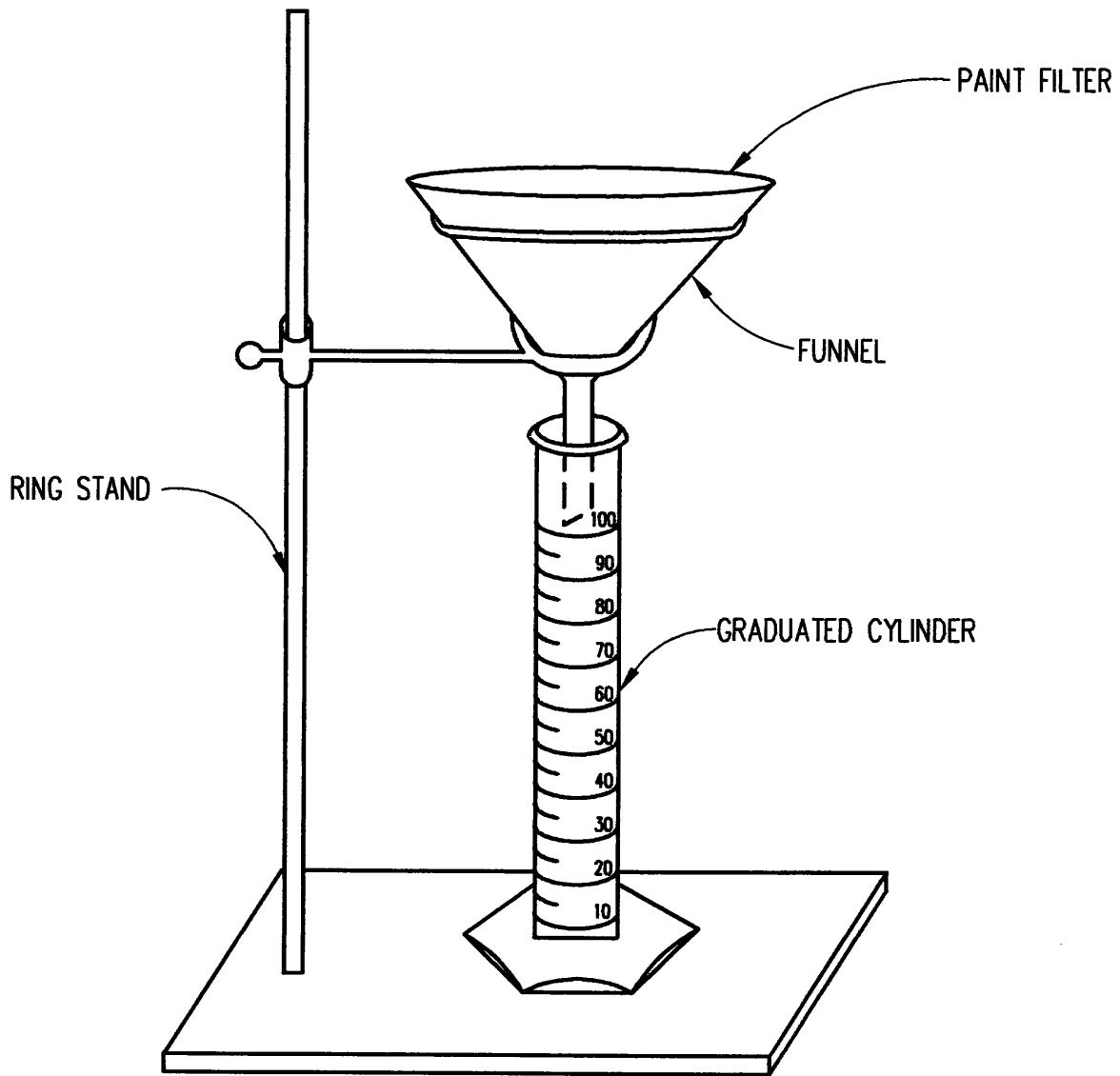
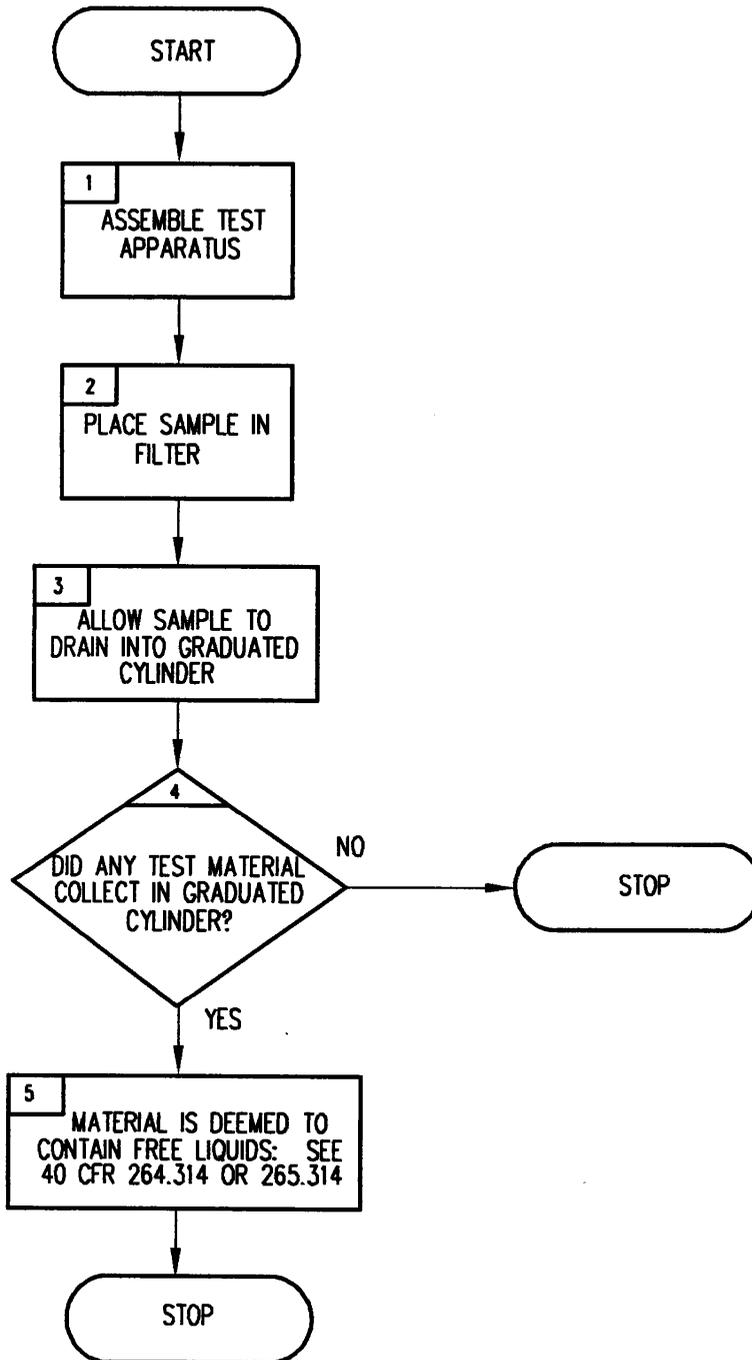


FIGURE 1. PAINT FILTER TEST APPARATUS.

METHOD 9095
PAINT FILTER LIQUIDS TEST



Appendix B

Waste Screening Form

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Johnston County Department of Public Utilities
Johnston County Landfill Facility
Permit No. 51-03
(919) 938-4750

WASTE SCREENING FORM

Day / Date: _____ Time Weighed in: _____
Truck Owner: _____ Driver Name: _____
Truck Type: _____ Vehicle ID / Tag No: _____
Weight _____ Tare: _____
Waste Generator / Source: _____

Reason Load Inspected: Random Inspection _____ Staff Initials _____
 Detained at Scales _____ Staff Initials _____
 Detained by Operating Staff _____ Staff Initials _____

Inspection Location: _____

Approved Waste Determination Form Present? Yes _____ No _____ N/A _____

Description of Load: _____

Load Accepted (signature) _____ Date _____
Load Not Accepted (signature) _____ Date _____

Reason Load Not Accepted (complete only if load not accepted)

Description of Suspicious Contents: Color _____ Haz. Waste Markings _____
 Texture _____ _____
 Drums Present _____ Smell _____
 Est. Cu. Yds. Present in Load _____
 Est. Tons Present in Load _____

Johnston County Emergency Management Contacted? Yes _____ No _____

Company or Authority Contacted? _____
Hazardous Materials Present: _____

Hauler Notified (if waste not accepted) Phone: _____ Time Contacted: _____
Other Observations: _____

Final Disposition
Signed _____ Date _____
 Waste Screening Inspector or Solid Waste Manager

Attach related correspondence to this form.
File completed form in Operating Record.

