

**REGION 2000
PROOF OF CONCEPT**

**REGIONAL LANDFILL OPERATIONS
CITY OF LYNCHBURG
CITY OF BEDFORD
AMHERST COUNTY
CAMPBELL COUNTY
NELSON COUNTY**

Prepared for:

**Region 2000
And
Virginia Department of Environmental Quality
South Central Regional Office**

Prepared by:

**Draper Aden Associates
Engineering • Surveying • Environmental Services
2206 S. Main Street
Blacksburg, Virginia 24060**

December 29, 2006

**DAA JN: B06209-01
Final**

TABLE OF CONTENTS

1.0 PROJECT OVERVIEW..... 1

1.1 PARTICIPANTS 1

1.2 PROPOSED PROJECT 1

1.3 ADVANTAGES OF THIS PROPOSAL 3

1.4 SCHEDULE 3

2.0 POTENTIAL CONCERNS 5

2.1 EXTENSION OF TIME FRAME FOR FINAL COVER AND NEED FOR VARIANCE 5

 2.1.1 Regulatory basis 5

 2.1.2 Timing of interim closure status 5

 2.1.3 Configuration of the Campbell County landfill at interim closure 6

 2.1.4 Interim Closure Plan 6

 2.1.5 Variance request 6

2.2 INTERIM COVER 9

 2.2.1 Description of the interim cover 9

2.3 LEACHATE MANAGEMENT 10

2.4 GAS MANAGEMENT AND AIR PERMITTING 11

 2.4.1 Gas management at the Campbell County landfill 11

 2.4.2 Air permitting 11

2.5 FINANCIAL ASSURANCE 12

2.6 INCREASED OPERATIONS 13

2.7 RELATIONSHIP TO SOLID WASTE MANAGEMENT PLAN PROCESS 14

2.8 PRESENCE OF OLDER UNLINED LANDFILLS AT LYNCHBURG AND CAMPBELL COUNTY 14

2.9 PERMITTING 15

3.0 SUMMARY 16

APPENDICES

Appendix 1 Participant Resolutions

Appendix 2 Permits and Site Maps for Lynchburg and Campbell County Landfills

Appendix 3 Project Schedule

Appendix 4 Campbell County Landfill at Interim Closure

Appendix 5 Interim Closure Plan - draft

Appendix 6 Interim cover details and specifications

Appendix 7 Landfill Gas Emissions Modeling

Appendix 8 Information from RW Beck on Equipment and Personnel

1.0 PROJECT OVERVIEW

The following section will discuss key components of the proposed regional project.

1.1 Participants

The participants in the proposed Region 2000 regional landfill project include the following:

- City of Lynchburg
- Campbell County
- Amherst County
- Nelson County
- City of Bedford

Appendix 1 contains resolutions from these participating local governments relative to their commitment to the project.

1.2 Proposed project

The project can be generally described as follows:

The participants identified above are considering development of a regional authority which would oversee solid waste disposal in the region. This authority would initially be responsible for landfill operations assuming the use of the currently permitted landfills. In the future, the authority may branch out into other solid waste management activities such as collections or recycling, etc. but specific activities have not been decided at this time. Under the current proposal, the authority would purchase the three operating landfills which include the following:

LANDFILL	PERMIT NUMBER	DATE PERMITTED	ESTIMATED REMAINING CAPACITY as of 7/1/07 (CY)	CURRENT TONNAGE RECEIVED	TONS PER DAY (6 days)
City of Lynchburg	558	11/4/93 (Orig.) 4 Amendments	1,927,231	165,570	530
Amherst County	563	3/2/94 (Orig.) 3/2/99 (Amend)	2,764,523	30,150	97
Campbell County	285	10/26/79 Multiple Amend	1,118,922	47,693	153

*Copies of the most recent permits are included in Appendix 2. Capacity information taken from RW Beck report dated April 2006.

The operating landfills under these permits are lined with leachate collection systems. Both the Campbell County and City of Lynchburg landfills have older closed landfills included within

their current permit boundaries. Both of these older landfills are involved in remediation of some form at this time.

The authority would purchase the assets of the three operating landfills (land, lined cells, infrastructure and equipment) and would assume responsibility for all liabilities (closure, post closure care, financial assurance etc). Thus the authority would be responsible for all future liner construction, cap construction, infrastructure development, operations, financial assurance and post closure care of the operating landfills. To determine the best way to fund this transition, Region 2000 has recently retained legal and financial advisors.

With this transition, the authority would assume the permits for the three landfills, the obligation to complete all future permit amendments and would ultimately retain all compliance responsibilities for the currently operating landfills. During the transition period, any required permit amendments will be filed by the current permit holder. Relative to the two older landfills, the authority would also accept the responsibility for the older Campbell County and Lynchburg landfills but will then contract with the original permit holders to fund the compliance obligations, i.e. post closure maintenance and monitoring, remediation, and financial assurance. This decision was made after discussions with DEQ which outlined the complexity of separating these older landfills from the existing permits and the potential impact such separations could have on compliance boundaries.

The authority would operate two of the landfills initially and would place the third landfill into interim closure status. The two landfills which would remain operational include the City of Lynchburg Landfill and the Amherst County Landfill. The Campbell County Landfill would be placed into interim closure status. Waste from Campbell County, the City of Lynchburg and the City of Bedford would be directed to the City of Lynchburg landfill. Waste from Nelson County and Amherst County would be directed to the Amherst County landfill. In addition, the authority may chose to direct some of the commercial waste or sludge from the Lynchburg landfill to Amherst to balance the operations. Once these landfills are filled, waste will be directed to the Campbell County landfill.

The following table summarizes the estimated tonnages for 2006, and startup and closure dates.

LANDFILL	USERS	TOTAL ESTIMATED TONNAGE (2006)	START UP DATE	CLOSURE DATE	OPERATING LIFE All permitted phases constructed (Years)
City of Lynchburg	Lynchburg, Campbell County City of Bedford	217,273	7/2007	4/2014	6.8
Amherst County	Amherst County Nelson County	43,684	7/2007	1/2020	12.5

LANDFILL	USERS	TOTAL ESTIMATED TONNAGE (2006)	START UP DATE	CLOSURE DATE	OPERATING LIFE All permitted phases constructed (Years)
	Some selected commercial haulers				
Campbell County	All of the above	260,958	4/2014	3/2023	8.9

*Information taken from RW Beck report dated October 27, 2006.

1.3 Advantages of this proposal

There are multiple advantages to this proposal. These include the following:

- Operational costs will be shared among all members and hence all members will benefit from the economy of scale of the larger combined operations.
- Because the operational costs will be reduced, the tipping fees for commercial waste can be competitive and hence the region may retain control of their commercial waste stream and hence its revenues.
- One entity, whose sole responsibility will be to manage solid waste, will oversee the three permits. DEQ will have only one entity to work with instead of multiple local governments.
- Operating two landfills initially allows for a more efficient transportation network during the first 12 years of regionalization.
- The Campbell County landfill is at a perfect stage to be placed into interim closure as it is nearing the end of the useful life of Cell 5. Cells 6 and 7 and Phase IV have not been constructed and will not require any monitoring or maintenance activity during the interim period. The acreage which requires interim cover is minimal (5 acres). The remaining acreage in Cells 1 – 4 which have reached final grade would receive the final cap with appropriate storm water management and gas venting systems.
- Amherst County can receive the benefits of regionalization without having to receive the full tonnage at its facility which would have required extensive upgrades to the infrastructure and the state access roads leading to the site through residential neighborhoods.

1.4 Schedule

Appendix 3 contains the schedule currently under consideration by Region 2000. This schedule indicates that implementation of this proposal must be rapid to prevent Campbell County from having to construct Cell 6. This is key to the effectiveness of this proposal. If Campbell County must construct Cell 6 then additional acreage would require interim cover, maintenance costs would increase and storm water management and the leachate collection system would be

significantly more complicated. Thus, the Region is focused on preventing this situation through rapid implementation of the authority and regional program.

Initial key steps to the program relative to permitting include the following:

- Revision to the City of Lynchburg SWMP for the following items:
 - Expanded service area
 - Increased average daily and peak daily tonnages
 - Modification to schedule for 20 year planning period to reflect the Region 2000 regional approach
 - Revised recycling discussion as appropriate
- Revision to the City of Lynchburg Landfill permit currently under amendment for the following items:
 - Expanded service area
 - Modification to the average daily and peak daily tonnages
 - Modification to the operations manual to reflect the increased operations
 - Modifications to the design report and closure plan relative to life expectancy of operations
- Preparation of a variance request for the Campbell County Landfill for interim closure with appropriate modification to the permit. Variance request to address the following:
 - Type of cover material
 - Storm water management
 - Impact on gas and leachate generation
 - Equivalency to final cover system
 - Protection of human health and the environment
 - Innovation of system
- Revision to Amherst County SWMP and permit in a way similar to the modifications to the City of Lynchburg documentation.
- Preparation of a regional solid waste management plan which will focus on the following:
 - Justification of the regional configuration
 - Umbrella organization and its responsibilities relative to reporting and maintaining the regional plan
 - Detailed description of Region 2000 approach
 - Evaluation of recycling operations and reporting requirements
 - All other requirements of solid waste planning.
- Ultimately a modification to ownership will be filed for the permitted landfills once the authority is running and the transition of the facilities underway.

2.0 POTENTIAL CONCERNS

The following section discusses some of the concerns that have been historically raised by the Virginia Department of Environmental Quality relative to the regional proposal. It should be noted that early discussions have revolved around the concept of three landfills operating sequentially and providing interim closure for two facilities. The new concept discussed during the Fall of 2006 considers the operation of two landfills with only one landfill placed in interim closure. The discussion below reflects information gained during discussions with DEQ after review of the original preliminary proof of concept documentation and in particular from final discussions held with the Region 2000 Working Group and DEQ on December 14, 2006. At this time, all of the concerns have been addressed conceptually with specific information to be provided during the permitting phase to follow soon after acceptance of this proof of concept.

The concerns expressed by DEQ have included the following key items:

- Extension of time frame for final cover and need for variance
- Design, construction and maintenance of interim cover
- Leachate management
- Gas management and potential air permitting requirements
- Financial assurance
- Increased operations
- Relationship to solid waste management planning process
- Presence of older unlined landfills

2.1 Extension of time frame for final cover and need for variance

2.1.1 Regulatory basis

Timing for placement of final cover on a landfill is addressed under 9 VAC 20-80-250.C.2.e.1 (cover requirements during operation) and 9 VAC 20-80-250.E.4, (cover requirements for closure). After discussions with DEQ, it was agreed that a variance relative to the cover requirements during operation would be the required. This section states the following:

“C.2.e Final cover construction will be initiated in accordance with the requirements of subdivision E.1.b of this section when the following pertain:

(1) An additional lift of solid waste is not to be applied within one year.”

2.1.2 Timing of interim closure status

Under this regional proposal the Lynchburg and Amherst landfills would remain operational. Only the Campbell County landfill would be placed in an interim closure status. It is estimated that this landfill would be placed in interim status for 7 years from 7/2007 through 4/2014.

2.1.3 Configuration of the Campbell County landfill at interim closure

Currently Campbell County is working in the Cell 4 and Cell 5 areas of Phase III of their landfill. These cells are expected to reach capacity by early 2008. However, operations between July 2007 and early 2008 will be less than optimum as the working face will be located in a constricted area at the top of the fill. Campbell County would prefer to move into the Lynchburg landfill as a member of the regional authority rather than construct the final cells of the Phase III area. Thus, Phase III – Cells 6 and 7 would remain available for future use by the region as would the permitted Phase IV area.

Placement into interim status would require that the final cap be placed on all areas at final grade and that an interim cover be placed on the working face of Cell 5. Appendix 4 contains a figure which indicates the area anticipated to be at final grade and the area requiring interim cover. The total acreage of final cover is estimated to be 14 acres. The total acreage of interim cover is estimated to be 5 acres. The interim cover area will not be steeper than 3:1 nor flatter than 5% as can be seen on the drawing and thus, it will meet the regulatory slope requirements. Storm water will be routed away from the landfill and managed in the approved storm water management system. What little storm water will infiltrate through the interim cover will be collected in the leachate system under Cell 5 and handled in accordance with the permit. A gas management system will be provided as discussed below.

2.1.4 Interim Closure Plan

To assure DEQ that “all steps necessary to prevent threats to human health and the environment from the unclosed unit” are taken it is suggested that an “Interim Closure Plan” be prepared for this landfill which would be submitted to DEQ for approval as a supplement to the permitted closure plan. It would be appropriate to submit this as a part of the variance request discussed below. This plan would include discussions on interim cover type, maintenance, inspections, storm water management, leachate handling, environmental monitoring etc. An example of this document is included in Appendix 5. The advantage of this document is that it would provide the information necessary for an inspector to evaluate the interim cover and to verify its compliance with the facility permit.

2.1.5 Variance request

To grant an extension to the regulation for timing of initiation of closure, a variance must be submitted by the regional authority. This variance must be completed in accordance with the requirements of 9 VAC 20-80-750.A which states that an applicant for a variance must demonstrate to the satisfaction of the director that:

“1. a. Strict application of the regulation to the facility will result in undue hardship that is caused by the applicant’s particular situation; or

b. The alternate design or operation will result in a facility that is equally protective of the human health and the environment as that provided for in the regulations; or

c. *Technical conditions exist that make a strict application of the regulation difficult to achieve; and*

2. *Granting the variance will not result in an unreasonable risk to the public health or the environment.*"

After discussions with DEQ and further consideration, the authority would seek a variance in accordance with 1.b. indicating that the interim cover as proposed will be equally protective of human health and the environment as a final cover as required by the regulations. This demonstration would include the use of LF HELP modeling to evaluate infiltration through the interim cover as compared to the permitted cap if the limitations of the model addressed under Section 2.2 below can be overcome. As discussed below under Section 2.2, the authority will propose the use of a membrane for the interim cover system. The following table indicates other aspects of the interim cover system which may be addressed in the variance in comparison to a final cover system assuming the use of a membrane to address equal protection:

**COMPARISON OF ENVIRONMENTAL "IMPROVEMENTS"
Interim Cover vs. Final Cap
Preliminary Considerations**

Item	Interim Cover	Final Cap
Headover Membrane (Surface water)	Negligible water infiltration into waste mass under the Interim Cover. The majority of water will run off the membrane.	Higher potential for increased head. Soil cover and drainage layers will hold water and allow more time for water to build up over membrane.
Veneer Stability	More stable without soil on membrane, i.e., decreased number of slip planes. The layer that typically fails in a cover cap is the soil above the membrane and this will be alleviated with the interim cover.	A greater number of material types with different friction angles thereby increasing the number of potential slippage planes especially under saturated conditions.
Runoff into Storm water System	Theoretically, any runoff from this cover should pass through the storm water control system. However, the runoff from the interim cover will not be in contact with any soil cover material and will therefore be "clean water" and can be discharged directly off site. Detention for flow discharge may still be required however.	Prior to final vegetative stabilization, the final cover system will produce runoff potentially laden with significant quantities of sediment. This storm water must be managed via use of a sediment basin sized to handle the quantity of anticipated runoff.
Operations/Inspection/Maintenance	The membrane will require less maintenance during the interim.	The facility personnel will need to monitor this cap daily until the

Item	Interim Cover	Final Cap
	closure period – no mowing, no erosion repairs, no sediment basin cleanout etc. Inspections will be easy to perform because the white upper surface will expose any areas with damage, i.e., they will show as black areas in the white membrane.	vegetative cover is fully established and after every significant storm event. Once stabilization occurs, maintenance items such as mowing and erosion repair will need to be performed.

The potential risks to human health and the environment created by using an interim cover must also be addressed under the variance process. The proposed interim cover will not create an unreasonable risk. The following table summarizes some of the initial ideas relative to risk and exposure:

RISK ASSESSMENT OF INTERIM COVER
(Assumes use of an exposed membrane for the cover system)
Preliminary Assessment

Potential Threats	Interim Closure
Surface Water Contamination	Runoff from membrane will be ‘clean’ – no sediment runoff; no potential contact with waste
Ground Water Contamination	Diminished infiltration will reduce the amount of leachate produced, thereby reducing the potential for groundwater contamination.
Gas Migration	The membrane will reduce the amount of landfill gas generated. A gas collection system will be provided and the gas passively vented.
Vector Control	Rodents will not be able to burrow through the cap or into the waste. No waste will be exposed to collect water or create other habitats for vectors.
Odors	With reduced gas generation, odor will be less of a problem when compared to an operating landfill.
Blowing Litter	The membrane will eliminate the potential for waste to be exposed and hence the potential for blowing litter.
Leachate Seeps	Not anticipated with membrane cover.
Leachate Discharge from Collection System	The on-site 380,000 gallon storage tank will be checked as appropriate.
Impact to adjacent properties	Over 1000’ to property boundary

2.2 Interim Cover

The purpose of the interim cover is to provide a stable cover over the waste which will reduce vector and odor problems, reduce infiltration and provide a slope with minimum maintenance requirements. It should be noted that with the use of a membrane little if any infiltration is expected. Should any infiltration penetrate the cover, it will be captured in the leachate collection system and discharged for treatment. The authority will be bound to continued maintenance of the facility during the interim closure period. Maintenance will include frequent inspections and implementation of adequate measures to assure structural integrity, stabilization and continued leachate and storm water management and gas control. The authority will be responsible for these activities.

The interim cover should have a sufficient life to reduce maintenance and if maintenance is required it should be easily repaired. Likewise the cost of placing the cover should balance with its function with knowledge that whatever is placed is “sacrificial” and will need to be removed once the landfill returns to operation.

2.2.1 Description of the interim cover

After considering various options for the interim cover, the Region has determined that it will place a membrane cover on the area requiring interim closure. The proposed section is illustrated in the figures provided in Appendix 6. The section consists of 6” of daily cover, 6” of intermediate cover, an 8 oz. non-woven geotextile, and a 30 mil geomembrane with a sandbag and rope tie down system. The geotextile will serve as a protective layer between the membrane and the soil and as a gas collection layer.

The membrane chosen can be described as a 30 mil, textured, high density polyethylene geomembrane with a white coating on the exterior side of the material. This material would be similar to GSE HDT 030G000. Specifications for this material are included in Appendix 6.

The membrane would be attached to the top of the slope with a seamed connection to the final cover system placed for final closure of the upper area. The toe of the slope would be anchored in a trench outside of the liner system. Drainage away from the toe would be provided and intermediate slope diversions included. The seamed connection at the top would be designed to allow for the expansion and contraction of the exposed membrane. By using the colored surface, the material will undergo less expansion and contraction than standard membrane material but these environmental stresses must still be accounted for. When operations are reinstated at the landfill, the interim cover will be cut from the final cover system and the final cover system anchored for future connections.

At the upper connection, a trench will be designed with a perforated pipe to collect and vent gas that may be collected in the gas collection layer. Three to five vertical pipes tied to the horizontal pipe will be placed to allow proper venting. Each vertical pipe will have a suitable membrane penetration design.

The sand bag and rope anchor system will be constructed to hold the membrane in place under windy conditions. Appendix 6 includes a wind rose from the closest weather station at Lynchburg which indicates an average wind speed of 4.36 meters per second or 10 miles per hour. Maximum wind speed indicated is 25 miles per hour. The predominant wind direction is from the southwest and secondarily from the northeast. The proposed anchor system will be adequate given these criteria. Should stronger winds create any damage to the membrane, the authority will repair the membrane immediately.

Placement of the interim cover would be completed under standard quality control procedures with seams properly tested in accordance with the manufacturer's recommendations. The cover will be inspected periodically to assure its continued function and repaired if necessary.

The final design of this system will be provided with the required permit amendment and variance request.

Relative to the performance of this system, the LF HELP computer model cannot be used to calculate infiltration through the membrane. Section 3.9.2, Limits of Application, of the User's Guide for Version 3 of the HELP model (EPA/600/R-94/168a, September 1994, Page 40), states the following, "*The model has limits on the arrangement of layers in the landfill profile.....The top layer may not be a liner.....*" Given this direction, the exposed membrane cannot be modeled using conventional methods. DEQ has indicated that it will provide the mathematical model used in the LF HELP model for calculation and this information will be included with the variance request. Empirically, precipitation on an exposed membrane on a 3:1 slope will run off rapidly. There will be no head over the membrane and hence little if any infiltration. Any infiltration would be collected in the leachate collection system.

2.3 Leachate Management

Leachate will continue to be managed at the facility. Once the final cap and interim cover (assumed to be a membrane) are placed, limited infiltration into the waste mass will occur. Most, if not all of the leachate that will be collected over the interim closure period will come from the waste mass itself. This would occur with or without the use of the proposed interim cover system.

In actuality, the regional approach with the interim closure period will actually allow for reduced leachate production over the total operating life of Phase III of the landfill. Operating landfills allow more infiltration than landfills that are either closed or in interim closure. When Phase III becomes operational after the interim closure period it will operate for a shorter period of time than it would have had the landfill remained operational and only received Campbell County waste. R.W. Beck estimated in their 2006 report on page 2-7, that Phase III of the landfill would be operational from the present time until 2022 if used by Campbell County alone. (16 years of continual operation). With the Regional proposal, Phase III will only be operational for 4 – 5 years (2014 – 2019) after which time this phase of the landfill will be capped. Thus overall, total leachate generation will be less for the regional operation of 5 years versus continued operations for 16 years.

2.4 Gas Management and Air permitting

Gas management and air permitting are potential issues relative to the interim closure and the accelerated fill of the permitted capacity. The following section discusses these activities relative to the regional proposal.

2.4.1 Gas management at the Campbell County landfill

Gas management includes methane monitoring and venting of gas from the landfill through the final cap. When the Campbell County landfill enters interim closure 14 acres of final cap will be placed. This cap will require placement of gas vents through the waste mass to relieve pressure from the landfill gas on the final cover. A minimum of 1 vent per acre will be placed. In addition, the interim cover will have a gas collection layer and venting system. Gas will thus be managed and not impact the membrane cover.

During the interim closure period less gas would be produced than if the landfill remained open. With a final cap and a membrane interim cover system, little additional moisture will enter the landfill. Moisture is required for methane production. Hence it is anticipated that methane production will actually decrease during the interim cover period than if the landfill remained operational. Once the landfill reopens, it will operate for a much shorter period of time before it reaches final grade and receives the final cover. The gas production rate will increase during this period of accelerated fill. However, with the cap being placed sooner, gas generation rates may then drop more rapidly than if the landfill was operational for a longer period of time.

Methane monitoring will continue during interim closure in accordance with the approved gas management plan. The authority will be responsible for all monitoring activities.

2.4.2 Air permitting

The Lynchburg Landfill has sufficient capacity to be classified as a Title V landfill and has been permitted as such. It also runs an active gas collection system which will continue to operate under the oversight of the authority. This system is privatized and will not change under this proposal.

Neither the Amherst County nor the Campbell County landfills have sufficient permitted capacity to move these facilities into Title V air permitting. However, based on communications with the DEQ – Air Division, it has been indicated that with the accelerated fill operations, gas emission rates may change and this will require the landfills to file a New and Modified Source Permit Application (Form 7). Filing this documentation will allow the DEQ – Air Division to evaluate whether or not any type of permitting will be required.

Appendix 7 contains emission modeling data for the three landfills completed using the EPA Landfill Gas Emission Model, Version 3.02. Three scenarios were considered. The first was continued operation as is currently permitted, the second was the original regional configuration with each landfill being operated sequentially, and the third was the new regional configuration

with the two landfills operating simultaneously. In order to properly compare the impacts of each scenario on each landfill, each model run starts at July 1, 2007 and does not consider the emissions from the waste currently in place. The data indicates that the accelerated use of the Lynchburg landfill under the new regional proposal has little impact on the peak year, peak flow or total emissions when compared to either continued operation as is or the original regional proposal. However, the accelerated fill does impact gas emissions for the Campbell and Amherst landfills when compared to continued operation as is. Amherst is impacted the least while Campbell is impacted the most.

The increased gas emissions will not negatively impact landfill operations. Lynchburg already operates an active system and will continue to do so. If odor or gas emissions become a problem at either of the other landfills, additional vents, or some type of control system will be considered and the gas management plan revised accordingly. The increased gas emissions may impact air permitting but this will not be known until the Form 7 is completed and filed with DEQ. Peak years for both Amherst and Campbell will occur near the end of the regional capacity as currently permitted.

2.5 Financial assurance

Responsibility for financial assurance will transfer to the authority when the landfill ownership is transferred to the authority. Currently all financial assurance is posted via the local government financial test (9 VAC 20-70-210). There will be no lapse in financial assurance although the mechanism will change as indicated below.

At this time, it is probable that the authority will require Campbell County and Lynchburg to post financial assurance for each of its older landfills using the local government guarantee with appropriate contract. In addition it is most probable that the authority will ask each of the local governments to financially assure some percentage of each of the regional landfills based on preexisting tonnage in place and the annual tonnage placed. The percentage will vary on an annual basis and this calculation will be provided to DEQ. This is similar to the mechanism used for the Augusta Regional landfill by the Augusta County Service Authority which requires that financial assurance be posted by Augusta County, and the Cities of Waynesboro and Staunton. The local governments will use the local government guarantee with appropriate contract for this aspect of financial assurance.

As was understood during various discussions on financial assurance, a combination of reserve fund cash held by the Authority and local government guarantees is not possible. It should be noted however, that the Authority will be building a cash reserve fund for closure and post closure care.

The local government guarantee will be posted in accordance with 9 VAC 20-70-230.

For the Campbell County landfill, which will be placed into interim closure for 7 years, it is suggested that a supplement to the existing financial assurance responsibilities be provided which will include the costs for final closure of the 5 acres of interim cover should this landfill not be used ultimately as a regional facility (an unlikely scenario) and for the maintenance of the

interim cover system during the 7 year interim period. All monitoring and leachate handling costs are addressed under the existing financial assurance requirements and hence would not be required in this supplement.

It is recognized that the 30 year post closure period will not start until the landfills are deemed to be officially closed by DEQ and the closure recorded on the deed of the property. Financial assurance will be the responsibility of the authority.

2.6 Increased operations

Additional tonnage will be delivered to all three landfills at some point. The increases by percentage based on 2006 data provided by RW Beck can be indicated as follows:

LANDFILL	ANNUAL TONNAGE	PERCENTAGE
Lynchburg Landfill		
Existing tonnage	165,570	76.2%
Campbell County	47,693	21.9%
City of Bedford	4,010	1.9%
TOTAL	217,273	100.0%
Amherst Landfill		
Existing tonnage	30,150	69.0%
Nelson County	13,534	31.0%
TOTAL	43,684	100.0%
Campbell Landfill		
Existing tonnage	47,693	18.3%
Lynchburg	165,570	63.4%
City of Bedford	4,010	1.5%
Amherst County	30,150	11.6%
Nelson County	13,534	5.2%
TOTAL	260,957	100.0%

Both Lynchburg and Amherst receive a 30+% increase in tonnage while Campbell County's tonnage will increase by 82%.

Increased operations will require that the operations manuals be updated for the landfills. This will require a permit amendment and DEQ will be allowed the opportunity to comment on the specific methods for handling the increased tonnage through the permit amendment process. Appendix 8 includes information from the RW Beck report which outlines personnel requirements and equipment availability. This evaluation was based on the original regional proposal of sequential landfill operations. The final personnel and equipment requirements will be revised during preparation of the permit amendments to reflect the new proposal. At this time there is sufficient equipment to handle the increased tonnage at the Lynchburg landfill. In the future, this equipment will be provided to the Campbell County landfill for their operations. If additional equipment is necessary, the authority will purchase it. Sufficient equipment exists at

the Amherst County landfill to handle the increased tonnage of Nelson County without changing operations.

Increased operations may also impact the infrastructure at the entrance to the landfills. Neither the Lynchburg nor the Amherst landfills will require upgrade to receive the additional tonnage. The Campbell County landfill will require an additional set of scales and revisions to its internal landfill roads. The infrastructure improvements have been described by RW Beck in their report entitled, "Final Report, Regional Solid Waste Management Financial, Operational, and Regulatory Analysis", dated April 2006 excerpts of which are also included in Appendix 8.

2.7 Relationship to Solid Waste Management Plan Process

The local governments involved in this regional proposal understand that the regional authority will need to complete a new regional solid waste management plan which encompasses this proposal. Under this regional proposal, no capacity is changing, but only the timing of the fill operations at each of the individual landfills. As the schedule contained in Appendix 3 indicates preparation of a revised regional solid waste management plan will be prepared during FY 2007 and this regional plan will replace the existing solid waste management plans currently held by each locality. It is understood that the regional solid waste management plan must be approved prior to final approval of the variance request or permit amendments needed for implementation.

To bridge the time between final authority formation and acquisition of the landfills, the local governments will need to revise their existing solid waste management plans. Such revisions are considered major permit amendments and will require a public comment period. The following plans will be revised in the priority indicated:

City of Lynchburg	Will revise plan to allow waste from Campbell County and Bedford City. Very critical given Campbell County's schedule.
Amherst County	Will revise plan to allow waste from Nelson County and some commercial and sludge waste from Lynchburg.
Campbell County	May revise theirs to indicate the transfer of waste. Not critical.
Nelson County	Will need to notify existing region that it will be leaving region and joining new region.
City of Bedford	May need to revise theirs to indicate in more detail the transfer operation.

2.8 Presence of older unlined landfills at Lynchburg and Campbell County

Appendix 2 includes two figures which illustrate the location of the older landfills to the operating landfills at Lynchburg and Campbell County. These older landfills are included within the operating landfill permits. After discussions with DEQ, these landfills will remain within the

existing permits and the authority will become responsible for their post closure care, maintenance, remediation and monitoring. However, the authority will return these responsibilities to the original owners through appropriate contracts.

2.9 Permitting

Timing of permitting will be critical for the success of this project. At this time, the following permit amendments or variances will be required. The entity that will file the documentation will be dependent on authority formation and acquisition of the landfills. If the permit amendment or variance must be filed before acquisition, the current permit holder will file the documentation.

LOCALITY	PERMITTING ACTIVITY	GENERAL TIMING
Authority	Regional SWMP	ASAP (2007)
Campbell County Landfill	Variance request for interim closure	ASAP (2007)
	Major Permit Amendment for increased operations	Submittal: 2008 - 2009
	Major Permit Amendment for closure configuration and alternate cap	ASAP (2007) – alternate cap configuration is pending with DEQ but may need to be modified.
Lynchburg Landfill	Revision to SWMP – may not be necessary as it will be replaced by regional plan	2008
	Major permit amendment to change service area, average and peak tonnages, operations if impacted by increased tonnage.	ASAP – will ride on the current permit amendment pending with DEQ for next phase of landfill.
	Revision to SWMP	ASAP – to modify service area, average and peak tonnages, timing of facility, description of Region 2000 proposal and schedule.
Amherst County Landfill	Major permit amendment to revise service area, average and peak tonnages, operations if impacted by increased tonnage.	Timing dependent on when Nelson County would want to terminate contract with private company and begin use of Amherst.
	Revision to SWMP	Timing dependent on when Nelson County would want to begin use of facility. Revision will be to modify service area, average and peak tonnages, timing of facility, description of Region 2000 proposal and schedule.

3.0 SUMMARY

This final proof of concept has incorporated comments received from DEQ over the past several months and provides many details on the proposed regional approach. Final details will be provided during the permitting process. This report and previous discussions have indicated that DEQ will have multiple opportunities to comment on, and provide guidance to, the project and to assure that permit compliance is maintained through the permit amendment and variance processes. The public will also have an opportunity to comment on this proposal via the public participation required during the permit amendment and variance process. There are still multiple legal and financial details to be worked out relative to the project and these are currently being addressed by the legal and financial advisors recently retained by the Region.

To embark further on the project however will require significant financial commitment by the participants. At this time, the regional participants are requesting assurance from DEQ that there are no major stumbling blocks for the implementation of this regional proposal, and are requesting an approval of the concept described herein. It is recognized that this Proof of Concept is not an official permit document but does provide valuable information relative to the proposal.

Implementation of this regional concept will require significant permitting and coordination of operations. Thus a very discrete "window of opportunity" exists in which the review and approval of this concept must occur to enable the project to move forward. The concept described herein will not only benefit the participating local governments by reducing their disposal costs and by maximizing the use of the air space in the region, it will improve protection of the public and the environment by reducing the number of operating facilities, minimizing traffic due to waste hauling, and the creation of a more cohesive management system for the waste products generated within the region.

APPENDIX 1
Participant Resolutions

Jerome

BOOK 32

VIRGINIA:

At a continued meeting of the Board of Supervisors of Amherst County held at the Administration Building thereof on Tuesday, the 20th day of June, 2006 at 3:30 p.m. at which the following members were present and absent:

BOARD OF SUPERVISORS:

PRESENT:	Mr. T. Fore	ABSENT: None
	Mr. R. Vandall	
	Mr. J. Albert	
	Mr. V. Wood	
	Mr. L. Parrish	

IN RE: REGIONAL SOLID WASTE MANAGEMENT PLAN

Lynn Klappich, of Draper Aden Associates, county landfill engineer met with the Board and presented information regarding the Solid Waste Plan.

There was a Board discussion specifically focusing on concern for large increase of truck traffic when the Amherst landfill would serve the Region. There was interest in investigating a possible modified regional concept that would not require all of the region's truck traffic.

On motion of Mr. T. Fore, and with the following vote, the Board of Supervisors moved that Amherst County proceed with the first phase of the Regional Solid Waste Implementation Plan for an estimate total cost of up to \$30,000 contingent upon sufficient funding in the Solid Waste budget Fund 85.

AYE: Mr. T. Fore, Mr. R. Vandall, Mr. J. Albert, Mr. V. Wood and Mr. L. Parrish
NAY: None

A. COPY, TESTE: *Rodney E. Taylor*
Rodney E. Taylor, County Administrator

RESOLUTION

WHEREAS, the City of Bedford has actively participated in the Regional Solid Waste Management Initiative sponsored by the Virginia's Region 2000 Partnership Local Government Council in conjunction with the Counties of Amherst, Campbell, and Nelson, and the City of Bedford; and

WHEREAS, the Regional Solid Waste Management Initiative has undertaken an initial Regional Solid Waste Management Analysis, completed in April 2005, and a Regional Solid Waste Management Financial, Operational, and Regulatory Analysis completed in May 2006; and

WHEREAS, both analyses describe a potential regional solid waste management structure that is financially advantageous and operationally sound; and

WHEREAS, the Implementation Phase will involve significant effort to negotiate with DEQ, designate a solid waste management region, prepare a revised solid waste management plan, develop a detailed proof of concept technical proposal and transition plan, secure solid waste permit amendments, legally establish the regional entity, and hire initial staff; and

WHEREAS, this activity will require a significant commitment of both staff time and financial resources, with a timeframe for the implementation expected to take approximately three years; and

NOW THEREFORE BE IT RESOLVED, the City of Bedford does hereby support the concept of implementing the Regional Solid Waste Management Initiative and directs staff to continue efforts to successfully form the regional solid waste management entity.

BE IT FURTHER RESOLVED, that the City Council of the City of Bedford does authorize its City Manager to sign any documents necessary for this effort short of the formal establishment of the entity.

COUNTY OF CAMPBELL



At the regular meeting of the Campbell County Board of Supervisors held on the 15th day of May 2006 in the Board of Supervisors Meeting Room of the Haberer Building, Rustburg, Virginia:

On motion of Supervisor Pendleton, it was resolved the Board of Supervisors adopts the following resolution:

Resolution for Implementation of the Regional Solid Waste Management Initiative

Whereas, Campbell County has actively participated in the Regional Solid Waste Management Initiative sponsored by the Virginia's Region 2000 Partnership Local Government Council in conjunction with the Counties of Amherst, Campbell, and Nelson, and the Cities of Bedford and Lynchburg; and

Whereas, the Regional Solid Waste Management Initiative has undertaken an initial Regional Solid Waste Management Analysis, completed in April 2005, and a Regional Solid Waste Management Financial, Operational, and Regulatory Analysis, completed in May 2006; and

Whereas, both these analysis' demonstrate a regional solid waste management structure is financially advantageous and operationally sound; and

Whereas, the next phase of the Regional Solid Waste Management Initiative is implementing the recommendations of the Regional Solid Waste Management Financial, Operational, and Regulatory Analysis to form the regional solid waste management entity; and

Whereas, this Implementation Phase will involve significant effort to negotiate with DEQ, designate a solid waste management region, prepare a revised solid waste management plan, develop a detailed proof of concept technical proposal and transition plan, secure solid waste permit amendments, legally establish the regional entity, and hire initial staff; and

Whereas, this activity will require a significant commitment of both staff time and financial resources, with a timeframe for the implementation expected to take approximately three years.

Now therefore, the Campbell County Board of Supervisors does hereby support the concept of implementing the Regional Solid Waste Management Initiative and directs Campbell County staff to continue efforts to successfully form the regional solid waste management entity.

The vote was: Aye: Boyer, Carter, Falwell, Gunter, Pendleton, Puckett, Rosser
Nay: None

A copy teste:


R. DAVID LAURELL
COUNTY ADMINISTRATOR

Whereas the City of Lynchburg has actively participated in the Regional Solid Waste Management Initiative sponsored by the Virginia's Region 2000 Partnership Local Government Council in conjunction with the Counties of Amherst, Campbell, and Nelson, and the Cities of Bedford and Lynchburg; and

Whereas the Regional Solid Waste Management Initiative has undertaken an initial Regional Solid Waste Management Analysis, completed in April 2005, and a Regional Solid Waste Management Financial, Operational, and Regulatory Analysis, completed in May 2006; and

Whereas both analyses describe a potential regional solid waste management structure that is financially advantageous and operationally sound; and

Whereas the next phase of the Regional Solid Waste Management Initiative is implementing the recommendations of the Regional Solid Waste Management Financial, Operational, and Regulatory Analysis to form the regional solid waste management entity; and

Whereas the Implementation Phase will involve significant effort to negotiate with Department of Environmental Quality, designate a solid waste management region, prepare a revised solid waste management plan, develop a detailed proof of concept technical proposal and transition plan, secure solid waste permit amendments, legally establish the regional entity, and hire initial staff; and

Whereas this activity will require a significant commitment of both staff time and financial resources, with a timeframe for the implementation expected to take approximately three years.

Now therefore, the City of Lynchburg does hereby support the concept of implementing the Regional Solid Waste Management Initiative and directs City of Lynchburg staff to continue efforts to successfully form the regional solid waste management entity.

And furthermore, does authorize the City Manager to sign any documents necessary for this effort short of the formal establishment of the entity.

Adopted: May 23, 2006

Certified: *Catherine W. Kost*
Clerk of Council

053L

cf. D. Owen
K. Payne

BOARD OF
SUPERVISORS

THOMAS D. HARVEY
North District

HARRY S. HARRIS
South District

ALLEN M. HALE
East District

THOMAS H. BRUGUIERE, JR.
West District

CONSTANCE BRENNAN
Central District



STEPHEN A. CARTER
Administrator

VIRGIE A. CARTER, CMC
Administrative Assistant/
Deputy Clerk

DEBRA K. McCANN
Director of Finance and
Human Resources

RESOLUTION

AUTHORIZATION TO CONTINUE PARTICIPATION IN REGION 2000 SOLID WASTE MANAGEMENT INITIATIVE

WHEREAS, the County of Nelson has actively participated in the Regional Solid Waste Management Initiative sponsored by the Virginia's Region 2000 Partnership Local Government Council in conjunction with the Counties of Amherst, Campbell, and Nelson, and the Cities of Bedford and Lynchburg; and

WHEREAS, the Regional Solid Waste Management Initiative has undertaken an initial Regional Solid Waste Management Analysis, completed in April 2005, and a Regional Solid Waste Management Financial, Operational, and Regulatory Analysis, completed in May 2006; and

WHEREAS, both analyses describe a potential regional solid waste management structure that is financially advantageous and operationally sound; and

WHEREAS, the next phase of the Regional Solid Waste Management Initiative is implementing the recommendations of the Regional Solid Waste Management Financial, Operational, and Regulatory Analysis to form the regional solid waste management entity; and

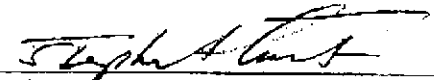
WHEREAS, the Implementation Phase will involve significant effort to negotiate with DEQ, designate a solid waste management region, prepare a revised solid waste management plan, develop a detailed proof of concept technical proposal and transition plan, secure solid waste permit amendments, legally establish the regional entity, and hire initial staff; and

WHEREAS, this activity will require a significant commitment of both staff time and financial resources, with a timeframe for the implementation expected to take approximately three years.

NOW THEREFORE BE IT RESOLVED, that the Nelson County Board of Supervisors does hereby support the concept of implementing the Regional Solid Waste Management Initiative and directs Nelson County staff to continue efforts to successfully form the regional solid waste management entity.

AND BE IT FURTHER RESOLVED, that the Board does authorize the County Administrator to sign any documents necessary for this effort short of the formal establishment of the entity.