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Appendix C

Cell Activation Forms

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**JOHNSTON COUNTY MSW LANDFILL - PHASE 4A
CELL ACTIVATION FORM**

Date: _____

Cell: _____

Size of Geosynthetic Rain Cover Removed (Length/Width): _____

Length of Type GT-S Geotextile Removed from Gravel Column(s): _____

Remarks: _____

Signed: _____

Sketch:

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**JOHNSTON COUNTY C&D LANDFILL - AREA 2
CELL ACTIVATION FORM**

Date: _____

Cell: _____

Size of Geosynthetic Rain Cover Removed (Length/Width): _____

Length of Type GT-S Geotextile Removed from Gravel Column(s): _____

Remarks: _____

Signed: _____

Sketch:

A large empty rectangular box with a black border, intended for a sketch. It occupies the lower half of the page.

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Appendix D

Leachate Recirculation Plan

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**Operations Manual
Appendix D: Leachate Recirculation Plan**

**Johnston County Landfill Facility
Smithfield, North Carolina**

Prepared for:

**Johnston County Department of Public Utilities
Smithfield, NC**

June 2007



RICHARDSON SMITH GARDNER & ASSOCIATES

Engineering and Geological Services

14 N. Boylan Avenue
Raleigh, North Carolina 27603

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**JOHNSTON COUNTY
JOHNSTON COUNTY LANDFILL FACILITY**

**OPERATIONS MANUAL
APPENDIX D: LEACHATE RECIRCULATION PLAN**

1.0 OVERVIEW

Water is the most significant factor influencing waste stabilization and leachate quality. Moisture addition has been demonstrated repeatedly to have a stimulating effect on methanogenesis (Barlaz et al, 1990), although some researchers indicate that it is the movement of moisture through the waste as much as it is water addition that is important (Klink and Ham, 1982). Moisture within the landfill serves as a reactant in the hydrolysis reactions, transports nutrients and enzymes, dissolves metabolites, provides pH buffering, dilutes inhibitory compounds, exposes surface area to microbial attack, and controls microbial cell swelling (Noble, et al, 1991). Lu, et al, (1985) stated that high moisture flow rates can flush soluble organics and microbial cells out of the landfill and in such cases microbial activity plays a lesser role in determining leachate quality. Also, high moisture application rates can remove the majority of waste contaminants early in the life of the fill. Under low flow rate conditions, anaerobic microbial activity is the significant factor governing leachate organic strength (McBean et al, 1995). The quantity of moisture is important because it directly affects stabilization rates within the landfill. Sulfito et al, (1992) and Miller, et al, (1994) both noted the important role of moisture in supporting methanogenic fermentation of solid waste when examining samples removed from operating landfills. Relatively dry landfills (i.e. 20-40% water) have very slow stabilization rates because there is only a small quantity of moisture for biological degradation. Recommended moisture content reported in the literature ranges from a minimum of 25 percent (wet basis) to optimum levels of 40 to 70 percent (Barlaz, et al, 1990; Chen and Bowerman, 1974).

Leachate is recirculated in MSW landfills for one or more of the following reasons:

- as an alternative to leachate treatment,
- to promote biodegradation of the waste as detailed above to produce a smaller and more stable waste mass, and
- to accelerate the production of landfill gas (LFG).

Johnston County's plan to recirculate leachate within the Phase 5 area of their Subtitle D landfill is based on a desire to stabilize the waste and associated contaminants prior to placement of the final cover. The County facility is presently equipped with a leachate force main to a County owned and operated wastewater treatment plant (WWTP) so that disposal of leachate is not a concern. As such, this recirculation plan is developed with the goal of maximizing the rate of degradation of the waste and not for the purpose of leachate disposal.

2.0 REGULATORY REQUIREMENTS

The recirculation of leachate within lined MSW landfills is provided for in Federal RCRA Subtitle D regulations and not prohibited in North Carolina regulations. It is anticipated that design and operational requirements for recirculation will evolve from guidance provided by the Solid Waste Section of the North Carolina Division of Waste Management (DWM).

2.1 40 CFR 258 RCRA Subtitle D

Federal regulations provide both specific and implied requirements that must be met by landfills recirculating leachate. Relevant sections of the Federal regulations are as follows:

§258.28 (a): Bulk or non-containerized liquid waste may not be placed in the MSWLF units unless: (1) The waste is household waste other than septic waste; or (2) The waste is leachate or gas condensate from the MSWLF unit and the MSWLF unit, whether it is a new or existing MSWLF, or lateral expansion, is designed with a composite liner and leachate collection system as described in §258.40(a)(2) of this part...

§258.40(a)(2): With a composite liner, as defined in paragraph (b) of this section and a leachate collection system that is designed and constructed to maintain less than a 30-cm depth of leachate over the liner. (b) For purposes of this section, *composite liner* means a system consisting of two components: the upper component must consist of a minimum 30-mil flexible membrane liner (FML), and the lower component must consist of at least a two-foot layer of compacted soil with a hydraulic conductivity of no more than 1×10^{-7} cm/sec...

2.2 North Carolina Rule NCAC T15A: 13B.1600

North Carolina regulations mirror the above referenced Federal regulations in Rule .1624(b)(1) related to design and construction, Rule .1624(b)(2)(A) related to maximum head, and Rule .1626(9)(a)(ii) related to recirculation of leachate. Currently, however, implementation of leachate recirculation is administered using policy established in DWM guidance for leachate recirculation. This guidance establishes basic elements that must be incorporated into a leachate recirculation plan prior to implementation of a 120-day trial period and eventual long-term operation. Key elements of this guidance are listed on **Table 1** along with the location in this manual where the element is addressed.

3.0 FACILITY LIQUIDS CONTROL - ENGINEERED PERFORMANCE

Significant engineering effort has been expended to ensure that the maximum head acting on the liner system during routine recirculation does not exceed 30 cm and that the recirculation system itself does not adversely affect the integrity or stability of the landfill. This section provides a general description of these systems and the technical evaluation performed to ensure adequate performance.

3.1 Leachate Recirculation System

The leachate recirculation system uses a network of horizontal porous galleries to both inject leachate into the waste and to vent landfill gas (LFG) generated by the degradation of the waste. The galleries are designed to minimize leachate short circuiting of the waste and the potential for landfill fires in the LFG collection system. Each gallery consists of a family of parallel trench drains that are individually fitted with a leachate injection pipe. The **Project Drawings** show the general geometry and placement of the injection/LFG galleries and details for their construction. The galleries are placed at an approximate 30 foot vertical spacing and a maximum 80 foot horizontal spacing. Each successive vertical gallery is staggered to provide for more uniform leachate distribution and gas collection. The porous LFG collection and leachate distribution media can be constructed using gravel, tire chips, or other relatively inert media having a permeability greater than 1×10^{-2} cm/sec. The leachate injection and LFG collection pipes are high density polyethylene (HDPE) fusion welded pipe having a maximum SDR of 11. Leachate is injected under a minimum 10 psi pressure through a series of 1/8 inch holes spaced 10 feet apart. Field tests by GNRA have confirmed that this hole size and spacing allows for a very uniform release of leachate from each hole for pipe lengths up to 800 feet in length. For this project, lengths were designed up to ± 400 feet in length. Installation details for each injection/LFG gallery are recorded using the form provided in **Appendix D1**.

Significant settlement of the waste is anticipated during the service life of the recirculation system. HDPE was selected for use in the injection/LFG pipes due to both its chemical resistance and its low coefficient of friction which minimizes potential tensile forces caused by differential settlement of the waste. The selected SDR of the pipes is based on anticipated maximum tensile forces related to differential settlement and not the stresses generated by the leachate pressure.