Approved: May 15, 2006

Attest:  , Clerk
Nelson County Board of Supervisors

APPENDIX 2
Permits and Site Maps



Record of
Permit Amend's

COMMONWEALTH of VIRGINIA
DEPARTMENT OF ENVIRONMENTAL QUALITY

SOLID WASTE FACILITY PERMIT
PERMIT NUMBER 285

AMENDMENT #4

Facility Name: Campbell County Sanitary Landfill

Facility Type: Sanitary Landfill

Latitude: 37° 16' 49" N

Site Location: Campbell County, Virginia

Longitude: 79° 08' 51" W

Location Description: The facility is located east of US Route 29, at the end of State Route 674, approximately 5 miles south of Lynchburg, Virginia.

Background: The facility is serving as a sanitary landfill in compliance with §9 VAC 20-80-10 et seq., Amendment 3, for disposal of certain waste from Campbell County, to include the Towns of Altavista and Brookneal. Phases III and IV of the facility are designed with a composite liner system, which consists, from top to bottom, of 18 inches of drainage material (VDOT #8) with a minimum hydraulic conductivity of 1×10^{-3} cm/sec, 60-mil HDPE geomembrane, and 24 inches of soil liner with a maximum permeability of 1×10^{-7} cm/s. Leachate generated within each cell will flow by gravity to the leachate holding tank, which has a capacity of 224,700 gallons. From there, the leachate will be pumped and hauled to a local wastewater treatment facility. The waste accepted will conform to those wastes listed in Permit Attachment II-1 (Operations Manual). Based on a disposal rate of 36 tons/day, the facility will operate for an estimated 24 years with an ultimate solid waste disposal capacity of 3.96 million cubic yards.

op manual 1998
285-250

Permit Highlights:

Permit Amendment #4 (Minor Amendment): This minor amendment incorporates the Gas Remediation Plan (GRP) for Phase II that has been prepared to address methane gas concentrations above the lower explosive limit in probes surrounding the Phase II area. The GRP will be incorporated into Permit Module XIV, Attachment XIV-2. In addition, testing frequencies were updated in Table I of the Construction Quality Assurance Plan.

Permit Amendment #3 (Minor Amendment): This minor amendment incorporated a modification of the groundwater monitoring network.

Permit Amendment #2 (Major Amendment): This major amendment incorporated Groundwater Protection Standards for Phase II and also incorporated a variance for the use of alternate concentrations limits as Groundwater Protection Standards, in lieu of background data.

Permit Amendment #1 (Major Amendment): This major amendment incorporated Modules II (Operation), III (Design and Construction), X and XI (Groundwater Monitoring), and XII (Closure/Post-Closure) for Phases III and IV. This permit amendment also incorporated design elements for a Subtitle D composite liner system.

The facility was issued Permit #285 on October 26, 1979.

THIS IS TO CERTIFY THAT:

Campbell County
Box 100
Rustburg, VA 24588

is hereby granted a permit to construct, operate, and maintain the facility as described in the attached Permit Modules I, II, III, X, XI, XII and XIV and the Permit Attachments cited in these Modules. These Permit Modules and Permit Attachments are as referenced hereinafter and are incorporated into and become a part of this permit.

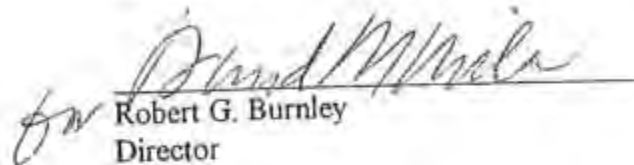
The herein described activity is to be established, modified, constructed, installed, operated, used, maintained, and closed in accordance with the terms and conditions of this permit and the plans, specifications, and reports submitted and cited in the permit. The facility shall comply with all regulations of the Virginia Waste Management Board.

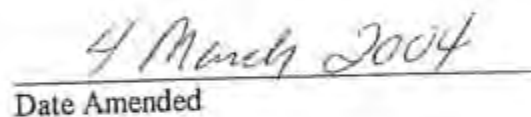
Failure to comply with the terms and conditions of this permit shall constitute grounds for the revocation or suspension of this permit and for the initiation of necessary enforcement actions.

The permit is issued in accordance with the provisions of § 10.1-1408.1A, Chapter 14, Title 10.1, Code of Virginia (1950) as amended. A Variance was granted August 7, 2001, for the use of alternate concentration limits as groundwater protection standards, in lieu of background data.

Issued: October 26, 1979
Amended: October 7, 1994
Amended: August 7, 2001
Amended: November 12, 2003

APPROVED:


Robert G. Burnley
Director


Date Amended



COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

Street address: 629 East Main Street, Richmond, Virginia 23219

Mailing address: P.O. Box 10009, Richmond, Virginia 23240

Fax (804) 698-4500 TDD (804) 698-4021

<http://www.deq.state.va.us>

James S. Gilmore, III
Governor

John Paul Woodley, Jr.
Secretary of Natural Resources

Dennis H. Treacy
Director

(804) 698-4000
1-800-592-5452

SOLID WASTE FACILITY PERMIT PERMIT NUMBER 563

Facility Name:	Amherst County Landfill	
Facility Type:	Sanitary Waste Disposal Facility	Latitude: 37°28'38"
Site Location:	Amherst County	Longitude: 79°02'05"

Location Description: The facility is located on Route 613, approximately 6 miles northeast of Madison Heights, Virginia. The facility property is approximately 275 acres of which approximately 38 acres will be disposal area.

Background: The facility is to serve as a sanitary solid waste landfill in order to dispose of certain waste for municipalities within Amherst County, Virginia. The facility has been designed to receive approximately 56 tons per day (tpd) of municipal sanitary waste, 1 tpd CDD waste, and 22 tpd of commercial/industrial waste. The total life span of the landfill is 45 years with an estimated capacity of ±1.64 million cubic yards (cy) of waste. The waste accepted will conform to those wastes listed in the section titled "Type of Wastes" located in Permit Module II and Permit Attachment II-1 (Operations Manual).

Permit Highlights: This permit amends the existing permit issued on March 2, 1994. This permit includes five permit modules and associated permit attachments which are, in general, based on information submitted in the permit application. Permit Module I includes general permit conditions, and Permit Modules II and III stipulate requirements for the design and operation of the landfill. Permit Module X contains groundwater monitoring requirements. Requirements regarding closure and post-closure of the landfill are addressed in Permit Module XII. Amendment 1 modifications are listed in Permit Attachment III-5. The most significant modification is the combination of Trench A and Trench B into Trench A/B. The new configuration will add 24 years of life to the original lifespan of 21 years. The original permit incorporated design elements for a double liner system consisting of a composite liner system, overlain by a synthetic geonet witness zone and a 60 mil textured HDPE liner. The single liner system for Trench A/B will consist of (from bottom to top) 24" of 1 x 10⁻⁷ cm/sec clay, 60 mil textured HDPE and 16 oz. geotextile, 12" of # 57 stone as a drainage layer and 6" of # 57 stone as a cushion layer.

THIS IS TO CERTIFY THAT:

Amherst County
P.O. Box 779
Madison Heights, Virginia 24572

is hereby granted a permit to construct, operate, and maintain the facility as described in the attached Permit Modules I, II, III, X, and XII, and the Permit Attachments were cited in these Modules. These Permit Modules and Permit Attachments are as referenced hereinafter and are incorporated into and become a part of this permit.


The herein described activity is to be established, modified, constructed, installed, operated, used, maintained, and closed in accordance with the terms and conditions of this permit and the plans, specifications, and reports submitted and cited in the permit. The facility shall comply with all regulations of the Virginia Waste Management Board.

Failure to comply with the terms and conditions of this permit shall constitute grounds for the revocation or suspension of this permit and for the initiation of necessary enforcement actions.

The permit is issued in accordance with the provisions of § 10.1-1408.1.A, Chapter 14, Title 10.1, Code of Virginia (1950) as amended.

Issued: March 2, 1994

APPROVED:


for Dennis H. Treacy

DATE: April 29, 1999
Amended



COMMONWEALTH of VIRGINIA
DEPARTMENT OF ENVIRONMENTAL QUALITY

SOLID WASTE FACILITY PERMIT
PERMIT NUMBER #558

Facility Name: Lynchburg Sanitary Landfill
Facility Type: Sanitary Landfill Latitude: 37° 23' 30"
Site Location: City of Lynchburg Longitude: 79° 6' 35"

Location Description: The facility is located on Concord Turnpike approximately one half mile north of the intersection of US Route 460 in the eastern section of the City.

Background: The Lynchburg Sanitary Landfill is to serve as a sanitary landfill. The landfill will service the City of Lynchburg with an estimated fill rate of 260 tons per day. The City has refuse collection for its residents. The waste accepted will be municipal solid waste and industrial waste as specified in Permit Module II (Operations Manual). The landfill capacity is estimated to be 4.4 million cubic yards over a design life of 19.4 years.

The permitted facility includes a parcel of land owned by the City of Lynchburg that is 107 acres. The existing landfill is on 32 acres and 75.1 acres were added to the facility in 1993. Of the 75.1 acres, 36.2 acres will be used as actual disposal area, with the remainder for support facilities (equipment and operation office building, equipment yard, household disposal area, access roads, sedimentation basins, etc.) and required buffers.

Permit Highlights:

Amendment #5 (Minor): This amendment establishes the monitoring frequency of monthly at those individual probes where the methane concentration exceeds 5%. Methane monitoring in on-site structures will also follow this frequency if the methane concentration exceeds 1.25%. Also, Permit Module I has been updated to current standards and Permit Conditions I.G.4, I.G.5, I.G.7, and I.G.8 have been eliminated.

Amendment #4 (Major): This amendment established the Corrective Action Program and groundwater monitoring program which includes the groundwater monitoring system, groundwater sampling and analysis procedures, laboratory data evaluation methods, recordkeeping, and reporting requirements to be used during the remediation program.

Amendment #3 (Minor): This amendment makes minor changes to the Operations Manual to allow the disposal of Construction/Demolition Debris and non-friable asbestos wastes in the landfill.

Amendment #2 (Minor): This amendment was for implementation of gas controls at the facility. The facility submitted an initial gas remediation plan in May 1994, which focused on the closed fill area. The facility commenced operation of the active gas control system at the facility in April 1996. This permit amendment was for the institution and expansion of active gas controls at the facility. Updated remedial measures for landfill decomposition gas is summarized in Module LF.2.

Amendment #1 (Major): This amendment was for extending the composite liner 0.5 acres from the area contained in the permit issued November of 1993. It modified the modules and attachments for the liner extension and includes a revision to the CQA Plan.

This permit includes eight permit modules. Permit Module I includes general permit conditions. Permit Module II includes information on the facility's operations. Permit Module III and Permit Attachments III-1 through III-3 detail design and construction information pertinent to the facility. Permit Module X, Permit Attachment X-1, and Permit Module XI include conditions related to ground water monitoring of the facility. Permit Modules XII and XIII contain requirements for closure and post-closure care of the facility. Permit Module XIV contains information regarding corrective action in regards to landfill decomposition gas. All permit modules and attachments were prepared based on information submitted in the permit application. The permit incorporates design elements for the use of a single composite liner system and leachate collection and removal piping system. The leachate will flow by gravity to the Wastewater Treatment Plant for treatment.

THIS IS TO CERTIFY THAT:

The City of Lynchburg
Waste Management
2704 Concord Turnpike
Lynchburg, VA 24504

is hereby granted a permit to construct, operate, and maintain the facility as described in the attached Permit Module I General Permit Conditions, Permit Module II Operations, Permit Module III Sanitary Landfill, Permit Module X Final Detection Monitoring, Permit Module XI Assessment Groundwater Monitoring, Permit Modules XII and XIII Closure and Post-Closure, and Permit Module XIV Corrective Action. These Permit Modules and Permit Attachments are as referenced hereinafter and are incorporated into and become a part of this permit.

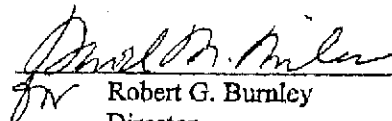
The herein described activity is to be established, modified, constructed, installed, operated, used, maintained, and closed in accordance with the terms and conditions of this permit and the plans, specifications, and reports submitted and cited in the permit. The facility shall comply with all regulations of the Virginia Waste Management Board. In accordance with Chapter 14, §10.1 - 1408.1(D) of the Code of Virginia, prior to issuing this permit, any comments by the local government and general public have been investigated and evaluated and it has been determined that the proposed facility poses no substantial present or potential danger to human health or the environment. The permit contains such conditions and requirements as are deemed necessary to comply with the requirements of the Virginia Code, the regulations of the Board, and to prevent substantial or present danger to human health or the environment.

Failure to comply with the terms and conditions of this permit shall constitute grounds for the revocation or suspension of this permit and for the initiation of necessary enforcement actions.

The permit is issued in accordance with the provisions of §10.1-1408.1.A, Chapter 14, Title 10.1, Code of Virginia (1950) as amended.

Issued: November 4, 1993
Amendment #1: January 23, 1997
Amendment #2: July 30, 2001
Amendment #3: February 20, 2003
Amendment #4: June 17, 2005


APPROVED:


Robert G. Burnley
Director

DATE: 5 January 2006
Amended



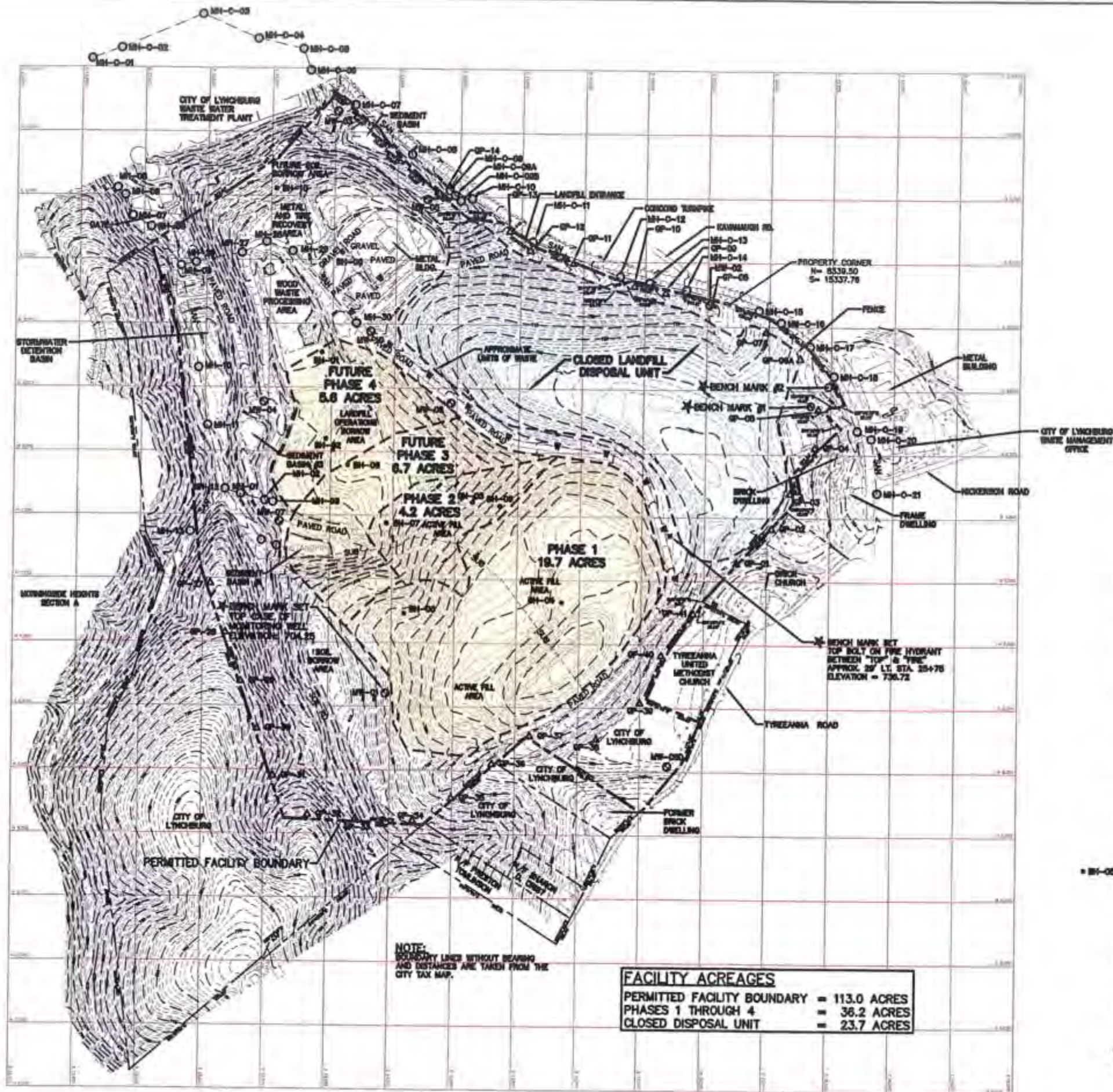
SCALE: 1"=250'



Draper Aden Associates
 Engineering • Surveying • Environmental Services
 Blacksburg, VA
 2200 Avenue of the Americas
 Blacksburg, VA 24060
 404-432-8444 • FAX 404-432-0891
 www.draaden.com

SITE MAP
CAMPBELL COUNTY LANDFILL
 CAMPBELL COUNTY, VIRGINIA

DESIGNED BY	JWB
DRAWN BY	JWB
CHECKED BY	JWB
DATE	11-2008
DATE	NOVEMBER 8, 2008
PROJECT NUMBER	B06209-01
OF	



FACILITY ACREAGES	
PERMITTED FACILITY BOUNDARY	= 113.0 ACRES
PHASES 1 THROUGH 4	= 36.2 ACRES
CLOSED DISPOSAL UNIT	= 23.7 ACRES

- NOTE:**
- ADJACENT PROPERTY LINES ARE BASED ON INFORMATION FROM TAX MAPS AND HAVE NOT BEEN FIELD VERIFIED BY DRAPER ADEN ASSOCIATES.
 - THIS SHEET WAS PREPARED FROM TOPOGRAPHIC MAPPING BY HERT & PROFFITT, INC., LYNCHBURG, VIRGINIA IN APRIL 1988 AND SUBSEQUENT UPDATES, LATEST IN JUNE, 2001.
 - THIS SHEET IS NOT A PLAT. THE BOUNDARY INFORMATION SHOWN IS FROM A PLAT ENTITLED "PROPERTY OF CITY OF LYNCHBURG BEING 137.00 ACRES (TOTAL) SITUATED ALONG THE SOUTH LINE OF CONCORD WINDPIPE" DATED 08/28/90, PREPARED BY DRAPER ADEN ASSOCIATES.
 - FOR DETAILS ON PHASES 1 AND 2 LNER GRADES, ON SITE BUILDINGS AND ACCESS ROADS SEE "PART B PERMIT APPLICATION" PLANS, PROJECT NO. 05863.05, PREPARED BY DRAPER ADEN ASSOCIATES, DATED NOVEMBER 25, 1991, LAST REVISED APRIL 18, 1993.
 - SOLID WASTE FACILITY PROPERTY LIES ABOVE THE 100-YEAR FLOOD PLAIN (APPROXIMATELY ELEVATION 820 DETERMINED BY NATIONAL FLOOD INSURANCE PROGRAM).

BH-05 BORING LOCATION (APPROXIMATE) BORINGS BH-01 THROUGH BH-05 CONDUCTED IN 1990 BY VIRGIEA GEOTECHNICAL SERVICES, BORINGS BH-06 THROUGH BH-10 CONDUCTED IN 1991 BY ENGINEERING TECTONICS.

BENCHMARK DATA:
 BM #1 N 7,842.0282 E 15,998.400 ELEV. 740.14
 3/4" IRON ROD - CITY OF LYNCHBURG HORIZONTAL DATUM
 BM #2 N 8,017.71 E 15,726.08 ELEV. 753.64
 3/4" IRON ROD - CITY OF LYNCHBURG HORIZONTAL DATUM



Draper Aden Associates
 Engineering • Surveying • Environmental Services
 Richmond, VA
 8000 Villa Park Drive
 2200 South Main Street
 Lynchburg, VA 23902
 404-244-2228
 www.dra-aden.com

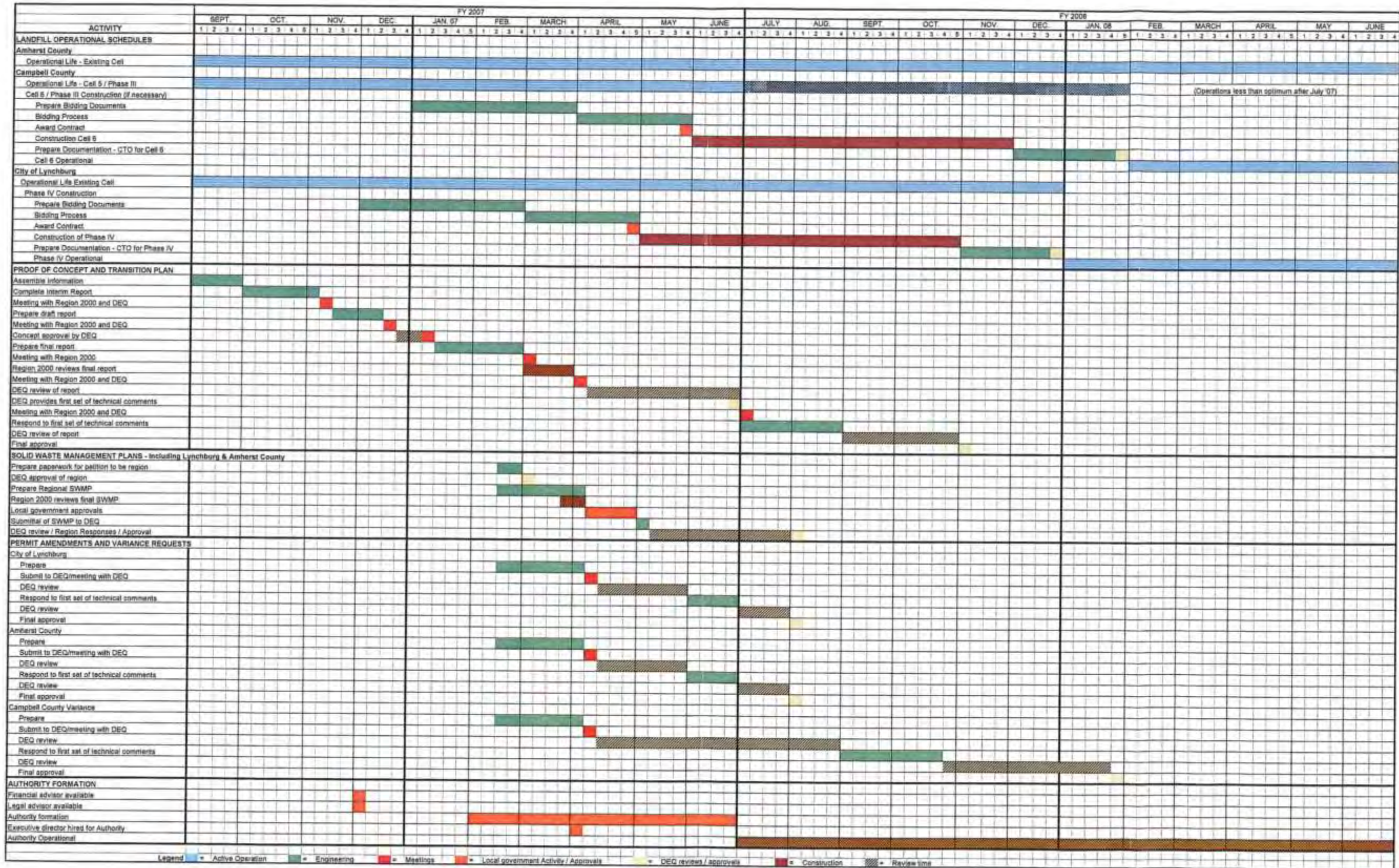
SITE MAP
LYNCHBURG PERMIT AMENDMENT
 CITY OF LYNCHBURG, VIRGINIA

REVISIONS	
NOTE 1	4/2/02

DESIGNED BY:	WGH
DRAWN BY:	EWL
CHECKED BY:	SJH
SCALE:	1"=200'
DATE:	09/14/01
PROJECT NUMBER:	05863.55

APPENDIX 3
Project Schedule

REGION 2000
PROPOSED IMPLEMENTATION SCHEDULE
December 13, 2006



Legend: Active Operation (Blue), Engineering (Green), Meetings (Red), Local government Activity / Approvals (Orange), DEQ reviews / approvals (Yellow), Construction (Dark Red), Review time (Grey)

APPENDIX 4
Campbell County Landfill at Interim Closure

LEGEND

- = FINAL CAP
- = INTERIM COVER



B06209-01
 CAMPBELL COUNTY LANDFILL
 SHEET - 1B
 DATE OF DRAWING: NOT KNOWN
 SOURCE: JOYCE ENGINEERING INC
 OCTOBER 2, 2008

Draper Aden Associates
 Engineering • Surveying • Environmental Services
 Blacksburg, VA
 2260 South Main Street
 Blacksburg, VA 24060
 540.532.0444 Fax: 540.532.0201
 www.daa.com

CONCEPTUAL INTERIM CLOSURE GRADE
 CAMPBELL COUNTY LANDFILL
 CAMPBELL COUNTY, VIRGINIA

REVISIONS	
DESIGNED BY	MAC
DRAWN BY	AVW
CHECKED BY	LPL
SCALE	Not Scale
DATE	November 3, 2008
PROJECT NUMBER	B06209-01
OF	

APPENDIX 5
Interim Closure Plan
(DRAFT)

**INTERIM CLOSURE, MAINTENANCE,
AND INSPECTION PLAN**

**Campbell County Landfill
Permit #285**

Prepared for:

Virginia's Region 2000 Local Government Council
915 Main Street, Suite 202
Lynchburg, Virginia 24504

Prepared by:

Draper Aden Associates
2206 South Main Street
Blacksburg, Virginia 24060
(540) 552-0444

December 14, 2006

DAA JN: B06209-01

Draper Aden Associates (DAA) prepared this document (which may include drawings, specifications, reports, studies and attachments) in accordance with the agreement between DAA and Virginia's Region 2000 Local Government Council.

The standard of care for all professional engineering, environmental and surveying, and related services performed or furnished by DAA under this Agreement are the care and skill ordinarily used by members of these professions practicing under similar circumstances at the same time and in the same locality. DAA makes no warranties, express or implied, under this Agreement in connection with DAA's services.

Conclusions presented are based upon a review of available information, the results of our field studies, and/or professional judgment. To the best of our knowledge, information provided by others is true and accurate, unless otherwise noted.

DAA's liability, hereunder, shall be limited to amounts due DAA for services actually rendered, or reimbursable expenses actually incurred.

Any reuse or modification of any of the aforementioned documents (whether hard copies or electronic transmittals) prepared by DAA without written verification or adaptation by DAA will be at the sole risk of the individual or entity utilizing said documents and such use is without the authorization of DAA. DAA shall have no legal liability resulting from any and all claims, damages, losses, and expenses, including attorney's fees arising out of the unauthorized reuse or modification of these documents. Client shall indemnify DAA from any claims arising out of unauthorized use or modification of the documents whether hard copy or electronic.

The actual conditions and characteristics encountered in soils, groundwater, bedrock, weathered rock, colluvium, karst terrain, and other subsurface investigations may vary significantly between successive test points and sample intervals, and at locations other than where observation, exploration, and investigations have been made. Because of the inherent uncertainties in subsurface evaluations, changed or unanticipated subsurface conditions may occur that could affect total project costs and/or execution. Additional activities and expenses related to changed subsurface conditions are not the responsibility of the ENGINEER unless they are a result of the ENGINEER'S failure to exercise the standard of care set forth herein. Design shall reflect these subsurface conditions reasonably anticipated from data obtained from the subsurface investigations performed for this project.

Conclusions presented by DAA do not reflect variations in subsurface groundwater quality that might exist between or beyond sampling points or between specific sample collections events. DAA shall incur no liability resulting from information supplied by others.

I. INTRODUCTION.....	1
A CAMPBELL LANDFILL SITE DESCRIPTION	1
II. INTERIM CLOSURE PLANS	2
A INTERIM CLOSURE ACTIVITIES.....	2
1. <i>Performance Standard</i>	2
a) Interim Closure Performance Standard.....	2
2. <i>Inventory Removal and Disposal</i>	2
3. <i>Interim Closure</i>	2
a) Surface Impoundments	2
b) Leachate storage	2
c) Landfill Final and Interim Closure	2
(1) Plan Sheets	2
(2) Interim Cap Descriptions	3
(3) Interim Slopes	3
(4) Maintenance Needs	4
(5) Construction Quality Assurance Plan	4
4. <i>Schedules for Closure</i>	4
a) Interim Closure	4
5. <i>Posting</i>	5
B. CONSTRUCTION SPECIFICATIONS.....	5
C. GROUNDWATER MONITORING SYSTEM.....	5
D. LEACHATE COLLECTION SYSTEM.....	5
E. GAS COLLECTION SYSTEM.....	5
F. POST-CLOSURE AND INTERIM ACTIVITIES.....	6
1. <i>Post-Closure/Interim Closure Contacts</i>	6
2. <i>Security</i>	6
3. <i>Inspection Plan</i>	6
4. <i>Maintenance Plan</i>	6
a) Repair of security control devices	6
b) Erosion damage repair.....	7
c) Correction of settlement, subsidence and displacement.....	7
d) Repair of run-on and run-off control structures.....	7
e) Leachate collection systems maintenance	7
f) Correction of leachate outbreaks.....	7
g) Gas collection/venting system maintenance and replacement	8
h) Groundwater monitoring well replacement and repair/maintenance	8
i) Mowing frequency.....	8
j) Seeding and fertilization of the vegetative layer	8
5. <i>Monitoring Plan</i>	9
a) Groundwater Monitoring.....	9
b) Leachate Collection and Disposal	9
c) Gas Collection and Venting.....	10
d) Leak detection between liners	10
e) Dewatering.....	10
6. <i>Training</i>	10

LIST OF APPENDICES

- Appendix A Interim Closure Drawing
- Appendix B Inspection and Maintenance Log Sheet
- Appendix C Signage Details

1. INTRODUCTION

This Interim Closure, Maintenance and Inspection Plan (Plan) has been developed for the Region 2000 Authority. This Plan covers the Campbell County Landfill (Permit No 285). The development of this Plan is in response to the establishment of a regional landfill system owned and operated by the Virginia's Region 2000 Local Government Council (Region 2000 Authority) within South Central Virginia. Over the span of 20 years, this regional landfill system would utilize three of the area landfills for the disposal of municipal solid waste. The landfills involved in the regional system are the City of Lynchburg Landfill, the Amherst County Landfill and the Campbell County Landfill. The Lynchburg and Amherst Landfills would be utilized for waste disposal and the Campbell Landfill would be placed in an interim closure status until the Lynchburg and Amherst Landfills reach final capacity. This Plan will detail the operational, maintenance and inspection activities anticipated for the Campbell County Landfill during the interim closure period.

The areas of the Campbell Landfill that reach final permitted closure grades prior to the interim closure period would receive a final cap system as presented in the Permit documents previously approved by the Virginia Department of Environmental Quality (DEQ). All specifications, quality assurance/quality control, and design criteria for this final cap system are detailed in the permit documentation and will be strictly followed during the interim closure process to close the areas at final grade. The final cap system will be installed to minimize leachate production and to ensure the protection of the human health and the environment during this interim closure period.

A. CAMPBELL LANDFILL SITE DESCRIPTION

The Campbell Landfill is located on Livestock Road in Rustburg, Virginia, approximately 10 miles southeast of Lynchburg, Virginia. The Campbell Landfill contains 4 Phases, numbered I through IV. Phases I and II are closed, unlined disposal areas. Phase III is the active, lined disposal area and Phase IV is a permitted, undeveloped disposal area.

The leachate for Phase III flows by gravity to an on-site 380,000 gallon, double-lined leachate storage tank. The leachate is then pumped to a tanker truck and hauled to a City of Lynchburg sewer connection for disposal.

A stormwater pond located at the northeast corner of Phase III is sized to accommodate flow from the existing Phase III and future Phase IV disposal areas.

The Campbell Landfill has two previously closed portions, Phases I and II, comprising approximately 25 acres. The post-closure care activities for these Phases will continue under the current Closure Plan even when the facility is inactive for disposal operations.

II. INTERIM CLOSURE PLANS

A. INTERIM CLOSURE ACTIVITIES

1. Performance Standard

a) Interim Closure Performance Standard

The design, construction and proper maintenance of the interim cap will be similar to a final cap. The features of this interim cap will reduce infiltration through the cap and minimize the volume and rate of leachate generation that must be contained and properly disposed by the landfill. Slopes of at least 2% on the top and not more than 3H:1V on the side slopes will provide positive runoff of precipitation, minimize infiltration, contribute to an adequate vegetative cover, and facilitate maintenance by mowing.

The interim closure grade site plan for the Campbell Landfill can be found in Appendix A.

2. Inventory Removal and Disposal

All wastes will remain in place.

3. Interim Closure

a) Surface Impoundments

The Campbell Landfill does not have any surface impoundments effected by this interim closure. All sediment basins will remain active, monitored and maintained throughout the interim closure (see Appendix C for inspection and maintenance sheet)

b) Leachate storage

The Campbell Landfill contains a leachate collection and removal system that flows by gravity to a double-walled storage tank within the facility boundary. The leachate is pumped periodically from this tank into tanker trucks and hauled to a City of Lynchburg sewer connection for transport to a wastewater treatment plant. The storage tank is expected to serve the Landfill through the interim closure period as well as the Landfill's final closure.

c) Landfill Final and Interim Closure

(1) Plan Sheets

Grading of the Campbell sites for the interim closure will be in accordance with the approved Closure Plan for the facility. The design of the interim closure grades are indicated on the Drawings included in Appendix A of this Plan. The landfill will be brought to the interim grades shown using the appropriate landfilling and construction methods. The interim cap and

the cushion/vegetative layer will be installed after the interim grades are reached. For the areas of the Landfill that are at final elevations, a partial final closure process will be initiated.

(2) Interim Cap Descriptions

(a) Description of Layers

The Campbell Landfill interim cap consists of the following from bottom to top: a 6" daily cover layer, a 6" layer of unspecified on-site soil on top, a 8 oz. non-woven geotextile and a 30-mil geomembrane. A cross section of this interim cap can be found in Appendix B.

(b) Interim Soil Cap Construction Plan

Daily cover shall be completed before closure cap installation begins. Daily cover will consist of at least 6" of compacted soil material.

Preparation of the soil component of the closure cap will begin with a topographic survey of the daily soil layer. The 6" additional compacted soil shall be placed on top of the 6" daily layer. This grading will be followed by another topographic survey.

(c) Seeding

Permanent seeding will be in accordance with the Virginia Erosion and Sediment Control Handbook (VESCH) and as determined by the timing of construction. Timing on seeding is critical for stabilization. If permanent seeding cannot be placed immediately then temporary seeding shall be placed. Matting may be used with temporary seeding also. Permanent seeding will be protected by mulch or matting. Soils shall be tested for need of both lime and fertilizer. Recommended application rates per acre will be placed prior to seeding and mulching.

(d) Erosion Control Devices

The erosion control devices for the interim closure are shown on the drawings in Appendix A. These measures include diversion dikes, and outlet protection for culverts. These measures shall be installed and maintained in accordance with the VESCH.

(3) Interim Slopes

The interim closure slopes will consist of 3:1 side slopes, depending on the site specific requirements. The flatter areas will be a minimum of 5% on the flatter areas at the tops of the side slopes. Such grades will promote positive drainage, reduce infiltration, and facilitate maintenance.

All stockpiled material shall be graded on site. No stockpiles shall be left. Benches will be placed at intervals along the slopes of the landfill to control stormwater and prevent erosion. Positive drainage shall be maintained at all times.

(4) Maintenance Needs

The average interim slopes of the landfills will be no greater than 33% with diversion dikes used to control storm water and sediment. Drainage and erosion control measures, structural and vegetative, will be used to stabilize the site. All measures will be placed and maintained in accordance with the VESCH. These measures are discussed in the following paragraphs. See Appendix B for HIELP models for the infiltration figures through the interim cap.

The following maintenance schedule is suggested for erosion and sedimentation control, but it represents a minimum. Inspection should be increased as necessary:

- **Silt Fences**
 - Inspect immediately after each rainfall and daily during a prolonged rainfall. Immediately make all repairs.
 - Should the fabric on a silt fence decompose or become ineffective prior to the end of the expected usable life, the fabric shall be replaced promptly.
 - Sediment deposits should be removed after each storm event. They must be removed when deposits reach approximately 1/2 the height of the barrier.
 - Any sediment deposits remaining in place after the silt fence or filter barrier is no longer required shall be dressed to conform with the existing grade, prepared and seeded.
- **Diversion Dikes**
 - During the initial establishment, the dikes should be inspected weekly and after every major storm event and repaired immediately if necessary.
 - After grass in the surrounding areas has become established, the dikes should be checked periodically to determine if the grass is remaining viable.
 - Mow periodically, being sure that the grass cover is protected from damage.

All erosion control measures shall be completed in accordance with the VESCH, latest edition.

(5) Construction Quality Assurance Plan

The Quality Assurance/Quality Control Plan submitted with the permit documentation will be followed during the construction of the interim closure cap.

4. Schedules for Closure

a) Interim Closure

Time frame for interim closure activities is anticipated as follows:

- a. Interim Cover Construction drawings to DEQ (Prior to interim closure)..... 90 days

- b. Interim Closure construction (after landfill placed in interim status)6 months
- c. Engineer’s certification of interim closure 30 days
- d. DEQ inspection and certification of interim closure..... 30 days
- e. Groundwater and Gas Monitoring..... ongoing

The final date of interim closure will be approximately 2007-2008. If the landfill were to cease taking waste before this date, the timing of interim and partial final cap placements will be in accordance with the regulation as outlined above.

5. Posting

When the landfill is in an inactive status, the Region 2000 Authority will publicize in the local media, including public service announcements on local radio and in the newspaper. Signage at the entrance to the landfill will also state the inactive status of the facility and provide directions for the waste hauler to the appropriate receiving point of waste.

B. CONSTRUCTION SPECIFICATIONS

The technical specifications for the proposed interim closure cap will be provided under separate cover at a future date. These specifications will consist of items previously approved by DEQ in the permitting process for the Landfill facility.

C. GROUNDWATER MONITORING SYSTEM

A Groundwater Monitoring Plan (GMP) for the facility was submitted as a part of the permitting process. This GMP outlines in detail the type of monitoring system in place for the facility. This GMP will be implemented in its entirety at the facility during this interim closure period.

D. LEACHATE COLLECTION SYSTEM

The leachate collection systems for the Campbell Landfill are discussed in the Design Report, Closure/Post-Closure Plan, and Operation Manual for the facility. Each system will be maintained in accordance with these documents during the interim closure period.

E. GAS COLLECTION SYSTEM

The Gas Management Plan for the Landfill has been previously submitted. The gas management system described in this document will be implemented for the portions of the Landfill in final closure. The portions of the Landfill with an interim closure cap will not receive the gas vents and collection systems until the disposal cells reach their final closure elevations.

F. POST-CLOSURE AND INTERIM ACTIVITIES**1. Post-Closure/Interim Closure Contacts**

Name: Region 2000 Authority
Deputy Director
915 Main Street, Suite 202
Lynchburg, Virginia 24504
Phone: (434) 845-3491

2. Security

Until this Landfill is closed, there will be areas which are in the post-closure period during active work in other parts of the Landfill. There are no plans to leave any wastes exposed after completion of closure of any waste disposal cell.

Access to the Landfill property is gained through a single gate at the entrance. Any access road to the closed out areas will be posted at all times and access by the general public will be prohibited. Authority personnel who will be monitoring the closed site during the Post-Closure period will notify the proper authorities of any violations to these access rules.

Signage will be placed to inform the public which areas are closed to disposal use and landfill operators shall direct them to the current active tipping area on the landfill face.

Once the entire Landfill has been closed to incoming waste disposal, all access roads to the disposal areas will be gated and signs posted that the site is a closed landfill and no trespassing shall be tolerated.

3. Inspection Plan

Until the facility is closed, the operator will include the previously closed areas with the inactive areas in the routine **weekly** site inspections. Once the sites have been closed for a year, the inspection frequency will be reduced to **monthly**. In the event of severe weather, the inspections will be performed weekly until the situation stabilizes.

A site map of the facility and an Inspection and Maintenance Log (see Appendices A and B) will be used to record any areas that are in need of repairs.

4. Maintenance Plan**a) Repair of security control devices**

The facility has a single, padlocked access gate. These gates are located at the main entrances near the weigh scales. These gates will be closed during the interim closure period.