3.2 Leachate Collection System (LCS)

The leachate collection system (LCS) for Phase 5 was modified by the County as follows. The modification consisted of removal of 12 inches of sand and a geotextile that had originally been placed between the primary leachate collection pipes and the waste. This material was replaced with a NC DOT #57 stone that provides a significant increase in the transmissivity of the pipe/stone drain and resistance to bioclogging of the drain. This conversion of the primary collection pipe system is performed just in advance of the placement of waste immediately on the #57 stone to ensure that the stone remains free of fines from the protective cover.

The HELP (v. 3.07) Model was used to evaluate the impact of leachate recirculation on the head acting on the composite liner system. This analysis indicates that the average head acting on the liner system is less than 12 inches when a minimum of 30 feet of waste is in place prior to initiating recirculation. The short-term HELP evaluations are conservative in that only a single 30 foot lift of waste is modeled for a 5 year period. As the height of waste is increased, the storage capacity within the waste increases and the

resulting head on the liner system decreases. For example, modeling a 60 foot layer of waste under intermediate cover reduces the short term head from 10.2 inches to 5.4 inches.

4.0 FACILITY EQUIPMENT AND OPERATING PRACTICES

Leachate recirculation must be performed in a manner that does not create odor or stability problems and produces heads on the liner system less than 30 cm. Odor problems are minimized in the proposed system by the use of leachate injection galleries such that raw leachate is not applied to the surface of the waste. The permanent system for injection of leachate is shown in the **Project Drawings** and requires operational steps as follows:

- Leachate to be recirculated is collected in the existing leachate pump station located adjacent to the existing leachate storage lagoon.
- Leachate is pumped from the pump station to the injection galleries using a submersible high-head pump capable of maintaining a minimum 10 psi pressure at the inlet of the injection gallery. Each injection gallery is provided with a positive on-off ball valve as shown in the **Project Drawings**.
- Leachate is pumped into individual injection galleries in metered $\pm 6,000$ gallon slugs designed to prevent localized saturation of the waste and stability problems. Injection is sequenced between the galleries and recorded using the form provided in **Appendix D1**.
- A backup system can be provided using a water truck that receives leachate from the leachate lagoon and then transports it back to the top of Phase 5 and injects it directly from the truck to one of the injection galleries. This system may be utilized in the event of a shutdown of the recirculation pump.

The general recirculation philosophy is to avoid visible discharge of leachate, e.g., spraying into the air by truck, sprinklers, or hoses, to minimize the potential for odor problems and excessive discharge in one zone of waste to minimize stability and seep related problems. This section discusses the facility hardware and operational procedures employed to successfully recirculate leachate to the waste.

4.1 Leachate Injection Gallery

Each injection gallery extends horizontally from the face of the final cover into the waste a distance of no more than about 400 ($\pm 10\%$) feet in length. Each injection gallery consists of a granular windrow or trench drain containing a HDPE leachate injection pipe. The details of this system are discussed in **Section 3.1**. Each leachate injection gallery pipe is fitted at its exposed end with a positive on-off valve connected to the supply line. A check valve and cleanout are also provided for each injection gallery pipe.

The injection pipe diameter and pressure are selected to ensure that leachate flow velocities are sufficient to prevent fouling of the injection pipe and the perforations. It is not anticipated that the leachate injection pipes will require servicing during their estimated 5-8 year service life. The granular drain surrounding the injection pipe is designed to both allow a more uniform distribution of the leachate and for the collection of LFG within the waste. The size and permeability of the granular trench drain is based on the desire to maintain internal LFG pressures less than 6-inches H₂O (0.22 psi). All injection gallery installation details will be recorded using the form provided in **Appendix D1**.

4.2 Leachate Injection Equipment

One submersible pump will be provided in the existing pump station for recirculating leachate. This pump is rated for a flow of 50 gpm at a head of 210 feet. This pump was selected to provide the required minimum inlet pressure to the leachate injection gallery of 10 psi and approximately 2 hours pumping time to inject 6,000 gallons of leachate. The injection pump is equipped with on-off controls within the pump station.

4.3 Leachate Amendment

With time it is anticipated that the leachate draining from Phase 5 will become increasingly acidic. Research by Barlaz (1990) has shown that the rate of waste decomposition actually decreases with increasing acidity. Therefore it may be necessary to buffer the leachate prior to future recirculation. This will be accomplished using a liquid lime injector as needed. Currently there are no plans for leachate amendment other than buffering.

5.0 FACILITY MONITORING PRACTICES

The facility must be monitored to ensure that the combination of leachate recirculation and natural precipitation does not produce excessive head on the liner system, side slope seeps, or stability problems. This section reviews a monitoring system to be installed at Phase 5 to monitor both weather and leachate quantities.

5.1 Weather Monitoring

Daily weather monitoring will be obtained using a rain gauge and tell-tale equipped thermometer located at the landfill office. Daily readings would be obtained for the maximum temperature, total rainfall, and general weather conditions. This information would be recorded on the form provided in **Appendix D1**. This data allows an accurate evaluation of the water-balance over time within the waste.

5.2 Leachate Monitoring

Leachate from Phase 5 gravity drains to the leachate lagoon. The cumulative flow through the gravity drain line will be monitored via flowmeters for all pumps. Calculations commonly performed to determine action leakage rates (ALR) for leak detection systems show that the flow rate will be 130,600 gallons per day when the maximum head acting on the liner is 30 cm. The cumulative flow monitoring will provide verification that the head acting on the liner system is less than 30 cm.

Landfill personnel will pay particular attention to sudden increases in leachate generation during or immediately after recirculation activities. Sudden increases in rate of leachate generation from the facility not accompanied by precipitation indicates that injected leachate is moving through the waste faster than normal. This may imply either saturation of the waste due to over injection of leachate or short circuiting (via voids in the waste) of the waste by a single injection. Both situations require a cessation of injection to the injection gallery in question and a modification of the injection sequence.

6.0 REPORTS

The following reports will be prepared:

- Pre-Operational Report;
- 120-Day Trial Period Reporting (Progress and Final Reports); and
- Quarterly Operational Reports.

Reporting forms proposed in this pre-operational report will be revised with experience.

6.1 Pre-Operational Report

The pre-operational report provides sufficient information to justify the 120-day trial recirculation period. This Leachate Recirculation Plan is the pre-operational report for the Johnston County Phase 5 leachate recirculation program.

6.1.1 Weather Monitoring

A daily rain gauge and thermometer will be installed at the landfill office to allow daily recording of total rainfall and maximum temperature. This data will be recorded at the end of each working day.

6.1.2 Baseline Leachate Sampling

Baseline leachate quality data for Phase 5 will be provided within the last 30 days prior to the initiation of leachate recirculation. This data will include test results

for BOD, COD, temperature, conductivity, pH, ammonia, suspended solids, metals, and volatiles.

6.1.3 Operational Procedures

Johnston County plans on proceeding with the installation of the recirculation pump and force main. Thus, the operational procedures during the 120-day trial recirculation period will be the same as for long-term operations as previously described in **Section 4**.

6.1.4 Operational Equipment

The operational equipment during the 120-day trial will include the recirculation pump and force main and a portion of the first level of injection galleries as shown in the **Project Drawings** and installed at a nominal elevation of 30 feet of waste.

6.1.5 Record Keeping

Daily readings for rainfall, maximum temperature, quantity of leachate generated/recirculated, and leachate injection galleries used will be maintained using the form provided in **Appendix D1**. This form provides for a week of data and allows comments on the daily weather conditions and unusual operating conditions, e.g., odor or seeps. These data sheets will be provided to the State as part of the technical report submitted to DWM in support of implementation of the long-term leachate recirculation program.

6.2 **120-Day Trial Period Reporting**

6.2.1 Progress Report

After a minimum of 60 days, a progress report will be prepared which describes and documents the monitoring activities since initiation of the 120-day trial period, presents observed difficulties and/or operational modifications, and presents leachate quality data. Leachate quality data will include test results for BOD, COD, temperature, conductivity, pH, ammonia, suspended solids, metals, and volatiles.

6.2.2 Final Report

At the completion of the 120-day trial period, a final report will be prepared which describes and documents the monitoring activities for the entire trial period, presents observed difficulties and/or operational modifications, and presents leachate quality data. Leachate quality data will include test results for BOD, COD, temperature, conductivity, pH, ammonia, suspended solids, metals, and volatiles. The most critical aspect of this report is confirmation that the

proposed leachate injection sequence results in acceptable performance. Final drawings and specifications for the facility modifications will also be submitted with this report. Based on this report, Johnston County will request approval by DWM to implement the long-term leachate recirculation program.

6.3 Quarterly Operational Reports

Quarterly leachate recirculation operational reports will be submitted to DWM after the 120-day trial period. These reports will provide the daily log sheets provided in **Appendix D1**, identify all leachate injection galleries in service, and provide updated leachate quality data.

7.0 REFERENCES

- 1- Barlaz, M.A., R.K. Ham, and D.M. Schaefer, 1990. "Methane Production from Municipal Refuse: A review of Enhancement Techniques and Microbial Dynamics," Critical Reviews in Environmental Control, 19(6): 557.
- 2- Chen, K.Y. and F.R. Bowerman, 1974. "Mechanisms of Leachate Formation in Sanitary Landfills," in: Recycling and Disposal of Solid Wastes: Industrial, Agricultural, Domestic., Yen, T.F. editor, Ann Arbor, Ann Arbor Science Publication.
- 3- Klink, R.E. and R.K. Ham, 1982. "Effect of Moisture Movement on Methane Production in Solid Waste Landfill Samples," Resources and Conservation, 8: 29.
- 4- Lu, J.C.S., et al., editor, 1985. Leachate from Municipal Landfills, Production and Management, Noyes Publisher, Park Ridge, New Jersey.
- 5- McBean, E.A., F.A. Rovers, and G.J. Farquhar, 1995. Solid Waste Landfill Engineering and Design, Prentice Hall, Englewood Cliffs, NJ.
- 6- Miller, W.L., T. Townsend, J. Earle, H. Lee, and D.R. Reinhart, 1994. "Leachate Recycle and the Augmentation of Biological Decomposition at Municipal Solid Waste Landfills," Presented at the Second Annual Research Symposium, Florida center for Solid and Hazardous Waste Management, Florida.
- 7- Noble, J.J. and A.E. Arnold, 1991. "Experimental and Mathematical Modeling of Moisture Transport in Landfills," Chemical Eng. Comm., 100: 95-111.
- 8- Sulfito, J., C. Gerba, R. Ham, A. Palmisano, W. Rathje, and J. Robinson, 1992. "The World's Largest Landfill," Environmental Science & Technology, 26(8): 1486-1495.

TABLE 1: NC DWM POLICY ELEMENTS FOR LEACHATE RECIRCULATION

Conditions	Policy Element	Section(s)
Preoperative Conditions	A rain gauge and thermometer shall be placed on the site.	6.1.1
	A Baseline sampling of leachate shall be performed.	6.1.2
	An outline of expected operational procedures shall be submitted.	4.0
	A brief description of the equipment and its' associated specifications shall be submitted.	4.0 & Specs.
	A brief description of record-keeping forms shall be submitted including: <ul style="list-style-type: none"> ● daily/weekly record of leachate generated ● daily/weekly record of leachate recirculated ● weather conditions and other pertinent daily information ● a log for reporting operating or other unusual problems, and their subsequent rectification ● any other forms or procedures, etc., that the owner/operator will use. 	5.0/6.0
	An estimation of height of waste in the cell where leachate is anticipated to be applied.	Project Drawings
Operating Conditions	Records shall be kept on a daily/weekly basis as outlined.	6.0
	No leachate shall be applied on less than one lift (10 feet) of waste.	3.1
	No leachate shall be spray applied or surface circulated when it is raining, or when the waste is too wet.	4.0
	No run-off or side seepage will be allowed.	4.0
	Odors will be controlled.	4.0
	Leachate depth shall be monitored in the manhole to ensure that the head on the liner does not exceed one foot for more than 24 hours.	5.2
	Leachate will be spray applied or surface circulated during daylight hours only.	N/A
	The application system will be properly maintained and documented.	5.0/6.0
	Subsurface distribution systems will be outlined.	4.1
	Operation and maintenance of subsurface systems will be proposed.	4.0

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Appendix D1

Reporting Forms and Logs

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**JOHNSTON COUNTY MSW LANDFILL - PHASE 5
LEACHATE RECIRCULATION
120-DAY TRIAL PERIOD MONTHLY REPORTING FORM**

Start Date (Day 1): _____

Day	Rain (Inch)	Max. Temp.	Leachate Generated	Leachate Recirculated	Injection Galleries Used	Problems/Weather (Use Extra Sheet if Required)
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
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**JOHNSTON COUNTY MSW LANDFILL - PHASE 5
LEACHATE RECIRCULATION
LEACHATE RECIRCULATION MONTHLY REPORTING FORM**

Start Date (Day 1): _____

Day	Rain (Inch)	Max. Temp.	Leachate Generated	Leachate Recirculated	Injection Galleries Used	Problems/Weather (Use Extra Sheet if Required)
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
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**JOHNSTON COUNTY MSW LANDFILL - PHASE 5
LEACHATE RECIRCULATION
HORIZONTAL WELL INSTALLATION LOG**

Well Number: _____

Date(s) Installed: _____

Length Installed: _____

Elevation: _____

Number of Holes/Spacing: _____

Hole Size: _____

Coordinates:

Point #: _____ X: _____ Y: _____ Z: _____

Point #: _____ X: _____ Y: _____ Z: _____

Point #: _____ X: _____ Y: _____ Z: _____

Remarks: _____

Installation Sketch:



Appendix E

Irrigation of Reclaimed Wastewater

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**Operations Manual
Appendix E: Irrigation of Reclaimed Wastewater**

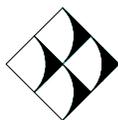
**Johnston County Landfill Facility
Smithfield, North Carolina**

Prepared for:

**Johnston County Department of Public Utilities
Smithfield, NC**

June 2007

Revised: December 2008



RICHARDSON SMITH GARDNER & ASSOCIATES
Engineering and Geological Services
14 N. Boylan Avenue
Raleigh, North Carolina 27603

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**JOHNSTON COUNTY
JOHNSTON COUNTY LANDFILL FACILITY**

**OPERATIONS MANUAL
APPENDIX E: IRRIGATION OF RECLAIMED WASTEWATER**

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FIGURES

Figure 1 Landfill Site Irrigation Plan

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**JOHNSTON COUNTY
JOHNSTON COUNTY LANDFILL FACILITY**

**OPERATIONS MANUAL
APPENDIX E: IRRIGATION OF RECLAIMED WASTEWATER**

1.0 OVERVIEW

This Operations Manual Addendum was prepared for the Johnston County MSW Landfill located off of Highway 210 on County Home Road for the purpose of describing the operation of an irrigation system for reclaimed wastewater. The system is owned and operated by Johnston County.

2.0 CONTACT INFORMATION

All correspondence and questions concerning the operation of the reclaimed wastewater irrigation system should be directed to the appropriate County personnel listed below:

Johnston County Department of Public Utilities
309 E. Market Street, P.O. Box 2263
Smithfield, NC 27577
Phone: (919) 209-8333 (Downtown); (919) 938-4750 (Landfill)
Fax: (919) 934-7174 (Downtown); (919) 989-7152 (Landfill)

Solid Waste Manager: Rick Proctor
Public Utilities Director: Tim Broome, P.E.

3.0 IRRIGATION SYSTEM OPERATION

3.1 Areas to be Irrigated

Areas to be irrigated and order of priority (1 being the highest) include the following:

Priority 1:

- Wooded area behind (south and east of) NC Forest Service building (Field 1) (Not on Solid Waste Permit Site);
- Agricultural fields to the south and west of the landfill office (Field 2) (majority not on Solid Waste Permit Site);
- Area behind (west of) landfill office (Fields 3 & 4 - future Phases 6, 9, and 10); and
- Wooded area south of the leachate storage lagoon (Fields 6, 7, & 8 - future Phases 7 and 8).

Priority 2:

- Closed landfill areas on Phase 1 & 2, 3, 4, and 5 (LF Cap 1 & 2, LF Cap 3, LF Cap 4, and LF Cap 5).

Priority 3:

- Inactive borrow areas (Field 5 - future Phases 6 and 7) (Fields 9, 10, & 11).