The facility's perimeter is lined with fencing to prevent unauthorized access to the landfill. Inspections of the fences, gates, and padlocks will lead to immediately making repairs to any damage discovered.

b) Erosion damage repair

Any soil erosion will be repaired with like soil and will be re-compacted and re-seeded and mulched. Where wash-out occurs, the Region 2000 Authority shall replace with similar material.

c) Correction of settlement, subsidence and displacement

It is not expected that major portions of the landfill will be subject to excessive settlement. However, if any areas appear to have settled to create ponding of stormwater, they shall be graded for positive drainage and seeded. As necessary, the cap will be repaired to the original closure specifications. This may require excavation of the settled area, regrading and placement of the cap. Testing of the cap materials as per the original construction quality control program will be needed. Major repairs to the cap will be reported to DEQ as will any major changes in the cap configuration.

d) Repair of run-on and run-off control structures

Ditches will be graded to provide adequate drainage. All drainage pipes, ditching, diversions and stormwater management basins will be routinely checked for sediment build-up and will be cleaned out when build-up exceeds 1/3 the depth of the feature, except for the basins, which must have the riser drains clear of any obstruction at all times. Sediment must be placed and spread up-gradient of any area of removal.

e) Leachate collection systems maintenance

Inspections of the leachate collection system will involve observing the manhole covers, exposed piping, and the storage tank liquid levels. If inspections reveal damage or missing locks, the subject hatch will be opened to determine if all interior piping is intact. If no damage is observed, a new lock shall be installed on the hatch. If the piping in the manhole or any other exposed piping appears to be damaged to the point of leaking, the site Supervisor shall be notified to determine repair solutions. Likewise, if the storage tank has visible damage or ruptures, the site Supervisor and Region 2000 Authority shall be notified. Repairs to the tank will require the services of a company specializing in the repairs of these types. If tank elevations are near or above the pump down elevation, the process for emptying the tank shall begin.

f) Correction of leachate outbreaks

The point where a leachate outbreak would most likely be detected is at one of the discharge points of the cap drainage system. If leachate is detected at one of the discharge points during routine inspection, the Region 2000 Authority should be notified for further investigation. The location of the drainage discharge point will help determine the most likely

area to begin looking for the breach. The ultimate solution will be to locate the tear in the liner material and repair it.

g) Gas collection/venting system maintenance and replacement

Damage to gas vents or probes will most likely be caused by human error, falling trees or vandalism. Anyone who is in the vicinity of gas vents and probes should **refrain from smoking and minimize the use of spark creating equipment**. Repairs to vents may include replacement of pipe sections or sealing of cracks in the concrete pad around each stack or probe. If a vent riser must be replaced, the pipe should be cut with a manual saw, **NO** electrical equipment should be used. The replacement pipe segment shall be connected to the remaining stub through the use of a Fernco® type coupler with integral stainless steel full-coverage banding for support.

Settlement of a concrete pad will require replacement, if the settling is creating a depression that is holding surface water or if riser pipe is being stressed. If the pad is to be replaced, it should be broken up carefully to not damage the riser pipe or underlying liner. The remaining depression should be backfilled and tamped with soil to create a firm foundation for the new slab. The new slab shall be formed so that the surface will shed water away from the riser pipe. Backfilled soil shall not form any kind of depression that would pond water.

h) Groundwater monitoring well replacement and repair/maintenance

Well replacement or repair shall conform to the groundwater monitoring plan submitted as part of the Part B application for the facility. The Region 2000 Authority shall make sure that the concrete pads and metal stand pipes are clear of vegetative material (vines/branches, etc.) Well head hinges and locks must be lubricated only with graphite powder lubricants. No petroleum based products may be used.

i) Mowing frequency

Grass shall be mowed 2 times a year after it is well established. During dry periods, grass may remain uncut to prevent scorching and to lessen the potential for erosion. No trees shall be allowed to grow on the closed areas, on embankments of cells outside of the waste closure caps or in or around stormwater management basins.

j) Seeding and fertilization of the vegetative layer

The Region 2000 Authority shall have the soils tested every 5 years for need of fertilization or lime. Seeding should occur every three years, except for erosion repaired areas, which should be seeded at the time of repair. The current practice is to seed 1/3 of the open area per year in a three year cycle to cover the entire open area. The Region 2000 Authority may choose to continue this application practice during the post-closure period or not.

5. Monitoring Plan

a) Groundwater Monitoring

The permitted monitoring well network for the Campbell Landfill can be found in the Groundwater Monitoring Plan submitted for the facility.

The facility is not aware of any "special conditions" at this site deemed likely to significantly affect the groundwater vector field. However, the direction of groundwater flow in the uppermost aquifer will be evaluated after each sampling event. In the unlikely event that the direction of groundwater flow changes (i.e., changes in relative groundwater elevations between the upgradient well and the downgradient wells), then the monitoring network may be altered (i.e., by constructing additional wells) to adequately monitor the groundwater in the uppermost aquifer.

b) Leachate Collection and Disposal

There is a perimeter leachate collection system consisting of a series of perforated PVC collection pipes installed in and around the Campbell Landfill. The collected leachate is discharged to a gravity sewer line which in turn discharges to a storage tank strategically located on the Campbell Landfill property. From the storage tank, the leachate is pumped into tanker trucks for transport to a City of Lynchburg sewer connection. The leachate is then transported for treatment at the City of Lynchburg Wastewater Treatment Plant.

The landfill will be monitored quarterly for signs of leachate seeps on slopes and around the base of slopes. Precautions will be taken to reduce leachate problems from developing at the site once the interim cover is installed. However, should evidence of a problem appear, the Region 2000 Authority will initiate a course of action to repair the affected area.

The following procedure may be used in the event an observed leachate seep appears to be minor in nature and is generally isolated in nature. For this type of situation, under the supervision of a professional engineer, excavate the affected area in an adequate area up hill of the seep to determine the extent of the problem and from what apparent layer the seepage is coming. Excavate to a depth sufficient to encounter a minimum of 3' to 4' of waste material. All excavated waste material will be properly disposed of in an active cell or landfill facility. Fill the excavated area with a porous material (VDOT #3's, broken rubble, tire chips, etc.) to a level equal with the bottom layer of the daily and intermediate cover material. Cover the porous material with a layer of filter fabric and replace the daily and intermediate cover. Replace and compact the soil infiltration layer with a material meeting the requirements of the closure plan specifications. Replace and compact the erosion/vegetation support layer with a material meeting the requirements of the closure plan specifications. Replace the topsoil/amended soil layer and grass. Place erosion control measures and retain in place until such time as vegetation is reestablished. Regrade any other damaged areas and grass.

For major seeps and/or seeps covering an expanded area, a professional engineer will be retained to investigate the situation and prepare a contingency/remedial action plan to correct the problem. The contingency/remedial action plan will be submitted to the DEQ for its comments and approval.

The site will be closely inspected for run-on and infiltration points that may allow excessive water into the fill area. Grading and erosion /sedimentation devices will be closely reviewed and modifications made as necessary.

e) Gas Collection and Venting

Landfill gas monitoring probes are installed around a portion of the perimeter of the Landfill. Should the need arise, additional gas monitoring probes will be installed as required to protect adjacent properties. The landfill gas monitoring system for the Campbell Landfill is described in the Gas Monitoring Plan previously approved by the DEQ.

A passive gas venting system has been developed for the Campbell Landfill. This portion of the landfill gas venting system may be converted into an active extraction system, if additional gas management practices are necessary.

If a more extensive passive gas collection and management system is required, a plan will be developed separately and submitted to the DEQ as a separate document to the Closure Plan. If conditions dictate and an active gas collection/extraction and management system is required, a plan will be developed separately and submitted to the DEQ as a separate document to the Closure Plan.

The gas probes and vents will be inspected along with the quarterly sampling. Damage will be promptly repaired. In the event of settlement around probes, the area will be regraded and a new concrete pad poured around the probe. Sampling tubes within the gas probes will also be inspected. If the tubes are broken, the probe will be replaced. Caps and pads around gas probes will be inspected and repaired or replaced as needed.

d) Leak detection between liners

There is no leak detection between liners at either site.

e) Dewatering

Not applicable to these facilities.

6. Training

As required, the Region 2000 Authority will use experienced personnel for site inspections and maintenance programs. The Authority's personnel will attend training seminars such as those provided by the Solid Waste Association of North America or the DEQ. Major problems arising such as leachate or excessive gas generation will be immediately referred to a registered professional engineer. Groundwater monitoring will be performed by qualified personnel trained for sample collection, analyzed by a qualified laboratory, and the results reviewed and evaluated by a qualified groundwater consultant.

APPENDIX A

INTERIM CLOSURE DRAWINGS

- 1) Campbell County Final and Interim Closure Plan Sheet
- 2) Interim Cover Cross Section

APPENDIX B

INSPECTION AND MAINTENANCE LOG SHEET

- 1) Interim Closure Inspection and Maintenance Log

INTERIM CLOSURE INSPECTION AND MAINTENANCE LOG
Campbell County Landfill

Inspector: _____ Date: _____
Weather: _____ Time: _____
Soil Conditions: Wet ___ Dry ___

Place a check by each item inspected. If something needs maintenance or repair, please write specific needs in section below list.

General

Security: Gate ___ Fence ___ Locks ___ Lights ___ Illegal dumping ___

Benchmarks ___

Sedimentation Basins ___

Disposal Area

Erosion Control (vegetative cover)

Drainage (run-on control, run-off control, cover ditches)

Cover (settlement, subsidence, displacement)

Leachate Collection and Gas Ventilation

Leachate Discharge (observations, level)

Gas Venting (observations)

Additional Comments

APPENDIX E

SIGNAGE DETAILS

- 1) Closed Fill Site sign
- 2) Active Fill Area direction sign
- 3) Landfill Closed sign

Campbell County Landfill

POSTED

Closed Fill Site

NO Dumping

Violators Will Be Prosecuted

Authorized by
Region 2000 Authority

Campbell County Landfill

ACTIVE FILL AREA



Authorized by
Region 2000 Authority

POSTED

Campbell County Landfill
IS
CLOSED

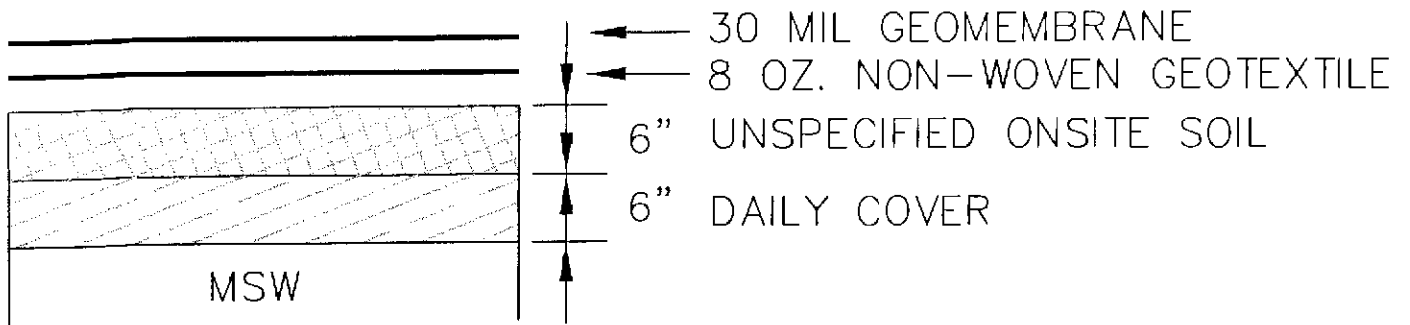
NO Dumping

Violators Will Be Prosecuted

Authorized by
Region 2000 Authority

APPENDIX 6
Interim cover details and specifications

P:\B062001\B06209\B06209-01\CAD\B06209-01_DSN.dwg - Campbell Co. I.F.-Phase III-5-Interim Closure.dwg December 13, 2006 3:23:45 PM



INTERIM CLOSURE CROSS SECTION
REGION 2000 AUTHORITY

SCALE: N.T.S.

PLAN NO. B06209-01



Draper Aden Associates

Engineering • Surveying • Environmental Services

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

Richmond, VA
Charlottesville, VA
Hampton Roads, VA

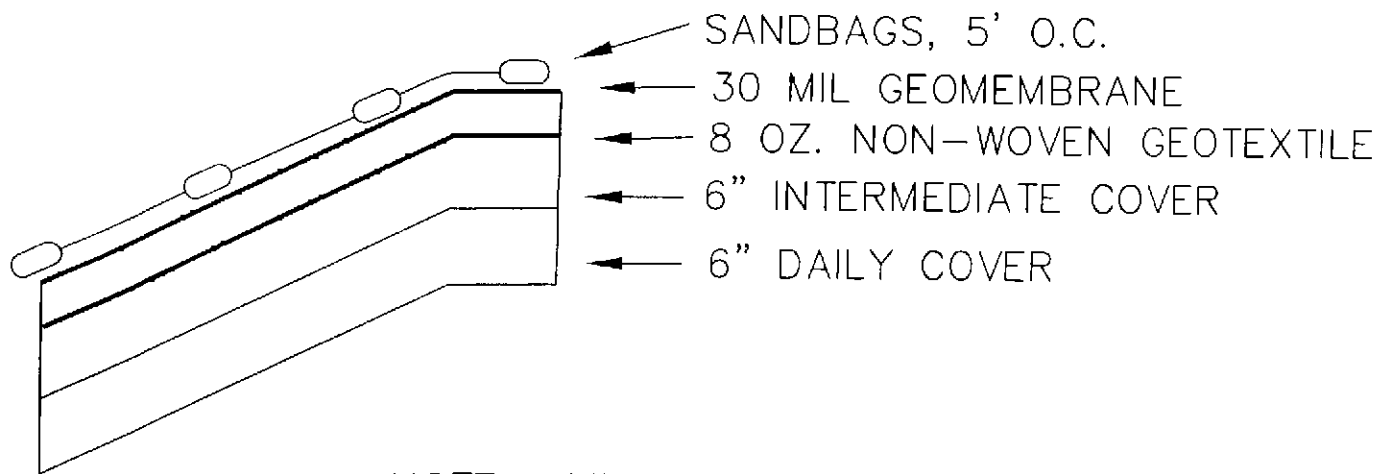
DESIGNED
DRAWN
CHECKED
DATE

MAC
AVW
LPK
12/13/2006

FIGURE

1

P:\B06209\B06209\B06209-01\CAD\B06209-01 - Campbell Co LF-Phase II-5-Interim Closure.dwg December 13, 2006 6:07:16 PM



NOTE: LINES OF
SANDBAGS TO BE SPACED
AT 10' O.C.

INTERIM CLOSURE - SANDBAG ROPE SYSTEM
REGION 2000 AUTHORITY

SCALE: N.T.S.

PLAN NO. B06209-01



Draper Aden Associates

Engineering • Surveying • Environmental Services

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

Richmond, VA
Charlottesville, VA
Hampton Roads, VA

DESIGNED
DRAWN
CHECKED
DATE

MAC
AVW
LPK
12/13/2006

FIGURE

2



GSE STANDARD PRODUCTS

Product Data Sheet

GSE HD Textured

GSE HD Textured is the textured version of GSE HD. It is a high quality, high density polyethylene (HDPE) geomembrane with one or two coextruded, textured surfaces, and consisting of approximately 97.5% polyethylene, 2.5% carbon black and trace amounts of antioxidants and heat stabilizers; no other additives, fillers or extenders are used. The resin used is specially formulated, virgin polyethylene and is designed specifically for flexible geomembrane applications. GSE HD Textured has excellent resistance to UV radiation and is suitable for exposed conditions. This product allows projects with greater slopes to be designed since frictional characteristics are enhanced. *These product specifications meet or exceed GRI GM13.*

Product Specifications

TESTED PROPERTY	TEST METHOD	FREQUENCY	MINIMUM VALUE				
Product Code			HDT 030G000	HDT 040G000	HDT 060G000	HDT 080G000	HDT 100G000
Thickness, (minimum average) mil (mm) Lowest individual for 8 out of 10 values Lowest individual for any of the 10 values	ASTM D 5994	every roll	29 (0.73) 27 (0.69) 26 (0.66)	38 (0.96) 36 (0.91) 34 (0.86)	57 (1.45) 54 (1.40) 51 (1.30)	76 (1.93) 72 (1.80) 68 (1.73)	95 (2.41) 90 (2.30) 85 (2.16)
Density, g/cm ³	ASTM D 1505	200,000 lb	0.94	0.94	0.94	0.94	0.94
Tensile Properties (each direction) ¹⁾ Strength at Break, lb/in-width (N/mm) Strength at Yield, lb/in-width (N/mm) Elongation at Break, % Elongation at Yield, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. = 2.0 in (51 mm) G.L. = 1.3 in (33 mm)	20,000 lb	45 (18) 63 (11) 100 12	60 (11) 84 (15) 100 12	90 (16) 126 (22) 100 12	120 (21) 168 (29) 100 12	150 (27) 210 (37) 100 12
Tear Resistance, lb (N)	ASTM D 1004	45,000 lb	71 (93)	28 (125)	42 (187)	56 (249)	70 (311)
Puncture Resistance, lb (N)	ASTM D 4833	45,000 lb	45 (200)	60 (267)	90 (400)	120 (534)	150 (667)
Carbon Black Content, %	ASTM D 1603	20,000 lb	2.0	2.0	2.0	2.0	2.0
Carbon Black Dispersion	ASTM D 5596	45,000 lb	+Note 1	+Note 1	+Note 1	+Note 1	+Note 1
Asperity Height	GRI GM 12	second roll	+Note 2	+Note 2	+Note 2	+Note 2	+Note 2
Notched Constant Tensile Load ²⁾ , lb	ASTM D 5397, Appendix	200,000 lb	300	300	300	300	300
REFERENCE PROPERTY	TEST METHOD	FREQUENCY	NOMINAL VALUE				
Oxidative Induction Time, min	ASTM D 3895, 200° C; O ₂ , 1 atm	200,000 lb	>100	>100	>100	>100	>100
Roll Length ³⁾ (approximate), ft (m)	Standard Textured		830 (253)	700 (213)	520 (158)	400 (122)	330 (101)
Roll Width ³⁾ , ft (m)			22.5 (6.9)	22.5 (6.9)	22.5 (6.9)	22.5 (6.9)	22.5 (6.9)
Roll Area, ft ² (m ²)			18,674 (1,735)	15,750 (1,463)	11,700 (1,087)	9,000 (836)	7,425 (690)

NOTES:

- +Note 1: Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- +Note 2: 10 mil average. 8 of 10 readings ≥ 7 mils. Lowest individual ≥ 5 mils.
- GSE HD Standard Textured is available in rolls weighing about 4,000 lb (1,800 kg).
- ¹⁾The combination of stress concentrations due to coextrusion texture geometry and the small specimen size results in large variation of test results. Therefore, these tensile properties are minimum average values.
- ²⁾INTEL for HD Textured is conducted on representative smooth membrane samples.
- All GSE geomembranes have dimensional stability of ±2% when tested with ASTM D 1204 and ITB of +77° C, when tested with ASTM D 746.
- ³⁾Roll lengths and widths have a tolerance of ± 1%.

D5009 HD/HD Textured

This information is provided for reference purposes only and is not intended as a warranty or guarantee. GSE assumes no liability in connection with the use of this information. Please check with GSE for current, standard minimum quality assurance procedures and specifications.

GSE and other trademarks in this document are registered trademarks of GSE Lining Technology, Inc. in the United States and various foreign countries.

North America	GSE Lining Technology, Inc.	Houston, Texas	800 435 2008	281 443 8564	Fax: 281 230 8650
South America	GSE Lining Technology Chile S.A.	Santiago, Chile		56 2 595 4200	Fax: 56 2 595 4290
Asia Pacific	GSE Lining Technology Company Limited	Bangkok, Thailand		66 2 937 0091	Fax: 66 2 937 0097
Europe & Africa	GSE Lining Technology GmbH	Hainburg, Germany		49 40 767420	Fax: 49 40 7674234
Middle East	GSE Lining Technology Egypt	The 6th of October City, Egypt		202 2 828 8888	Fax: 202 2 828 8889



INTRODUCTION TO SAMPLE SPECIFICATION - GEOMEMBRANES

The following specification guideline reflects current industry installation procedures and geomembrane quality control test procedures. This guideline is presented as a sample format to be used as a guide only in preparing project specific specification.

This information is provided for reference purposes only and is not intended as a warranty or guarantee. GSE assumes no liability in connection with the use of this information. Please check with GSE for current, standard minimum quality assurance procedures and specifications.

GSE and other trademarks in this document are registered trademarks of GSE Linings Technology, Inc. in the United States and certain foreign countries.

SECTION 02700

POLYETHYLENE GEOMEMBRANE LINER

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Specifications and guidelines for MANUFACTURING and INSTALLING geomembrane.