In addition to these areas, the County plans to use reclaimed wastewater for the control of dust within the facility and around the County livestock arena (not on Solid Waste Permit Site). **Figure 1** presents the location of the various planned irrigation areas.

3.2 Periods of Operation

The irrigation system will be operated during the months of April through October with the exception of Fields 1, 2, and 3. In addition, irrigation will be discontinued on any day that rainfall exceeds 0.2 inches.

For Fields 1, 2, and 3, irrigation will be year-round. A winter cover crop, such as annual rye, will be used as required. No irrigation will take place during freezing temperatures. Equipment will be drained as required to prevent problems due to freezing temperatures.

3.3 Irrigation Amounts

Irrigation amounts off the landfills will be in accordance with the agronomic rates determined for the landfill site (based on “wettest” year amounts) in an analysis performed by Robert Evans, Ph.D., P.E. of N.C. State University and entitled “Hydrologic Wastewater Reuse Irrigation Analysis for Johnston County”. Irrigation amounts on the landfill final covers will be in accordance with HELP model evaluations performed by Richardson Smith Gardner & Associates, Inc. (formerly G.N. Richardson & Associates, Inc.). A tabulation of amounts to be irrigated is given in **Table 1**. Restrictions to these amounts are as stated herein. Note that based on site monitoring of the irrigation program (see **Section 3.5**), future increases to these amounts may be allowed.

3.4 Irrigation Restrictions

3.4.1 Monitoring Wells

No irrigation will occur within 100 feet of an actively monitored site monitoring well.

3.4.2 Closed Landfill Areas

Irrigation over closed landfill areas shall only take place over closed areas which have at least 2 feet of soil cover or at least 1.5 feet of soil cover and a synthetic barrier.

3.4.3 Future Landfill Areas

Irrigation over areas designated as future landfill areas (or areas within 300 feet of future landfill areas) will be discontinued within 2 years before the anticipated start of construction for that area unless it is demonstrated by use of piezometers, monitoring wells, or other method (see **Section 3.5**) that irrigation rates are not creating an artificial rise in groundwater levels. Closed landfill areas, if to be lined over as part of a future landfill area may be irrigated in accordance with **Section 3.4.2**.

3.4.4 Borrow Areas

No irrigation will be performed in active borrow areas. Irrigation may be performed in inactive borrow areas as long as the ground surface is prepared to promote vegetation (soil type, nutrients, etc.).

3.5 Site Monitoring of Irrigation Program

In order to monitor the effect of the irrigation program both to ground water quality and to the ground water table a monitoring program will be implemented. This program will consist of two elements. One will be the addition of sampling and testing of the treated irrigation water as part of the regular Spring and Fall ground water sampling/testing events already performed as part of site operations. After sampling, the irrigation water will be tested for the same detection monitoring parameters as for the other site samples.

In addition, the second element of the monitoring program will be the installation of piezometers in each future landfill area to be irrigated (i.e. Phases 6-10). At a minimum, one piezometer will be installed roughly in the central portion of the proposed future landfill phase before irrigation can begin over that area. The water elevations in these piezometers will be measured and recorded both during the spring and fall, concurrent with regular site ground water monitoring, and in the mid-summer. These levels will be evaluated in order to determine if there appears to be a rise in ground water elevations due to the irrigation activities. Should ground water elevations be maintained within a couple of feet of initial levels or levels that might otherwise be considered normal considering other factors such as weather, etc., the irrigation amounts for that area may be increased. Likewise, if there appears to be a significant (more than a couple of feet) increase in ground water elevation, which cannot be otherwise explained, irrigation activities in this area will be reduced or suspended. Also, as stated in **Section 3.4.3**, irrigation in future landfill areas will be halted at least two years prior to planned construction activities in that area.

3.6 System Maintenance and Inspections

Inspection of the irrigation system during periods of operation will be performed by landfill staff on a weekly basis for the closed landfill areas. Other areas may be inspected less frequently, but not less than once per month. As much of the proposed system will be above ground, inspection for damaged piping, valves, sprinklers, etc. will be done on a mostly visual basis. Should maintenance be required to any portion of the irrigation system, that part of the system will be shut off until adequate repairs are made.

Table 1: Irrigation Amounts

Field	Max. Daily Application Rate cm/day (inch/day)	Annual Application Rate cm/year (inch/year)
Fields 1 and 2	0.60 (0.25)	70 (28)
Fields 3, 4, and 5	0.60 (0.25)	62 (25)
Fields 6, 7, and 8	0.60 (0.25)	42 (17)
Fields 9 and 10 Livestock Arena	0.60 (0.25)	50 (20)
Dust Control	0.60 (0.25)	45 (18)
Field 11	0.60 (0.25)	40 (16)
Landfill Final Cover ¹	0.25 (0.1)	12 (5)

Note:

- 1) At a rate less than that which would cause saturation of the upper 9 inches of soil cover. This will be controlled by the use of soil moisture devices, which will automatically shut off the irrigation system if the upper 9 inches becomes saturated.

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Closure and Post-Closure Plan

**Johnston County Landfill
Smithfield, North Carolina**

Prepared for:

**Johnston County Department of Public Utilities
Smithfield, NC**

December 2011



14 N. BOYLAN AVENUE
RALEIGH, NORTH CAROLINA 27603
NC LIC. NO. C-0828 (ENGINEERING)

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JOHNSTON COUNTY LANDFILL
CLOSURE AND POST-CLOSURE PLAN

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SECTION 1.0 CLOSURE PLAN

1.1 OVERVIEW

This plan is intended to serve as a guide for the proposed closure. A formalized Closure Plan for each landfill unit (or incremental portion thereof) will be submitted to the Solid Waste Section of the North Carolina Department of Environment and Natural Resources Division of Waste Management (DWM) for approval prior to beginning closure construction.

1.2 MAXIMUM CLOSURE AREA AND WASTE CAPACITY

The following are the estimated areas and capacity for each landfill unit to be closed under this plan.

Landfill Unit	Closure Area (Acres)	Gross Capacity (CY) ¹	Net (Waste) Capacity (CY/Tons) ¹
MSW Landfill Units			
Phase 4A (Through Cell 3 - Fill Sequence 1)	29.4	2,531,948	2,152,156 CY 1,383,316 Tons
Phase 5	19.2	1,087,199	884,625 CY 514,181 Tons
Total (MSW):	48.6	3,619,147	3,036,781 CY 1,897,497 Tons
C&D Units			
Area 1 (See Note 3)	12.9 (See Note 2)	614,472	515,563 CY 304,780 Tons
Area 2 (Cell 1)	11.9	410,675	353,056 CY 212,920 Tons
Total (C&D):	24.8	1,027,345	868,619 CY 517,700 Tons

Notes:

1. The volume and tonnage figures assumed for each landfill unit are based on the site's Facility Plan. Refer to Section 2.0 (Facility Report) of the Facility and Engineering Plan (**Attachment A**).
2. The Area 1 C&D landfill unit has a total area of 16.2 acres but has a reduced closure area due to the overlying Phase 4A - Cell 3 MSW landfill unit.
3. The Area 1 C&D landfill unit is currently closed and is awaiting approval of the closure certification.

1.3 FINAL COVER SYSTEM

The final cover system will consist of the following components (top-down):

- a 24-inch thick vegetative soil layer (including 6 inches of topsoil);
- a drainage geocomposite (with drainage breaks)
- a 30-mil textured LLDPE geomembrane; and
- a 12-inch thick intermediate cover layer.

The final cover system will be placed on prepared intermediate cover at a maximum slope of 4H:1V. Surface water control devices will also be incorporated into the final cover of each landfill unit and some units will have a landfill gas (LFG) control system. The final cover surface will be vegetated upon completion of the final cover installation according to the project seeding specifications.

Placement of the vegetative soil layer over the cover geosynthetics must be done with care to avoid damage to these materials. This soil layer should be placed from the bottom up using a small dozer equipped with low ground contact pressure (6 psi or less) tracks. A minimum of 12 inches of soil should be maintained between the dozer tracks and the underlying geosynthetics. The soil buffer should receive no compaction other than that provided by the dozer tracks. Pans or other heavy equipment should not operate on the vegetative soil layer.

Refer to the appropriate permit application for a detailed discussion and details related to the design of the final cover system for each landfill unit.

1.4 LANDFILL GAS SYSTEM

For the MSW landfill units and C&D landfill units overlying MSW units, a landfill gas system is provided in the final cover design. This system includes a system of collection wells placed within the waste to capture the gas and either passively vent or flare the gas via utility flares or, as required, actively collect and flare the gas via header piping and a blower/flare system. The collection wells should be placed before any geosynthetics are placed.

Refer to the appropriate permit application for a detailed discussion and details related to the design of the landfill gas system for each landfill unit.

1.5 SURFACE WATER SYSTEMS

Precipitation falling on the cover will infiltrate into the cover or run off the cover. Short-term the run-off runs down the surface of the intermediate cover. Long-term the run-off is collected in a series of drainage breaks built into the areas covered by final cover. These drainage breaks are provided along side slopes (rain gutters and diversion berms). Water captured by rain gutters or diversion berms is routed toward one of the down pipes. Flow in the down pipes is routed to the base of the landfill and to one of the site sediment basins.

Refer to the appropriate permit application for a detailed discussion and details related to the

design of surface water systems for each landfill unit.

1.5.1 Incremental Operation

During much of the life of the landfill, surface run-off will be handled by the intermediate cover system. Operations must strive to provide operational grading that encourages run-off from the intermediate cover to drain to the perimeter channels along the perimeter berms or to areas covered by final cover. Corrugated polyethylene (CPE) piping and temporary soil berms must be installed if required to accomplish this run-off routing.

1.5.2 Required Maintenance

The surface water systems must be inspected annually and immediately after every major storm. Sediment build-up in the drainage features/devices must be cleaned out on a regular basis to promote run-off. Sediments removed can be used as daily or intermediate cover.

1.6 CLOSURE SCHEDULE

In general, closure activities will occur on the following schedule:

MSW Landfill Units (15A NCAC 13B.1627(c)(5)):

- No later than 30 days after the date on which the MSWLF unit receives the known final receipt of wastes; or
- If the MSWLF unit has remaining capacity and there is a reasonable likelihood that the MSWLF unit will receive additional wastes, no later than one year after the most recent receipt of wastes.

C&D Landfill Units (15A NCAC 13B.0543(c)(5)):

- No later than 30 days after the date on which the C&DLF unit receives the known final receipt of wastes;
- No later than 30 days after the date that a 10 acre or greater area of waste, is within in 15 feet of final design grades; or
- No later than one year after the most recent receipt of wastes, if the C&DLF unit has remaining capacity.

Prior to beginning closure of any landfill unit, the County will notify the DWM that a notice of the intent to close the unit has been placed in the operating record.

All closure activities shall be completed within 180 days. Exemptions and extensions may be approved by the DWM.

1.7 CLOSURE VERIFICATION

The following procedures will be implemented following closure:

- A Construction Quality Assurance (CQA) report will be submitted to the DWM. This report will describe the observations and tests used before, during, and upon completion of construction to ensure that the construction materials meet the final cover design specifications and the construction and certification requirements. The CQA report will contain as-built drawings.
- A signed certification from a registered Professional Engineer verifying that closure has been completed in accordance with the closure plan will be submitted to the DWM.
- At least one sign notifying all persons of the closing of the landfill (or incremental portions thereof) and that wastes are no longer accepted will be posted. Suitable barriers will be installed as necessary at former access points to prevent new waste from being deposited.
- Within 90 days, a survey plat, prepared by a registered Professional Land Surveyor, indicating the location and dimensions of landfill disposal areas, will be prepared.
- A notation will be recorded on the deed notifying any potential purchaser of the property that the land has been used as a landfill facility and that future use is restricted under the approved closure plan. A copy of the deed notation as recorded will be filed with the operating record.

SECTION 2.0 POST-CLOSURE PLAN

2.1 OVERVIEW

This Post-Closure Plan has been developed to outline steps to be taken to ensure the integrity of the landfill during its post-closure care period. The post-closure care period will last at least 30 years after final closure and, at a minimum, will consist of the following:

- Maintaining the integrity and effectiveness of final cover system;
- Performing groundwater and surface water monitoring;
- Maintaining and operating a gas monitoring system; and
- Maintaining run-on/run-off controls.

No wastes will remain exposed after closure of the landfill. Access to the closed site by the public will not pose a health hazard.

2.2 POST-CLOSURE CONTACT

All correspondence and questions concerning the post-closure care of the unit should be directed to:

Johnston County Department of Public Utilities
Attn: Director
309 E. Market Street
Smithfield, NC 27577
Phone: (919) 209-8333
Fax: (919) 934-7174.

2.3 POST-CLOSURE USE

After filling operations cease at the landfill and the landfill is officially closed in accordance with the Closure Plan, each landfill unit will be maintained as a grassy hill. Johnston County will maintain control of the property and prevent public access to it during the post-closure period.

There may be (an) access road(s) on the final cover to allow proper maintenance during post-closure. Precise location of the access road(s) will be determined as a part of operations. Low ground pressure and rubber tire vehicles will be used for maintenance. Additionally, the County will maintain access to all site monitoring locations throughout the post-closure period.

2.4 MAINTENANCE

2.4.1 Repair of Security Control Devices

All security control devices will be inspected and maintained as necessary to ensure access to the site is controlled. Locks, vehicular gates, and fencing will be replaced if functioning improperly. Warning signs will be kept legible at all times and will be replaced if damaged by inclement weather or vandalism.

2.4.2 Erosion Damage Repair

If erosion of the final cover occurs during post-closure, the affected area will be repaired and reseeded as necessary. If necessary, rolled erosion control products (RECPs) will be used to expedite rapid revegetation of slopes and to secure topsoil in place.

2.4.3 Correction of Settlement, Subsidence, and Displacement

Minimum slopes of 5 percent will be maintained after settlement in order to prevent ponding and allow for proper drainage without infiltration. If vertical or horizontal displacement occurs due to differential settlement, cracks will be filled with appropriate material and final cover will be reestablished. Excessive vertical displacement is not anticipated.

2.4.4 Leachate Management System (Lined Units)

In order to maintain the free flow in leachate collection piping, they will be cleared of debris using the manholes or cleanout locations for access. If pipes should crush or buckle within the landfill, leachate will flow through the gravel columns. The leachate collection system (LCS) includes a continuous blanket drain on the base of the landfill which will allow drainage of leachate even in the very unlikely event of total failure of the leachate collection pipes.

2.4.5 Closure of Leachate Storage Lagoon

After closure of the lined landfill units has been achieved, the generation of leachate will eventually curtail. The flow rate immediately after closure should decrease to approximately 100 gallons/acre/day. Toward the end of the 30-year post-closure period, the flow should approach zero, at which time the storage lagoon will not be required. The following procedures will be followed to properly close the leachate storage lagoon:

- Completely drain and remove all liquids, sludges, sediments, etc. from the storage lagoon.
- Disassemble the lagoon, piping, and appurtenances and dispose of the contents in a manner approved by the DWM.
- Sample and analyze the underlying soil for appropriate constituents

inherent to leachate. Assess the results for evidence of contaminant migration.

- If contamination of underlying soils is exhibited, perform an assessment as to the degree of contamination and develop remedial actions.
- Obtain approval of the DWM for the assessment and associated remedial measures.
- Perform the remedial actions as necessary to limit any threats to public health and the environment.
- Restore the area to closely match pre-existing conditions in the vicinity of the containment areas. Activities may include: filling, grading, topsoiling, and seeding.

2.4.6 Repair of Run-On/Run-Off Control Structures

All drainage swales, ditches, and perimeter channels will be repaired, cleaned, or realigned in order to maintain their original condition. Any culverts that are damaged will be repaired or replaced.

2.4.7 Landfill Gas System

The landfill gas (LFG) system will be maintained by the County and operated in accordance with any site air quality permits. Proper operation of the system is verified through testing at the landfill gas monitoring wells.

If gas wells/vents do not function as a result of irregular settlement, accumulation of liquids (condensate, leachate, water), binding or corrosion, additional and/or replacement wells/vents can be installed if necessary in accordance with the current LFG Management Plan.