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM)
 1. D 1004 Test Method for Initial Tear Resistance of Plastic Film and Sheeting
 2. D 1238 Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
 3. D 1505 Test Method for Density of Plastics by the Density-Gradient Technique
 4. D 1603 Test Method for Carbon Black in Olefin Plastics
 5. D 3895 Standard Test Method for Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry
 6. D 4833 Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
 7. D 5199 Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
 8. D 5397 Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test
 9. D 5596 Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
 10. D 5994 Standard Test Method for Measuring Core Thickness of Textured Geomembranes
 11. D 6392 Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods
 12. D 6693 Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes
- B. Geosynthetic Research Institute
 1. GRI GM 13 Test Properties, Testing Frequency and Recommended Warranty for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes
 2. GRI GM 17 Test Properties, Testing Frequency and Recommended Warranty for Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembranes

1.03 DEFINITIONS

- A. Lot- A quantity of resin (usually the capacity of one rail car) used in the manufacture of geomembranes. Finished roll will be identified by a roll number traceable to the resin lot used.
- B. Construction Quality Assurance Consultant (CONSULTANT) - Party, independent from MANUFACTURER and INSTALLER that is responsible for observing and documenting activities related to quality assurance during the lining system construction.
- C. ENGINEER- The individual or firm responsible for the design and preparation of the project's Contract Drawings and Specifications.
- D. Geomembrane Manufacturer (MANUFACTURER) - The party responsible for manufacturing the geomembrane rolls.

- E. Geosynthetic Quality Assurance Laboratory (TESTING LABORATORY)- Party, independent from the OWNER, MANUFACTURER and INSTALLER, responsible for conducting laboratory tests on samples of geosynthetics obtained at the site or during manufacturing, usually under the direction of the OWNER.
- F. INSTALLER- Party responsible for field handling, transporting, storing, deploying, seaming and testing of the geomembrane seams.
- G. Panel- Unit area of a geomembrane that will be seamed in the field that is larger than 100 ft².
- H. Patch- Unit area of a geomembrane that will be seamed in the field that is less than 100 ft².
- I. Subgrade Surface- Soil layer surface which immediately underlies the geosynthetic material(s).

1.04 SUBMITTALS POST-AWARD

- A. Furnish the following product data, in writing, to ENGINEER prior to installation of the geomembrane material:
 - 1. Resin Data shall include the following.
 - a. Certification stating that the resin meets the specification requirements (see Section 1.09).
 - 2. Geomembrane Roll
 - a. Statement certifying no recycled polymer and no more than 10% rework of the same type of material is added to the resin (product run may be recycled).
- B. The INSTALLER shall furnish the following information to the ENGINEER and OWNER prior to installation:
 - 1. Installation layout drawings
 - a. Must show proposed panel layout including field seams and details
 - b. Must be approved prior to installing the geomembrane
 - 1. Approved drawings will be for concept only and actual panel placement will be determined by site conditions.
 - 2. installer's Geosynthetic Field Installation Quality Assurance Plan
- C. The INSTALLER will submit the following to the ENGINEER upon completion of installation:
 - 1. Certificate stating the geomembrane has been installed in accordance with the Contract Documents
 - 2. Material and installation warranties
 - 3. As-built drawings showing actual geomembrane placement and seams including typical anchor trench detail

1.05 QUALITY ASSURANCE

- A. The OWNER will engage and pay for the services of a Geosynthetic Quality Assurance Consultant and Laboratory to monitor geomembrane installation.

1.06 QUALIFICATIONS

- A. MANUFACTURER
 - 1. Geomembrane shall be manufactured by the following:
 - a. GSE Lining Technology, Inc.
 - b. approved equal
 - 2. MANUFACTURER shall have manufactured a minimum of 10,000,000 square feet of polyethylene geomembrane during the last year.

B. INSTALLER

1. Installation shall be performed by one of the following installation companies (or approved equal)
 - a. GSE Lining Technology, Inc.
 - b. GSE Approved Dealer/Installers
2. INSTALLER shall have installed a minimum of [] square feet of HDPE geomembrane during the last [] years.
3. INSTALLER shall have worked in a similar capacity on at least [] projects similar in complexity to the project described in the contract documents, and with at least [] square feet of HDPE geomembrane installation on each project.
4. The Installation Supervisor shall have worked in a similar capacity on projects similar in size and complexity to the project described in the Contract Documents.
5. The INSTALLER shall provide a minimum of one Master Seamer for work on the project.
 - a. Must have completed a minimum of 1,000,000 square feet of geomembrane seaming work using the type of seaming apparatus proposed for the use on this Project.

1.07 MATERIAL LABELING, DELIVERY, STORAGE AND HANDLING

- A. Labeling - Each roll of geomembrane delivered to the site shall be labeled by the MANUFACTURER. The label will identify:
 - a. manufacturer's name
 - b. product identification
 - c. thickness
 - d. length
 - e. width
 - f. roll number
- B. Delivery- Rolls of liner will be prepared to ship by appropriate means to prevent damage to the material and to facilitate off-loading.
- C. Storage- The on-site storage location for geomembrane material, provided by the CONTRACTOR to protect the geomembrane from punctures, abrasions and excessive dirt and moisture for should have the following characteristics:
 - a. level (no wooden pallets)
 - b. smooth
 - c. dry
 - d. protected from theft and vandalism
 - e. adjacent to the area being lined
- D. Handling- Materials are to be handled so as to prevent damage.

1.08 WARRANTY

- A. Material shall be warranted, on a pro-rata basis against Manufacturer's defects for a period of 5 years from the date of geomembrane installation.
- B. Installation shall be warranted against defects in workmanship for a period of 1 year from the date of geomembrane completion.

1.09 GEOMEMBRANE

- A. Material shall be smooth/textured polyethylene geomembrane as shown on the drawings.

- B. Resin
1. Resin shall be new, first quality, compounded and manufactured specifically for producing geomembrane.
 2. Natural resin (without carbon black) shall meet the following minimum requirements:

Property	Test Method	HDPE	LLDPE
Density [g/cm ³]	ASTM D 1505	0.932	0.915
Melt Flow Index [g/10 min.]	ASTM D 1238 (190/2.16)	≤ 1.0	≤ 1.0
OIT [minutes]	ASTM D 3895 (1 atm/200°C)	100	100

- C. Geomembrane Rolls
1. Do not exceed a combined maximum total of 1 percent by weight of additives other than carbon black.
 2. Geomembrane shall be free of holes, pinholes as verified by on-line electrical detection, bubbles, blisters, excessive contamination by foreign matter, and nicks and cuts on roll edges.
 3. Geomembrane material is to be supplied in roll form. Each roll is to be identified with labels indicating roll number, thickness, length, width and MANUFACTURER.
 4. All liner sheets produced at the factory shall be inspected prior to shipment for compliance with the physical property requirements listed in section 1.09, B, and be tested by an acceptable method of inspecting for pinholes. If pinholes are located, identified and indicated during manufacturing, these pinholes may be corrected during installation.
- D. Smooth surfaced geomembrane shall meet the requirements shown in the following table(s) for the following material(s):
1. Table 1.1 for black HDPE
 2. Table 1.2 for white-surfaced HDPE
 - a) The geomembrane shall be a white-surfaced, coextruded geomembrane.
 - b) The white surface shall be installed upwards.
 3. Table 1.3 for smooth conductive HDPE
 - a) The geomembrane shall have a coextruded, electrically conductive layer.
 - b) The conductive layer is installed downward.
 - c) Electrical testing shall be performed after liner installation by the INSTALLER.
 4. Table 1.4 for black LLDPE
 5. Table 1.5 for white-surfaced LLDPE
 - a) The geomembrane shall be a white-surfaced, coextruded geomembrane.
 - b) The white surface shall be installed upwards.
- E. Textured surfaced geomembrane shall meet the requirements shown in the following table(s) for the following material(s):
1. Table 2.1 for black coextruded textured HDPE
 2. Table 2.2 for white-surfaced coextruded textured HDPE
 - a) The geomembrane shall be a white-surfaced, coextruded geomembrane.
 - b) The white surface shall be installed upwards.
 3. Table 2.3 for black coextruded textured LLDPE
 4. Table 2.4 for white-surfaced coextruded textured LLDPE
 - a) The geomembrane shall be a white-surfaced, coextruded geomembrane.
 - b) The white surface shall be installed upwards.
- F. Extrudate Rod or Bead
1. Extrudate material shall be made from same type resin as the geomembrane.
 2. Additives shall be thoroughly dispersed.

3. Materials shall be free of contamination by moisture or foreign matter.

1.10 EQUIPMENT

- A. Welding equipment and accessories shall meet the following requirements:
 1. Gauges showing temperatures in apparatus (extrusion welder) or wedge (wedge welder) shall be present.
 2. An adequate number of welding apparatus shall be available to avoid delaying work.
 3. Power source must be capable of providing constant voltage under combined line load.

1.11 DEPLOYMENT

- A. Assign each panel a simple and logical identifying code. The coding system shall be subject to approval and shall be determined at the job site.
- B. Visually inspect the geomembrane during deployment for imperfections and mark faulty or suspect areas.
- C. Deployment of geomembrane panels shall be performed in a manner that will comply with the following guidelines:
 1. Unroll geomembrane using methods that will not damage geomembrane and will protect underlying surface from damage (spreader bar, protected equipment bucket).
 2. Place ballast (commonly sandbags) on geomembrane which will not damage geomembrane to prevent wind uplift.
 3. Personnel walking on geomembrane shall not engage in activities or wear shoes that could damage it. Smoking will not be permitted on the geomembrane.
 4. Do not allow heavy vehicular traffic directly on geomembrane. Rubber-tired ATV's and trucks are acceptable if wheel contact is less than 6 psi.
 5. Protect geomembrane in areas of heavy traffic by placing protective cover over the geomembrane.
- D. Sufficient material (slack) shall be provided to allow for thermal expansion and contraction of the material.

1.12 FIELD SEAMING

- A. Seams shall meet the following requirements:
 1. To the maximum extent possible, orient seams parallel to line of slope, i.e., down and not across slope.
 2. Minimize number of field seams in corners, odd-shaped geometric locations and outside corners.
 3. Slope seams (panels) shall extend a minimum of five-feet beyond the grade break into the flat area.
 4. Use a sequential seam numbering system compatible with panel numbering system that is agreeable to the CONSULTANT and INSTALLER.
 5. Align seam overlaps consistent with the requirements of the welding equipment being used. A 6-inch overlap is commonly suggested.
- B. During Welding Operations
 1. Provide at least one Master Seamer who shall provide direct supervision over other welders as necessary.
- C. Extrusion Welding
 1. Hot-air tack adjacent pieces together using procedures that do not damage the geomembrane.
 2. Clean geomembrane surfaces by disc grinder or equivalent.

3. Purge welding apparatus of heat-degraded extrudate before welding.
- D. Hot Wedge Welding
1. Welding apparatus shall be a self-propelled device equipped with an electronic controller which displays applicable temperatures.
 2. Clean seam area of dust, mud, moisture and debris immediately ahead of hot wedge welder.
 3. Protect against moisture build-up between sheets.
- E. Trial Welds
1. Perform trial welds on geomembrane samples to verify welding equipment is operating properly.
 2. Make trial welds under the same surface and environmental conditions as the production welds, i.e., in contact with subgrade and similar ambient temperature.
 3. Minimum of two trial welds per day, per welding apparatus, one made prior to the start of work and one completed at mid shift.
 4. Cut four, one-inch wide by six-inch long test strips from the trial weld.
 5. Quantitatively test specimens for peel adhesion, and then for shear strength.
 6. Trial weld specimens shall pass when the results shown in Table 3 are achieved in both peel and shear test.
 - a. The break, when peel testing, occurs in the liner material itself, not through peel separation (FTB).
 - b. The break is ductile.
 7. Repeat the trial weld, in its entirety, when any of the trial weld samples fail in either peel or shear.
 8. No welding equipment or welder shall be allowed to perform production welds until equipment and welders have successfully completed trial weld.
- F. Seaming shall not proceed when ambient air temperature or adverse weather conditions jeopardize the integrity of the liner installation. INSTALLER shall demonstrate that acceptable seaming can be performed by completing acceptable trial welds.
- G. Defects and Repairs
1. Examine all seams and non-seam areas of the geomembrane for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter.
 2. Repair and non-destructively test each suspect location in both seam and non-seam areas. Do not cover geomembrane at locations that have been repaired until test results with passing values are available.

1.13 FIELD QUALITY ASSURANCE

- A. MANUFACTURER and INSTALLER shall participate in and conform to all terms and requirements of the Owner's quality assurance program. CONTRACTOR shall be responsible for assuring this participation.
- B. Quality assurance requirements are as specified in this Section and in the Field Installation Quality Assurance Manual if it is included in the contract.
- C. Field Testing
1. Non-destructive testing may be carried out as the seaming progresses or at completion of all field seaming.
 - a. Vacuum Testing
 - 1) Shall be performed in accordance with ASTM D 5641, Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber.
 - b. Air Pressure Testing

- 1) Shall be performed in accordance with ASTM D 5820, Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes.
- c. Other approved methods.
2. Destructive Testing (performed by CONSULTANT with assistance from INSTALLER)
 - a. Location and Frequency of Testing
 - 1) Collect destructive test samples at a frequency of one per every 1500 lineal feet of seam length.
 - 2) Test locations will be determined after seaming.
 - 3) Exercise Method of Attributes as described by GRI GM-14 (Geosynthetic Research Institute, <http://www.geosynthetic-institute.org>) to minimize test samples taken.
 - b. Sampling Procedures are performed as follows:
 - 1) INSTALLER shall cut samples at locations designated by the CONSULTANT as the seaming progresses in order to obtain field laboratory test results before the geomembrane is covered.
 - 2) CONSULTANT will number each sample, and the location will be noted on the installation as-built.
 - 3) Samples shall be twelve (12) inches wide by minimal length with the seam centered lengthwise.
 - 4) Cut a 2-inch wide strip from each end of the sample for field-testing.
 - 5) Cut the remaining sample into two parts for distribution as follows:
 - a) One portion for INSTALLER, 12-inches by 12 inches
 - b) One portion for the Third Party laboratory, 12-inches by 18-inches
 - c) Additional samples may be archived if required.
 - 6) Destructive testing shall be performed in accordance with ASTM D 6392, Standard Test Method for Determining the Integrity of Non-Reinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.
 - 7) INSTALLER shall repair all holes in the geomembrane resulting from destructive sampling.
 - 8) Repair and test the continuity of the repair in accordance with these Specifications.
3. Failed Seam Procedures
 - 1) If the seam fails, INSTALLER shall follow one of two options:
 - a) Reconstruct the seam between any two passed test locations.
 - b) Trace the weld to intermediate location at least 10 feet minimum or where the seam ends in both directions from the location of the failed test.
 - 2) The next seam welded using the same welding device is required to obtain an additional sample, i.e., if one side of the seam is less than 10 feet long.
 - 3) If sample passes, then the seam shall be reconstructed or capped between the test sample locations.
 - 4) If any sample fails, the process shall be repeated to establish the zone in which the seam shall be reconstructed.

1.14 REPAIR PROCEDURES

- A. Remove damaged geomembrane and replace with acceptable geomembrane materials if damage cannot be satisfactorily repaired.
- B. Repair any portion of unsatisfactory geomembrane or seam area failing a destructive or non-destructive test.
- C. INSTALLER shall be responsible for repair of defective areas.
- D. Agreement upon the appropriate repair method shall be decided between CONSULTANT and INSTALLER by using one of the following repair methods:

1. Patching- Used to repair large holes, tears, undispersed raw materials and contamination by foreign matter.
 2. Abrading and Re-welding- Used to repair short section of a seam.
 3. Spot Welding- Used to repair pinholes or other minor, localized flaws or where geomembrane thickness has been reduced.
 4. Capping- Used to repair long lengths of failed seams.
 5. Flap Welding- Used to extrusion weld the flap (excess outer portion) of a fusion weld in lieu of a full cap.
 6. Remove the unacceptable seam and replace with new material.
- E. The following procedures shall be observed when a repair method is used:
1. All geomembrane surfaces shall be clean and dry at the time of repair.
 2. Surfaces of the polyethylene which are to be repaired by extrusion welds shall be lightly abraded to assure cleanliness.
 3. Extend patches or caps at least 6 inches for extrusion welds and 4 inches for wedge welds beyond the edge of the defect, and around all corners of patch material.
- F. Repair Verification
1. Number and log each patch repair (performed by CONSULTANT).
 2. Non-destructively test each repair using methods specified in this Specification.

1.15 MEASUREMENT AND PAYMENT

- A. Payment for geomembrane installation will be as per contract unit price per square foot, as measured parallel to liner surface, including designed anchor trench material and is based upon net lined area.
- B. Net lined area is defined to be the true area of all surfaces to be lined plus designed burial in all anchor trenches, rubsheets, and sacrificial layers.
- C. Prices shall include full compensation for furnishing all labor, material, tools, equipment, and incidentals.
- D. Prices also include doing all the work involved in performing geomembrane installation completely as shown on the drawing, as specified herein, and as directed by the ENGINEER.

Table 1.1: Minimum Values for Smooth Black-Surfaced HDPE Geomembranes

TESTED PROPERTY	TEST METHOD	FREQUENCY	MINIMUM VALUE				
Product Code			HDE 030A000	HDE 040A000	HDE 060A000	HDE 080A000	HDE 100A000
Thickness, minimum average) mil (mm) Lowest individual reading (+10%)	ASTM D 5199	every roll	30 (0.75) 27 (0.69)	40 (1.00) 36 (0.91)	60 (1.50) 54 (1.40)	80 (2.00) 72 (1.80)	100 (2.50) 90 (2.30)
Density) g/cm ³	ASTM D 1505	200,000 lb	0.94	0.94	0.94	0.94	0.94
Tensile Properties (each direction) Strength at Break, lb/in-width (N/mm) Strength at Yield, lb/in-width (N/mm) Elongation at Break, % Elongation at Yield, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in (51 mm) G.L. 1.3 in (33 mm)	20,000 lb	114 (20) 63 (11) 700 12	152 (27) 84 (15) 700 12	228 (40) 126 (22) 700 12	304 (53) 168 (29) 700 12	380 (67) 210 (37) 700 12
Tear Resistance, lb (N)	ASTM D 1004	45,000 lb	21 (93)	28 (125)	42 (187)	56 (249)	70 (311)
Puncture Resistance, lb (N)	ASTM D 4833	45,000 lb	54 (240)	72 (320)	108 (480)	144 (640)	180 (800)
Carbon/Black Content, %	ASTM D 1603	20,000 lb	2.0	2.0	2.0	2.0	2.0
Carbon/Black Dispersion	ASTM D 5596	45,000 lb	+Note 1	+Note 1	+Note 1	+Note 1	+Note 1
Notch Constant Tensile Load, hr	ASTM D 5397, Appendix	200,000 lb	300	300	300	300	300
REFERENCE PROPERTY	TEST METHOD	FREQUENCY	NOMINAL VALUE				
Oxidative Induction Time, min	ASTM D 1895, 200° C, O ₂ , 1 atm	200,000 lb	>100	>100	>100	>100	>100
Roll Length ^a , approximate) ft (m)			1,120 (341)	870 (265)	560 (171)	430 (131)	140 (104)
Roll Width ^b , ft (m)			22.5 (6.9)	22.5 (6.9)	22.5 (6.9)	22.5 (6.9)	22.5 (6.9)
Roll Area, ft ² (m ²)			25,200 (2,341)	19,575 (1,819)	12,600 (1,171)	9,675 (899)	7,650 (711)

NOTES:

- +Note 1: Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- GSE HD is available in rolls weighing about 3,900 lb (1,769 kg).
- All GSE geomembranes have dimensional stability of ±2% when tested with ASTM D 1204 and ITB at +77° C when tested with ASTM D 746.
- ^aRoll length) and widths have a tolerance of ± 1%.