At the point that LFG recovery drops below the minimum rates necessary for operation of an active gas collection and control system, the active system will be decommissioned and the wells will be converted to passive vents or capped as appropriate. Decommissioning of the active system will consist of the removal of the LFG flare, blower and equipment skids, fencing, and related electrical components. Piping and structures which have been in contact with LFG condensate will be removed and disposed of in a manner approved by the DWM. LFG piping and structures within the limits of the landfill units will be abandoned in-place if possible in a manner approved by the DWM to minimize the potential for damage to the final cover system of each unit. Once decommissioning activities are complete, the area(s) will be restored (grading as required and revegetation).

Any damage caused to the landfill liner or final cover systems as the result of

maintenance, repair, or decommissioning of the LFG system will be repaired following the appropriate specifications and construction quality assurance (CQA) requirements.

2.4.8 Groundwater Monitoring Wells

Procedures outlined in the current Water Quality Monitoring (WQM) Plan or subsequent revision will take precedence; however, a brief description follows. All groundwater monitoring wells have been installed with concrete pads and protective casings to prevent accidental damage by vehicles and equipment. The wells are also equipped with a locking cap to discourage vandalism. Groundwater wells will be inspected regularly (at the time of sampling) to ensure integrity. Persons inspecting a well should look at the overall condition of the well, for signs of well tampering, and cracking or degradation of the concrete pad. Should a well require replacement, the defective well should be abandoned in accordance with specifications provided in the WQM Plan and a new well installed at a location that is approved by the DWM.

2.5 MONITORING PLAN

The closed unit will be monitored for a minimum of 30 years. A series of inspections will be scheduled to ensure the integrity and effectiveness of the final cover system, surface water systems, groundwater monitoring system, landfill gas system, and to protect human health and the environment.

2.5.1 Inspection Frequencies

Inspections to be conducted during the post-closure care period will occur regularly as shown in **Table 2.1**.

2.5.2 Quarterly Inspections

Quarterly inspections of the closed site will be conducted by the County. These inspections will include examination of the security control devices for signs of deterioration or vandalism to ensure access to the site is limited to authorized persons. Each disposal area will be checked to ensure the integrity of the final cover system is maintained, erosion damage is repaired, vegetative cover persists, and that cover settlement, subsidence, and displacement are minimal. Drainage swales and channels will be cleared of litter and debris and benchmark integrity will be noted and maintained.

2.5.3 Semi-Annual Inspections

Semi-annual inspections of the site during the post-closure period will be conducted by the County with attention paid to integrity and drainage of the final cover system and condition of the groundwater and gas monitoring systems.

A report of findings will be made to the responsible party, including recommendations for actions deemed necessary to ensure the site continues to meet the closure performance

standard.

2.6 ENGINEERING CERTIFICATION

Based on the County's monitoring reports, annual certifications by a registered engineer will be placed in the operating record. They will certify that the closure plan has been followed, noting discrepancies along with the corrective actions undertaken. At the end of the post closure period, the individual certifications will be compiled into a final document and forwarded to the DWM.

TABLE 2.1: POST-CLOSURE INSPECTION FREQUENCIES

INSPECTION ACTIVITY	YEAR 1	YEARS 2-30
Security Control Devices	Quarterly	Quarterly
Vegetative Cover Condition	Quarterly ¹	Quarterly
Surface Water Systems	Quarterly ¹	Quarterly
Erosion Damage	Quarterly ¹	Quarterly
Cover Drainage System	Quarterly ¹	Semi-Annually
Cover Settlement, Subsidence, and Displacement	Quarterly ¹	Semi-Annually
Leachate Management System	Quarterly	Semi-Annually
Landfill Gas System	Quarterly ²	Semi-Annually ²
Water Quality Monitoring	Semi-Annually ³	Semi-Annually ³
Landfill Gas Monitoring	Quarterly ⁴	Quarterly ⁴
Benchmark Integrity	Annually	Annually
Leachate Collection Pipe Inspection/Cleanout	See Note 5	

Notes:

1. These items will be inspected after each large storm event (i.e. ≥ 1 inch in any 24 hours).
2. Or in accordance with the current Landfill Gas Management Plan or air quality permit(s).
3. Or in accordance with groundwater monitoring schedule described in the current Water Quality Monitoring Plan.
4. Or in accordance with the current LFG Monitoring Plan.
5. Remote camera inspection and flushing (if necessary) of leachate collection piping (portion that can be inspected and cleaned) will be performed every 3 years. If piping is mostly clean at a 3-year interval, the County may petition the DWM to increase the inspection/cleaning frequency to a 5-year interval.

SECTION 3.0 CLOSURE/POST-CLOSURE COST ANALYSIS

3.1 OVERVIEW

The purpose of this section is to provide a written estimate in current dollars of costs associated with all activities specified in the written closure and post-closure plans which have been developed for the MSW and C&D landfill units of the Johnston County Landfill.

3.2 ESTIMATED CLOSURE COSTS

Tables 3.1A, 3.1B, 3.1C, and 3.1D summarize the estimated costs for complete closure of the MSW Phase 4A (Cells 1-3), MSW Phase 5, C&D Area 1, and C&D Area 2 (Cell 1) landfill units, respectively (the maximum area to be closed). The cost estimate for each unit is based on a third party providing the necessary services and includes labor in the unit prices given. The estimated closure costs will be reviewed and updated as required to reflect adjustments for inflation, increased costs in construction or materials, or any other adjustments to the Closure Plan.

3.3 ESTIMATED POST-CLOSURE COSTS

Tables 3.2A and 3.2B summarize the estimated costs for the post-closure care maintenance activities for MSW Phases 1-4A and C&D Areas 1-2¹ and the MSW Phase 5 landfill unit. The cost estimate for each is based on a third party providing the necessary services and includes labor in the unit prices given. The estimated post-closure costs will be reviewed and updated as required to reflect adjustments for inflation, rising costs of anticipated post-closure care, or any other adjustments to the Post-Closure Plan.

3.4 ESTIMATED ASSESSMENT AND CORRECTIVE ACTION COSTS

Table 3.3 summarizes the current potential assessment and corrective (remedial) action cost for the landfill facility. This cost is based on the required minimum amount (\$2,000,000) per NCGS 130A 295.2(h) (as modified by Session Law 2011-262) and includes amounts for water quality and landfill gas (LFG) monitoring and reporting (per NC DWM policy) plus contingency funds to cover potential future assessment and corrective action costs.

3.5 FINANCIAL ASSURANCE MECHANISM

Johnston County intends to continue to use the Local Government Financial Test (15A NCAC 13B.1628(e)(1)(f)) to demonstrate financial assurance for this facility.

¹The MSW Phases 1-4 units (previously closed), the MSW Phase 4A unit, and the C&D Areas 1 and 2 units are combined in that these units are in the same portion of the site.

TABLE 3.1A: MSW - PHASE 4A - CLOSURE COST ESTIMATE¹

ITEM	QUANTITY	UNITS	UNIT COST	ITEM COST (2011 \$)
Surface Preparation	29.4	Acre	\$10,000	\$294,000
Landfill Gas System	29.4	Acre	\$15,000	\$441,000
30 mil Textured LLDPE Geomembrane	1,281,000	SF	\$0.45	\$576,450
Drainage Geocomposite	1,281,000	SF	\$0.55	\$704,550
Vegetative Soil Layer (24")	95,000	CY	\$5.00	\$475,000
Erosion Control (Rain Gutters, Diversion Berms, Down Pipes, Drainage Channels, Etc.)	29.4	Acre	\$15,000	\$441,000
Revegetation	29.4	Acre	\$1,500	\$44,100
Surveying	29.4	Acre	\$2,000	\$58,800
Subtotal:				\$3,034,900
Bonds, Mobilization, & Insurance	(4% of Subtotal):			\$121,396
Subtotal:				\$3,156,296
Contingency (10%):				\$315,630
Construction Subtotal:				\$3,471,926
Engineering	29.4	Acre	\$2,000	\$58,800
CQA	29.4	Acre	\$6,000	\$176,400
TOTAL:				\$3,707,126

Notes:

1. Assumes closure of 29.4 acres (Phase 4A).

TABLE 3.1B: MSW - PHASE 5 - CLOSURE COST ESTIMATE¹

ITEM	QUANTITY	UNITS	UNIT COST	ITEM COST (2011 \$)
Surface Preparation	19.2	Acre	\$10,000	\$192,000
Landfill Gas System	19.2	Acre	\$15,000	\$288,000
30 mil Textured LLDPE Geomembrane	837,000	SF	\$0.45	\$376,650
Drainage Geocomposite	837,000	SF	\$0.55	\$460,350
Vegetative Soil Layer (24")	62,000	CY	\$5.00	\$310,000
Erosion Control (Rain Gutters, Diversion Berms, Down Pipes, Drainage Channels, Etc.)	19.2	Acre	\$15,000	\$288,000
Revegetation	19.2	Acre	\$1,500	\$28,800
Surveying	19.2	Acre	\$2,000	\$38,400
Subtotal:				\$1,982,200
Bonds, Mobilization, & Insurance	(4% of Subtotal):			\$79,288
Subtotal:				\$2,061,488
Contingency (10%):				\$206,149
Construction Subtotal:				\$2,267,637
Engineering	19.2	Acre	\$2,000	\$38,400
CQA	19.2	Acre	\$6,000	\$115,200
TOTAL:				\$2,421,237

Notes:

1. Assumes closure of 19.2 acres (Phase 5).

TABLE 3.1C: C&D - AREA 1 - CLOSURE COST ESTIMATE¹

ITEM	QUANTITY	UNITS	UNIT COST	ITEM COST (2011 \$)
Surface Preparation	12.9	Acre	\$10,000	\$129,000
Landfill Gas System	12.9	Acre	\$15,000	\$193,500
30 mil Textured LLDPE Geomembrane	562,000	SF	\$0.45	\$252,900
Drainage Geocomposite	562,000	SF	\$0.55	\$309,100
Vegetative Soil Layer (24")	42,000	CY	\$5.00	\$210,000
Erosion Control (Rain Gutters, Diversion Berms, Down Pipes, Drainage Channels, Etc.)	12.9	Acre	\$15,000	\$193,500
Revegetation	12.9	Acre	\$1,500	\$19,350
Surveying	12.9	Acre	\$2,000	\$25,800
Subtotal:				\$1,333,150
Bonds, Mobilization, & Insurance	(4% of Subtotal):			\$53,326
Subtotal:				\$1,386,476
Contingency (10%):				\$138,648
Construction Subtotal:				\$1,525,124
Engineering	12.9	Acre	\$2,000	\$25,800
CQA	12.9	Acre	\$6,000	\$77,400
TOTAL:				\$1,628,324

Notes:

1. Assumes closure of 12.9 acres (Area 1).

TABLE 3.1D: C&D - AREA 2 - CLOSURE COST ESTIMATE¹

ITEM	QUANTITY	UNITS	UNIT COST	ITEM COST (2011 \$)
Surface Preparation	11.9	Acre	\$10,000	\$119,000
Landfill Gas System	11.9	Acre	\$15,000	\$178,500
30 mil Textured LLDPE Geomembrane	519,000	SF	\$0.45	\$233,550
Drainage Geocomposite	519,000	SF	\$0.55	\$285,450
Vegetative Soil Layer (24")	39,000	CY	\$5.00	\$195,000
Erosion Control (Rain Gutters, Diversion Berms, Down Pipes, Drainage Channels, Etc.)	11.9	Acre	\$15,000	\$178,500
Revegetation	11.9	Acre	\$1,500	\$17,850
Surveying	11.9	Acre	\$2,000	\$23,800
Subtotal:				\$1,231,650
Bonds, Mobilization, & Insurance	(4% of Subtotal):			\$49,266
Subtotal:				\$1,280,916
Contingency (10%):				\$128,092
Construction Subtotal:				\$1,409,008
Engineering	11.9	Acre	\$2,000	\$23,800
CQA	11.9	Acre	\$6,000	\$71,400
TOTAL:				\$1,504,208

Notes:

1. Assumes closure of 11.9 acres (Area 2 - Cell 1).

TABLE 3.2A: MSW PHASES 1-4A - C&D AREAS 1-2 - POST-CLOSURE COST ESTIMATE¹

ITEM	QUANTITY	UNIT	UNIT COST	TOTAL (2011 \$)
Site Inspection And Record Keeping	80	HR	\$75	\$6,000
Revegetation (5% Total Area)	5	Acre	\$1,500	\$7,500
Mowing (once per year)	100	Acre	\$100	\$10,000
Erosion Control	1	LS	\$5,000	\$5,000
Gates/Fences/Access	1	LS	\$2,000	\$2,000
LFG System ²	1	LS	\$5,000	\$5,000
Leachate Management ³	1	LS	\$45,149	\$45,149
Subtotal:				\$80,649
Contingency (10%):				\$8,065
ANNUAL TOTAL:				\$88,714
30-YEAR TOTAL:				\$2,661,420

Notes:

1. Assumes post-closure of 100 acres (MSW Phases 1-4A and C&D Areas 1 and Area 2 - Cell 1).
2. LFG system costs include basic maintenance necessary for regulatory compliance (\$4,000 per year) and decommissioning (\$1,000 per year to account for half of assumed \$60,000 cost) at end of post-closure period.
3. Leachate treatment based on 100 gal/ac/day x 41.3 acres lined x 365 x \$20/1,000 gal. (\$30,149/year) plus \$5,000/year staff cost plus \$3,000/year lab cost plus \$2,000/year leachate collection line cleanout costs. Also include \$5,000 per year to account for decommissioning leachate facilities (storage lagoon) (half of assumed \$300,000 assumed cost) at the end of the post-closure period.

TABLE 3.2B: MSW PHASE 5 - POST-CLOSURE COST ESTIMATE¹

ITEM	QUANTITY	UNIT	UNIT COST	TOTAL (2011 \$)
Site Inspection And Record Keeping	20	HR	\$75	\$1,500
Revegetation (5% Total Area)	1	Acre	\$1,500	\$1,500
Mowing (once per year)	20	Acre	\$100	\$2,000
Erosion Control	1	LS	\$5,000	\$5,000
Gates/Fences/Access	1	LS	\$2,000	\$2,000
LFG System ²	1	LS	\$5,000	\$5,000
Leachate Management ³	1	LS	\$29,016	\$29,016
Subtotal:				\$46,016
Contingency (10%):				\$4,602
ANNUAL TOTAL:				\$50,618
30-YEAR TOTAL:				\$1,518,540

Notes:

1. Assumes post-closure of 19.2 acres (MSW Phase 5).
2. LFG system costs include basic maintenance necessary for regulatory compliance (\$4,000 per year) and decommissioning (\$1,000 per year to account for half of assumed \$60,000 cost) at end of post-closure period.
3. Leachate treatment based on 100 gal/ac/day x 19.2 acres lined x 365 x \$20/1,000 gal. (\$14,016/year) plus \$5,000/year staff cost plus \$3,000/year lab cost plus \$2,000/year leachate collection line cleanout costs. Also include \$5,000 per year to account for decommissioning leachate facilities (storage lagoon) (half of assumed \$300,000 assumed cost) at the end of the post-closure period.

TABLE 3.3: ASSESSMENT & CORRECTIVE ACTION COST ESTIMATE¹

ITEM	ANNUAL COST	30-YEAR TOTAL (2011 \$)
<u>MSW - Phases 1-4A - C&D Areas 1-2 (See Notes 2 and 4):</u> Water Quality Monitoring & Reporting LFG Monitoring & Reporting	\$66,000 \$ 3,000	\$1,980,000 \$90,000
<u>MSW - Phase 5 (See Notes 3 and 4):</u> Water Quality Monitoring & Reporting LFG Monitoring & Reporting	\$34,000 \$ 3,000	\$1,020,000 \$90,000
TOTAL:		\$3,180,000

Notes:

1. Per NCGS 130A 295.2(h) (as modified by Session Law 2011-262).
2. The water quality monitoring and reporting cost for MSW Phases 1-4A and C&D Areas 1-2 assumes 33 long-term wells/points sampled semi-annually @ \$33,000 per event (annual cost = \$66,000).
3. The water quality monitoring and reporting cost for MSW Phase 5 assumes 17 long-term wells/points sampled semi-annually @ \$17,000 per event (annual cost = \$34,000).
4. The LFG monitoring and reporting costs assume quarterly monitoring for each unit at a cost of: \$750/event (MSW Phases 1-4A and C&D Areas 1-2) (annual cost = \$3,000); \$750/event (MSW Phase 5) (annual cost = \$3,000). Cost is reflective of combined monitoring events for both areas.