Table 1.2: Minimum Values for Smooth White-Surfaced HDPE Geomembranes

TESTED PROPERTY	TEST METHOD	FREQUENCY	MINIMUM VALUE				
			HDE 030A010	HDE 040A010	HDE 060A010	HDE 080A010	HDE 100A010
Product Code			HDE 030A010	HDE 040A010	HDE 060A010	HDE 080A010	HDE 100A010
Thickness, (minimum average) mil (mm) Lowest individual reading (+10%)	ASTM D 5199	every roll	30 (0.75) 27 (0.69)	40 (1.00) 36 (0.91)	60 (1.50) 54 (1.40)	80 (2.00) 72 (1.80)	100 (2.50) 90 (2.30)
Density ²⁾ , g/cm ³	ASTM D 1505	200,000 lb	0.94	0.94	0.94	0.94	0.94
Tensile Properties (each direction)	ASTM D 6693, Type IV	20,000 lb					
Strength at Break, lb/in-width (N/mm)	Dumbell, 2 ipm		114 (20)	152 (27)	228 (40)	304 (53)	380 (67)
Strength at Yield, lb/in-width (N/mm)			63 (11)	84 (15)	126 (22)	168 (29)	210 (37)
Elongation at Break, %	G.L. = 2.0 in (51 mm)		700	700	700	700	700
Elongation at Yield, %	G.L. = 1.1 in (33 mm)		12	12	12	12	12
Tear Resistance, lb (N)	ASTM D 1004	45,000 lb	21 (93)	28 (125)	42 (187)	56 (249)	70 (311)
Puncture Resistance, lb (N)	ASTM D 4833	45,000 lb	54 (240)	72 (320)	108 (480)	144 (640)	180 (800)
Carbon Black Content ³⁾ , %	ASTM D 1603, black layer	20,000 lb	2.0	2.0	2.0	2.0	2.0
Carbon Black Dispersion	ASTM D 5596	45,000 lb	+Note 1	+Note 1	+Note 1	+Note 1	+Note 1
Notched Constant Tensile Load, hr	ASTM D 5397, Appendix	200,000 lb	300	300	300	300	300
REFERENCE PROPERTY	TEST METHOD	FREQUENCY	NOMINAL VALUE				
Oxidative Induction Time ⁴⁾ , min	ASTM D 3895, 200° C; O ₂ , 1 atm	200,000 lb	>100	>100	>100	>100	>100
Roll Length ⁵⁾ (approximate), ft (m)			1,120 (341)	870 (265)	560 (173)	430 (131)	340 (104)
Roll Width ⁶⁾ , ft (m)			22.5 (6.9)	22.5 (6.9)	22.5 (6.9)	22.5 (6.9)	22.5 (6.9)
Roll Area, ft ² (m ²)			25,200 (2,341)	19,575 (1,819)	12,600 (1,171)	9,675 (899)	7,650 (711)

NOTES:

- +Note 1: Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- GSE White is available in rolls weighing about 3,900 lb (1,769 kg).
- GSE White may have an overall ash content greater than 3.0% due to the white layer.
- All GSE geomembranes have dimensional stability of ±2% when tested with ASTM D 1204 and DB of +77° C when tested with ASTM D 746.
- ²⁾ The values apply to the black layer only.
- ⁵⁾ Roll lengths and widths have a tolerance of ± 1%.

Table 1.3: Minimum Values for Smooth Conductive HDPE Geomembranes

TESTED PROPERTY	TEST METHOD	FREQUENCY	MINIMUM VALUE			
Product Code			HDC 040A000	HDC 060A000	HDC 080A000	HDC 100A000
Thickness, (minimum average) mil (mm) Lowest individual reading (+10%)	ASTM D 5199	every roll	40 (1.00) 36 (0.91)	60 (1.50) 54 (1.40)	80 (2.00) 72 (1.80)	100 (2.50) 90 (2.30)
Density (g/cm ³)	ASTM D 1505	200,000 lb	0.94	0.94	0.94	0.94
Tensile Properties (each direction) Strength at Break, lb/in width (N/mm) Strength at Yield, lb/in width (N/mm) Elongation at Break, % Elongation at Yield, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. = 2.0 in (51 mm) G.L. = 1.3 in (33 mm)	20,000 lb	152 (27) 84 (15) 700 12	228 (40) 126 (22) 700 12	304 (53) 168 (29) 700 12	380 (67) 210 (37) 700 12
Tear Resistance, lb (N)	ASTM D 1004	45,000 lb	28 (125)	42 (187)	56 (249)	70 (311)
Puncture Resistance, lb (N)	ASTM D 4833	45,000 lb	72 (320)	108 (480)	144 (640)	180 (800)
Carbon Black Content*, %	ASTM D 1603	20,000 lb	2.0	2.0	2.0	2.0
Carbon Black Dispersion	ASTM D 5596	45,000 lb	+Note 1	+Note 1	+Note 1	+Note 1
Notched Constant Tensile Load, hr	ASTM D 5397, Appendix	200,000 lb	300	300	300	300
REFERENCE PROPERTY	TEST METHOD	FREQUENCY	NOMINAL VALUE			
Oxidative Induction Time, min	ASTM D 3895, 200° C; O ₂ , 1 atm	200,000 lb	>100	>100	>100	>100
Roll Length** (approximate), ft (m)			870 (265)	560 (171)	430 (131)	340 (104)
Roll Width**, ft (m)			22.5 (6.9)	22.5 (6.9)	22.5 (6.9)	22.5 (6.9)
Roll Area, ft ² (m ²)			19,575 (1,819)	12,600 (1,171)	9,675 (899)	7,650 (711)

NOTES:

- +Note 1: Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- GSE Conductive is available in rolls weighing about 3,900 lb (1,769 kg).
- *Due to surface effects caused by the conductive layer, these tensile properties are minimum average values.
- **GSE Conductive may have an overall carbon black percentage above 2.0% due to the high carbon black loadings in the conductive layer.
- All GSE geomembranes have dimensional stability of ±2% when tested with ASTM D 1204 and IIB of <77° C when tested with ASTM D 746.
- **Roll lengths and widths have a tolerance of ± 1%.

Table 1.4: Minimum Values for Smooth Black-Surfaced LLDPE Geomembranes

TESTED PROPERTY	TEST METHOD	FREQUENCY	MINIMUM VALUE			
Product Code			LLD 030A000	LLD 040A000	LLD 060A000	LLD 080A000
Thickness, (minimum average) mil (mm)	ASTM D 5199	every roll	30 (0.75)	40 (1.00)	60 (1.50)	80 (2.00)
Lowest individual reading (+10%)			37 (0.69)	36 (0.91)	54 (1.40)	72 (1.80)
Density, g/cm ³	ASTM D 1505	200,000 lb	0.92	0.92	0.92	0.92
Tensile Properties (each direction)	ASTM D 6693, Type IV Dumbbell, 2 gpm G.L. = 2.0 in (51 mm)	20,000 lb				
Strength at Break, lb/in-width (N/mm)			114 (20)	152 (27)	228 (40)	304 (53)
Elongation at Break, %			800	800	800	800
Tear Resistance, lb (N)	ASTM D 1004	45,000 lb	16 (71)	22 (98)	33 (147)	44 (200)
Puncture Resistance, lb (N)	ASTM D 4833	45,000 lb	42 (190)	56 (250)	84 (370)	112 (500)
Carbon Black Content, %	ASTM D 1603	20,000 lb	2.0	2.0	2.0	2.0
Carbon Black Dispersion	ASTM D 5596	45,000 lb	+Note 1	+Note 1	+Note 1	+Note 1
REFERENCE PROPERTY	TEST METHOD	FREQUENCY	NOMINAL VALUE			
Oxidative Induction Time, min	ASTM D 3895, 200° C, 1 atm	200,000 lb	>100	>100	>100	>100
Roll Length (approximate), ft (m)			1,120 (341)	870 (265)	560 (171)	430 (131)
Roll Width ^a , ft (m)			22.5 (6.9)	22.5 (6.9)	22.5 (6.9)	22.5 (6.9)
Roll Area ^b , ft ² (m ²)			25,200 (2,341)	19,575 (1,819)	12,600 (1,171)	9,675 (899)

NOTES

- +Note 1: Dispersion only applies to non-spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- GSE UltraFlex is available in rolls weighing about 3,800 lb (1,724 kg) respectively.
- All GSE geomembranes have dimensional stability of ±2% when tested with ASTM D 1204 and 0% at -77° C when tested with ASTM D 746.
- ^aRoll lengths and widths have a tolerance of ± 1%.

Table 1.5: Minimum Values for Smooth White-Surfaced LLDPE Geomembranes

TESTED PROPERTY	TEST METHOD	FREQUENCY	MINIMUM VALUE	
Product Code			LLD040A010	LLD060A010
Thickness, (minimum average) mil (mm) Lowest individual reading (±10%)	ASTM D 5199	every roll	40 (1.00) 36 (0.91)	60 (1.50) 54 (1.40)
Density ¹⁾ , g/cm ³	ASTM D 1505	200,000 lb	0.92	0.92
Tensile Properties (each direction): Strength at Break, lb/in width (N/mm) Elongation at Break, %	ASTM D 6693, Type IV Dumbbell, 2 ipm (G.L. = 2.0 in (51 mm))	20,000 lb	152 (27) 800	228 (40) 800
Tear Resistance, lb (N)	ASTM D 1004	45,000 lb	22 (98)	33 (147)
Puncture Resistance, lb (N)	ASTM D 4833	45,000 lb	56 (250)	84 (370)
Carbon Black Content ²⁾ , %	ASTM D 1603	20,000 lb	2.0	2.0
Carbon Black Dispersion	ASTM D 5596	45,000 lb	+Note 1	+Note 1
REFERENCE PROPERTY	TEST METHOD	FREQUENCY	NOMINAL VALUE	
Oxidative Induction Time ³⁾ , min	ASTM D 3895, 200° C; O ₂ 1 atm	200,000 lb	>100	>100
Roll Length ⁴⁾ (approximate), ft (m)			870 (265)	560 (171)
Roll Width ⁴⁾ , ft (m)			22.5 (6.9)	22.5 (6.9)
Roll Area, ft ² (m ²)			19,575 (1,819)	12,600 (1,171)

NOTES:

- +Note 1: Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- GSE UltraFlex White is available in rolls weighing about 3,800 lb (1,724 kg).
- ¹⁾GSE UltraFlex White may have an overall ash content greater than 3.0% due to the white layer.
- All GSE geomembranes have dimensional stability of ±2% when tested with ASTM D 1204 and IIB of <-7° C when tested with ASTM D 746.
- ²⁾The values apply to the black layer only.
- ³⁾Roll lengths and widths have a tolerance of ± 1%.

Tab 2.1: Minimum Values for Black Surface Coextruded Textured HDPE Geomembranes

TESTED PROPERTY	TEST METHOD	FREQUENCY	MINIMUM VALUE				
Product Code			HDT 030C000	HDT 040C000	140T 060C000	HDT 080C000	HDT 100C000
Thickness, (minimum average) mil (mm) lowest individual for 8 out of 10 values lowest individual for any of the 10 values	ASTM D 5994	every roll	29 (0.73) 27 (0.69) 26 (0.66)	38 (0.96) 36 (0.91) 34 (0.86)	57 (1.45) 54 (1.40) 51 (1.30)	76 (1.93) 72 (1.80) 68 (1.73)	95 (2.41) 90 (2.30) 85 (2.16)
Density, g/cm ³	ASTM D 1505	200,000 lb	0.94	0.94	0.94	0.94	0.94
Tensile Properties (each direction) ^a Strength at Break, lb/in-width (N/mm) Strength at Yield, lb/in-width (N/mm) Elongation at Break, % Elongation at Yield, %	ASTM D 6691, Type IV Dumbbell, 2 ipm G.L. = 2.0 in (51 mm) G.L. = 1.3 in (33 mm)	20,000 lb	45 (8) 63 (11) 100 12	60 (11) 84 (15) 100 12	90 (16) 126 (22) 100 12	120 (21) 168 (29) 100 12	150 (27) 210 (37) 100 12
Tear Resistance, lb (N)	ASTM D 1004	45,000 lb	21 (93)	28 (125)	42 (187)	56 (249)	70 (311)
Puncture Resistance, lb (N)	ASTM D 4833	45,000 lb	45 (200)	60 (267)	90 (400)	120 (534)	150 (667)
Carbon Black Content, %	ASTM D 1603	20,000 lb	2.0	2.0	2.0	2.0	2.0
Carbon Black Dispersion	ASTM D 5596	45,000 lb	+Note 1	+Note 1	+Note 1	+Note 1	+Note 1
Asperity Height	GRI GM 12	second roll	+Note 2	+Note 2	+Note 2	+Note 2	+Note 2
Notched Constant Tensile Load ^b , hr	ASTM D 5397, Appendix	200,000 lb	300	300	300	300	300
REFERENCE PROPERTY	TEST METHOD	FREQUENCY	NOMINAL VALUE				
Oxidative Induction Time, min	ASTM D 3895, 200° C; O ₂ , 1 atm	200,000 lb	>100	>100	>100	>100	>100
Roll Length ^c (approximate), ft (m)	Standard Textured		830 (253)	700 (213)	520 (158)	400 (122)	330 (101)
Roll Width ^c , ft (m)			22.5 (6.9)	22.5 (6.9)	22.5 (6.9)	22.5 (6.9)	22.5 (6.9)
Roll Area, ft ² (m ²)			18,674 (1,735)	15,750 (1,464)	11,700 (1,087)	9,000 (836)	7,425 (690)

NOTES:

- +Note 1: Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- +Note 2: 10 mil average; 8 of 10 readings ≥ 7 mils; lowest individual ≥ 5 mils.
- GSE HD Standard Textured is available in rolls weighing about 4,000 lb (1,800 kg).
- ^aThe combination of stress concentrations due to coextrusion texture geometry and the small specimen size results in large variation of test results. Therefore, these tensile properties are minimum average values.
- ^bNotch for HD Textured is conducted on representative smooth membrane samples.
- All GSE geomembranes have dimensional stability of $\pm 2\%$ when tested with ASTM D 1204 and (TB of -77° C when tested with ASTM D 746).
- ^cRoll lengths and widths have a tolerance of $\pm 1\%$.

Table 2.2: Minimum Values for White-Surfaced Coextruded Textured HDPE Geomembranes

TESTED PROPERTY	TEST METHOD	FREQUENCY	MINIMUM VALUE			
Product Code			HDT 040G010	HDT 060G010	HDT 080G010	HDT 100G010
Thickness: minimum average) mil (mm) Lowest individual for 8 out of 10 values Lowest individual for any of the 10 values	ASTM D 5994	every roll	18 (0.96) 16 (0.93) 14 (0.86)	57 (1.45) 54 (1.40) 51 (1.30)	76 (1.93) 72 (1.80) 68 (1.73)	95 (2.41) 90 (2.30) 85 (2.16)
Density ¹⁾ , g/cm ³	ASTM D 1505	200,000 lb	0.94	0.94	0.94	0.94
Tensile Properties (each direction) ²⁾ Strength at Break, lbf/in-width (N/mm) Strength at Yield, lbf/in-width (N/mm) Elongation at Break, % Elongation at Yield, %	ASTM D 6691, Type IV Dumbbell, 2 gpm G.L. = 2.0 in (51 mm) G.L. = 1.3 in (33 mm)	20,000 lb	60 (11) 84 (15) 100 17	90 (16) 126 (22) 100 12	120 (21) 168 (29) 100 12	150 (27) 210 (37) 100 12
Tear Resistance, lb (N)	ASTM D 1004	45,000 lb	28 (125)	42 (187)	56 (249)	70 (311)
Puncture Resistance, lb (N)	ASTM D 4833	45,000 lb	60 (267)	90 (400)	120 (534)	150 (667)
Carbon Black Content ³⁾ , %	ASTM D 1603	20,000 lb	2.0	2.0	2.0	2.0
Carbon Black Dispersion	ASTM D 5596	45,000 lb	+Note 1	+Note 1	+Note 1	+Note 1
Asperity Height	GRI GM 12	second roll	+Note 2	+Note 2	+Note 2	+Note 2
Notched Constant Tensile Load ⁴⁾ , hr	ASTM D 5397, Appendix	200,000 lb	300	300	300	300
REFERENCE PROPERTY	TEST METHOD	FREQUENCY	NOMINAL VALUE			
Oxidative Induction Time ⁵⁾ , min	ASTM D 3895, 200° C, O ₂ , 1 atm	200,000 lb	>100	>100	>100	>100
Roll Length (approximate) ft (m)			700 (213)	520 (158)	400 (122)	330 (101)
Roll Width ⁶⁾ ft (m)			22.5 (6.9)	22.5 (6.9)	22.5 (6.9)	22.5 (6.9)
Roll Area, ft ² (m ²)			15,750 (1,463)	11,700 (1,087)	9,000 (836)	7,425 (690)

NOTES:

- +Note 1: Dispersion only applies to near spherical agglomerates. 9 or 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- +Note 2: 16 mil average. 8 of 10 readings ≥7 mils. Lowest individual ≥ 5 mils.
- GSE White Textured is available in rolls weighing about 4,000 lb (1,800 kg).
- The combination of stress concentrations due to construction texture geometry and the small specimen size results in large variation of test results. Therefore, these tensile properties are minimum average values.
- GSE White Textured may have an overall ash content greater than 3.0% due to the white layer.
- NCT is conducted on representative smooth membrane samples.
- All GSE geomembranes have dimensional stability of ±2% when tested with ASTM D 1204 and (DB at 77° C when tested) with ASTM D 746.
- The values apply to the black layer only.
- Roll lengths and widths have a tolerance of ± 1%.

Table 2.3: Minimum Values for Black Surfaced Coextruded Textured LLDPE Geomembranes

TESTED PROPERTY	TEST METHOD	FREQUENCY	MINIMUM VALUE		
Product Code			LUT040G000	LUT060G000	LUT080G000
Thickness, (minimum average) mil (mm) Lowest individual for 8 out of 10 values Lowest individual for any of the 10 values	ASTM D 5994	every roll	38 (0.96) 36 (0.91) 34 (0.86)	57 (1.45) 54 (1.40) 51 (1.30)	76 (1.93) 72 (1.80) 68 (1.73)
Density, g/cm	ASTM D 1505	200,000 lb	0.92	0.92	0.92
Tensile Properties (each direction) ^a Strength at Break, lb/in-width (N/mm) Elongation at Break, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. = 2.0 in (51 mm)	20,000 lb	60 (11) 250	90 (16) 250	120 (21) 250
Tear Resistance, lb (N)	ASTM D 1004	45,000 lb	22 (98)	33 (147)	44 (200)
Puncture Resistance, lb (N)	ASTM D 4833	45,000 lb	44 (200)	66 (300)	88 (400)
Carbon Black Content, %	ASTM D 1603	20,000 lb	2.0	2.0	2.0
Carbon Black Dispersion	ASTM D 5596	45,000 lb	+Note 1	+Note 1	+Note 1
Asperity Height	GRI GM 12	second roll	+Note 2	+Note 2	+Note 2
REFERENCE PROPERTY	TEST METHOD	FREQUENCY	NOMINAL VALUE		
Oxidative Induction Time, min	ASTM D 3895, 200° C; O ₂ , 1 atm	200,000 lb	>100	>100	>100
Roll Length ^b (approximate), ft (m)			700 (213)	520 (158)	400 (122)
Roll Width ^c , ft (m)			22.5 (6.9)	22.5 (6.9)	22.5 (6.9)
Roll Area, ft ² (m ²)			15,750 (1,463)	11,700 (1,087)	9,000 (836)

NOTES:

- +Note 1: Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- +Note 2: 10 mil average. 8 of 10 readings ≥ 7 mils. Lowest individual ≥ 5 mils.
- GSE UltraFlex Textured is available in rolls weighing about 3,900 lb (1,769 kg).
- ^aThe combination of stress concentrations due to coextrusion texture geometry and the small specimen size results in large variation of test results. Therefore, these tensile properties are average roll values.
- All GSE geomembranes have dimensional stability of ±2% when tested with ASTM D 1204 and ITR at <77° C when tested with ASTM D 746.
- Roll length and width have a tolerance of ± 1%.

Table 2.4: Minimum Values for White-Surfaced Coextruded Textured LLDPE Geomembranes

TESTED PROPERTY	TEST METHOD	FREQUENCY	MINIMUM VALUE		
Product Code			LUT040G010	LUT060G010	LUT080G010
Thickness, (minimum average) mil (mm)	ASTM D 5994	every roll	38 (0.96)	57 (1.45)	76 (1.93)
Lowest individual for 8 out of 10 values			36 (0.91)	54 (1.40)	72 (1.80)
Lowest individual for any of the 10 values			34 (0.86)	51 (1.30)	68 (1.73)
Density ¹⁾ , g/cm ³	ASTM D 1505	200,000 lb	0.92	0.92	0.92
Tensile Properties (each direction) ¹⁾	ASTM D 6993, Type IV Dumbbell, 2 ipm G.L. = 2.0 in (51 mm)	20,000 lb			
Strength at Break, lb/in-width (N/mm)			60 (11)	90 (16)	120 (21)
Elongation at Break, %			250	250	250
Tear Resistance, lb (N)	ASTM D 1004	45,000 lb	22 (98)	33 (147)	44 (200)
Puncture Resistance, lb (N)	ASTM D 4833	45,000 lb	44 (200)	66 (300)	88 (400)
Carbon Black Content ²⁾ , %	ASTM D 1603	20,000 lb	2.0	2.0	2.0
Carbon Black Dispersion	ASTM D 5596	45,000 lb	+Note 1	+Note 1	+Note 1
Asperity Height	CRI GM 12	second roll	+Note 2	+Note 2	+Note 2
REFERENCE PROPERTY	TEST METHOD	FREQUENCY	NOMINAL VALUE		
Oxidative Induction Time ³⁾ , min	ASTM D 3895, 200° C, O ₂ , 1 atm	200,000 lb	>100	>100	>100
Roll Length ⁴⁾ (approximate), ft (m)			700 (213)	520 (158)	400 (122)
Roll Width ⁴⁾ , ft (m)			22.5 (6.9)	22.5 (6.9)	22.5 (6.9)
Roll Area, ft ² (m ²)			15,750 (1,463)	11,700 (1,087)	9,000 (836)

NOTES:

- +Note 1: Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- +Note 2: 10 mil average. 8 of 10 readings ≥7 mils. Lowest individual ≤ 5 mils.
- GSE UltraFlex White Textured is available in rolls weighing about 3,900 lb (1,769 kg).
- The combination of stress concentrations due to coextrusion texture geometry and the small specimen size results in large variation of test results. Therefore, these tensile properties are average roll values.
- *GSE UltraFlex White Textured may have an overall ash content greater than 3.0% due to the white layer.
- All GSE geomembranes have dimensional stability of ±2% when tested with ASTM D 1204 and ITB of <77° C when tested with ASTM D 746.
- †The values apply to the black layer only.
- *Roll lengths and widths have a tolerance of ± 1%.

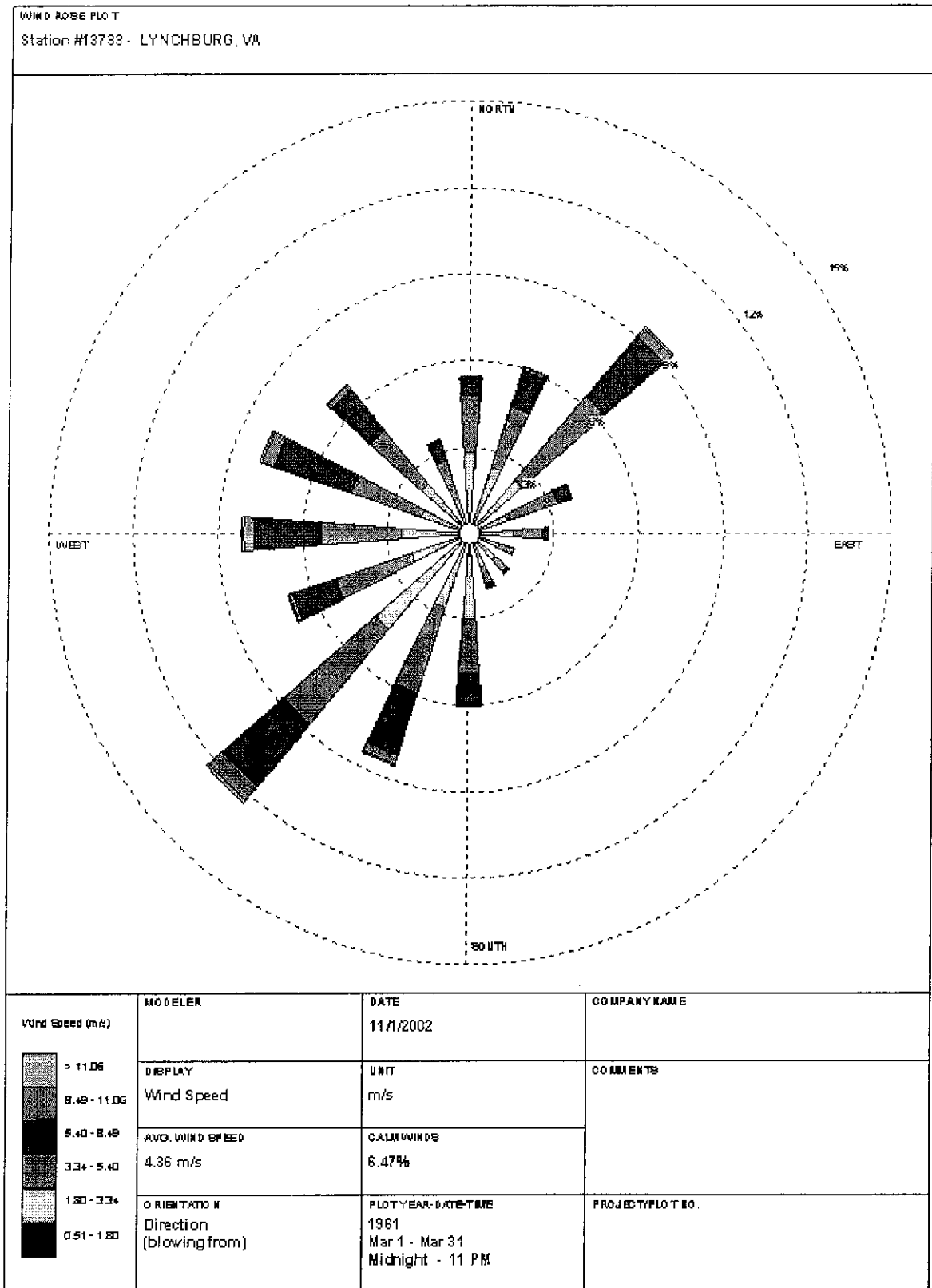
Table 3.1: Minimum Weld Values for HDPE Geomembranes

Property	Test Method	30 (0.75)	40 (1.0)	60 (1.5)	80 (2.0)	100 (2.5)	120 (3.0)
Peel Strength (fusion), ppi (kN/m)	ASTM D 6392	49 (8.6)	65 (11.4)	98 (17.2)	130 (22.8)	162 (28.4)	196 (34.3)
Peel Strength (extrusion), ppi (kN/m)	ASTM D 6392	39 (6.8)	52 (9.1)	78 (13.7)	104 (18.2)	130 (22.8)	157 (27.5)
Shear Strength (fusion & ext.), ppi (kN/m)	ASTM D 6392	61 (10.7)	81 (14.2)	121 (21.2)	162 (28.4)	203 (35.5)	242 (42.4)

Table 4.1: Minimum Weld Values for LLDPE Geomembranes

Property	Test Method	30 (0.75)	40 (1.0)	60 (1.5)	80 (2.0)	100 (2.5)
Peel Strength (extrusion), ppi (kN/m)	ASTM D 6392	36 (6.3)	48 (8.4)	72 (12.6)	96 (16.8)	120 (21.0)
Peel Strength (fusion), ppi (kN/m)	ASTM D 6392	38 (6.7)	50 (8.8)	75 (13.1)	100 (17.5)	125 (21.9)
Shear Strength (fusion & ext.), ppi (kN/m)	ASTM D 6392	45 (7.9)	60 (10.5)	90 (15.8)	120 (21.0)	150 (26.3)

END OF SECTION



WROTC 3.0 User's Manual - Copyright 2002 - www.wrotp.com

APPENDIX 7
Landfill Gas Emissions Modeling



Memorandum

To: File
From: Don Marickovich
Date: November 8, 2006
Project Name: Region 2000
Project Number: B06209-01
Subject: Air Permitting
cc: Lynn Klappich

1. Creating a regional system between the Lynchburg, Campbell County, and the Amherst County landfills will increase the maximum annual landfill gas emission rates for the Campbell and Amherst County landfills. For example, the peak annual landfill gas emissions for the Campbell County Landfill will increase from an estimated 6.77 million cm/yr in 2041 to 13.1 million cm/yr in 2021. For the Amherst County Landfill, the peak emissions will increase from an estimated 2.81 million cm/yr in 2025 to 5.79 million cm/yr in 2025.
2. According to Sharon Foley, the air permit manager in the Harrisonburg DEQ office, whom we are working with on several landfill air permitting issues, a significant increase in the waste acceptance rate which increases the peak gas emissions rate is a change in the operations of the landfill and could be subject to Virginia's New Source Review (NSR) air permitting. For each impacted landfill, a Form 7 permit application should be submitted to the applicable field office for determination of whether NSR applies.
3. Form 7 is the State's air permit application for new and modified source permits and state operating permits. As this would be considered preconstruction permitting, the Form 7 application should be submitted it time for DEQ to act on it before, the applicable landfill begins receiving the increased tonnage. The DEQ review and approval process takes about four months. Therefore, the application should probably be submitted approximately 6 months before the increased acceptance rate period begins. The application would need to describe the increase in waste acceptance rates.
4. Along with the application, air emissions modeling needs to be completed and submitted. The EPA's Landfill Gas Emissions Model (LandGEM) should be used to estimate the future air emissions. Two versions of the model should be run, one with the currently planned waste acceptance rates and one with the proposed larger waste acceptance rates so that the increase in emissions can be determined. AP-42 factors or site specific data (if available) can be used.

5. The Campbell County and the Amherst County landfill do not have design capacities that make them Title V landfills. Therefore, the federal Title V program will not require the installation of gas collection and treatment facilities at these landfills. However, the State itself could require landfill gas control and treatment in the future.

<p align="center">Table 1 Summary of Estimated Landfill Gas Emissions Assuming Waste Placement Beginning on July 1, 2007 for Comparison Purposes; Waste Already in Place is not Considered</p>					
	Lynchburg		Campbell County		Amherst County
Scenario No. 1 (As Is)	Peak Year = 2017		Peak Year = 2041		Peak Year = 2025
	Peak Flow = 9,636,290 cu m/yr		Peak Flow = 6,766,701 cu m/yr		Peak Flow = 2,814,541 cu m/yr
	Total Emissions = 240,045,698 cu m		Total Emissions = 213,441,358 cu m		Total Emissions = 77,889,319 cu m
Scenario No. 2 (Original Regional Proposal)	Peak Year = 2013		Peak Year = 2021		Peak Year = 2025
	Peak Flow = 9,471,181 cu m/yr		Peak Flow = 13,129,979 cu m/yr		Peak Flow = 5,786,043 cu m/yr
	Total Emissions = 229,086,038 cu m		Total Emissions = 309,000,396 cu m		Total Emissions = 116,953,780 cu m
Scenario No. 3 (Revised Regional Proposal)	Peak Year = 2015		Peak Year = 2024		Peak Year = 2024
	Peak Flow = 9,270,652 cu m/yr		Peak Flow = 12,909,764 cu m/yr		Peak Flow = 4,177,885 cu m/yr
	Total Emissions = 228,042,984 cu m		Total Emissions = 302,373,813 cu m		Total Emissions = 113,585,529 cu m

*Total Emissions are the sum of annual emissions from 2007 through 2055

Table 2
Estimated Landfill Gas Emissions - City of Lynchburg Landfill

Year	Lynchburg Scenario No. 1 Total Landfill Gas Emissions (m3/year) (av ft ³ /min)		Lynchburg Scenario No. 2 Total Landfill Gas Emissions (m3/year) (av ft ³ /min)		Lynchburg Scenario No. 3 Total Landfill Gas Emissions (m3/year) (av ft ³ /min)				
	2007	0	0	0	0	0	0		
2008	592,850	40	934,400	63	777,980	52			
2009	1,756,269	118	2,771,235	186	2,307,328	155			
2010	2,880,963	194	4,540,732	305	3,780,610	254			
2011	3,962,614	266	6,245,539	420	5,200,031	349			
2012	5,004,839	336	7,888,207	530	6,567,719	441			
2013	6,099,197	404	9,471,181	636	7,885,706	530			
2014	6,977,175	469	9,420,594	633	8,155,951	615			
2015	7,918,205	537	9,051,209	608	9,270,652	623			
2016	8,869,665	592	8,693,365	584	8,907,445	595			
2017	9,636,290	647	8,355,318	561	8,557,991	575			
2018	9,258,445	622	8,077,701	539	8,222,331	552			
2019	8,895,116	598	7,712,930	518	7,899,929	531			
2020	8,546,622	574	7,410,592	498	7,590,168	510			
2021	8,211,504	552	7,119,932	478	7,292,553	490			
2022	7,889,527	530	6,840,756	460	7,006,608	471			
2023	7,580,174	509	6,572,526	442	6,731,875	452			
2024	7,282,951	489	6,314,813	424	6,467,915	435			
2025	6,997,382	470	6,067,206	408	6,214,304	418			
2026	6,723,011	452	5,829,307	392	5,970,638	401			
2027	6,459,398	434	5,600,737	376	5,736,526	385			
2028	6,206,121	417	5,381,129	362	5,511,593	370			
2029	5,962,776	401	5,170,132	347	5,295,481	356			
2030	5,728,972	384	4,967,462	334	5,087,842	342			
2031	5,504,336	370	4,772,632	321	4,888,345	328			
2032	5,288,508	355	4,585,496	308	4,696,070	316			
2033	5,081,143	341	4,405,696	296	4,512,511	303			
2034	4,881,908	328	4,232,946	284	4,335,573	291			
2035	4,690,486	315	4,066,970	273	4,165,573	280			
2036	4,506,569	303	3,907,502	263	4,002,238	269			
2037	4,329,864	291	3,754,286	252	3,845,308	258			
2038	4,160,088	280	3,607,079	242	3,694,531	248			
2039	3,996,968	269	3,465,643	233	3,549,667	239			
2040	3,840,245	258	3,329,753	224	3,410,482	228			
2041	3,689,667	248	3,199,192	215	3,276,755	220			
2042	3,544,993	238	3,073,750	207	3,148,272	212			
2043	3,405,992	229	2,953,226	198	3,024,826	203			
2044	3,272,441	220	2,837,429	191	2,906,221	195			
2045	3,144,127	211	2,726,171	183	2,792,267	188			
2046	3,020,844	203	2,619,277	176	2,682,780	180			
2047	2,902,395	195	2,516,573	169	2,577,587	173			
2048	2,788,590	187	2,417,897	162	2,476,518	166			
2049	2,679,248	180	2,323,090	156	2,379,413	160			
2050	2,574,193	173	2,232,000	150	2,286,115	154			
2051	2,473,258	166	2,144,482	144	2,196,475	148			
2052	2,376,280	160	2,060,396	138	2,110,350	142			
2053	2,283,105	153	1,979,607	133	2,027,602	136			
2054	2,193,503	147	1,901,985	128	1,948,098	131			
2055	2,107,571	142	1,827,407	123	1,871,712	126			
2056	2,024,932	136	1,755,754	118	1,798,321	121			
Peak Year	2017	9,636,290 cu m/yr	647 cfm	2013	9,471,181 cu m/yr	636 cfm	2015	9,270,652 cu m/yr	623 cfm
Total (2007 to 2056)	240,045,698 cubic meters			229,086,038 cubic meters			228,042,984 cubic meters		

Table 3
Estimated Landfill Gas Emissions - Campbell County Landfill

Year	Campbell Scenario No. 1		Campbell Scenario No. 2		Campbell Scenario No. 3				
	Total Landfill Gas Emissions (m3/year)	(av ft ³ /min)	Total Landfill Gas Emissions (m3/year)	(av ft ³ /min)	Total Landfill Gas Emissions (m3/year)	(av ft ³ /min)			
2007	0	0	0	0	0	0			
2008	170,772	11	0	0	0	0			
2009	506,476	34	0	0	0	0			
2010	829,874	56	0	0	0	0			
2011	1,141,449	77	0	0	0	0			
2012	1,441,064	97	0	0	0	0			
2013	1,730,972	116	0	0	0	0			
2014	2,009,901	135	576,326	106	0	0			
2015	2,278,560	153	8,416,175	230	1,109,667	75			
2016	2,537,653	171	5,188,720	349	2,653,531	178			
2017	2,787,458	187	6,906,540	463	4,140,808	278			
2018	3,028,341	203	8,542,177	574	5,573,747	374			
2019	3,260,655	219	10,128,072	681	8,054,488	467			
2020	3,484,737	234	11,656,585	783	8,285,087	557			
2021	3,700,912	249	13,129,979	882	9,567,521	643			
2022	3,909,493	263	12,931,309	869	10,803,089	720			
2023	4,110,780	276	12,424,265	835	11,995,413	806			
2024	4,305,060	289	11,937,103	802	12,909,764	867			
2025	4,492,612	302	11,460,042	771	12,403,565	833			
2026	4,673,700	314	11,019,335	740	11,917,214	801			
2027	4,848,581	326	10,587,261	711	11,449,933	769			
2028	5,017,500	337	10,172,128	683	11,000,975	739			
2029	5,180,893	348	9,773,273	657	10,569,821	710			
2030	5,338,367	359	9,390,958	631	10,158,180	682			
2031	5,490,800	369	9,021,868	606	9,756,989	656			
2032	5,638,141	379	8,668,116	582	9,374,412	630			
2033	5,780,612	388	8,328,234	560	9,006,836	605			
2034	5,918,405	398	8,001,679	538	8,653,673	581			
2035	6,051,706	407	7,687,929	517	8,314,358	559			
2036	6,180,693	415	7,386,481	496	7,988,347	537			
2037	6,305,539	424	7,096,853	477	7,675,120	516			
2038	6,426,408	432	6,818,581	458	7,374,174	495			
2039	6,543,457	440	6,551,221	440	7,085,029	476			
2040	6,656,839	447	6,294,344	423	6,807,221	457			
2041	6,766,701	455	6,047,539	406	6,540,306	439			
2042	6,508,836	437	5,810,412	390	6,283,857	422			
2043	6,253,621	420	5,582,582	375	6,037,463	406			
2044	6,008,413	404	5,363,686	360	5,800,731	390			
2045	5,772,820	388	5,153,373	346	5,573,281	374			
2046	5,546,464	373	4,951,306	333	5,354,749	360			
2047	5,328,984	358	4,757,163	320	5,144,787	346			
2048	5,120,032	344	4,570,632	307	4,943,057	332			
2049	4,919,273	331	4,391,415	295	4,749,237	319			
2050	4,726,385	318	4,219,225	283	4,563,016	307			
2051	4,541,061	305	4,053,787	272	4,384,098	295			
2052	4,363,003	293	3,894,835	262	4,212,195	283			
2053	4,191,928	282	3,742,117	251	4,047,033	272			
2054	4,027,560	271	3,595,388	242	3,888,346	261			
2055	3,869,637	260	3,454,409	232	3,735,882	251			
2056	3,717,906	250	3,318,960	223	3,589,396	241			
Peak Year	2041	6,766,701 cu m/yr	455 cfm	2021	13,129,979 cu m/yr	882 cfm	2024	12,909,764 cu m/yr	867 cfm
Total (2007 to 2056)		213,441,358 cubic meters			309,000,396 cubic meters			302,373,813 cubic meters	

Table 4
Estimated Landfill Gas Emissions - Amherst County Landfill

Year	Amherst Scenario No. 1 Total Landfill Gas Emissions		Amherst Scenario No. 2 Total Landfill Gas Emissions		Amherst Scenario No. 3 Total Landfill Gas Emissions				
	(m3/year)	(av ft ³ /min)	(m3/year)	(av ft ³ /min)	(m3/year)	(av ft ³ /min)			
2007	0	0	0	0	0	0			
2008	107,959	7	0	0	156,420	11			
2009	320,180	22	0	0	463,906	31			
2010	524,621	35	0	0	760,126	51			
2011	721,588	48	0	0	1,045,504	70			
2012	911,375	61	0	0	1,320,487	89			
2013	1,094,260	74	0	0	1,585,477	107			
2014	1,270,533	85	0	0	1,840,869	124			
2015	1,440,436	97	0	0	2,087,941	140			
2016	1,604,226	108	0	0	2,324,356	156			
2017	1,762,144	118	0	0	2,553,163	172			
2018	1,914,423	129	0	0	2,773,799	188			
2019	2,061,284	138	0	0	2,986,586	201			
2020	2,202,941	148	0	0	3,191,832	214			
2021	2,339,600	157	0	0	3,389,837	228			
2022	2,471,459	166	1,619,123	109	3,580,866	241			
2023	2,598,706	175	3,495,750	235	3,765,254	253			
2024	2,720,963	183	5,303,644	356	4,177,885	281			
2025	2,814,541	189	5,786,043	389	4,104,944	276			
2026	2,704,181	182	5,559,169	374	3,949,987	265			
2027	2,596,149	175	5,341,191	359	3,789,341	255			
2028	2,496,274	168	5,131,760	345	3,640,759	245			
2029	2,399,394	161	4,930,541	331	3,490,003	235			
2030	2,304,351	155	4,737,212	318	3,360,844	226			
2031	2,213,997	149	4,551,463	306	3,229,064	217			
2032	2,127,185	143	4,372,997	294	3,102,450	208			
2033	2,043,776	137	4,201,530	282	2,980,801	200			
2034	1,963,639	132	4,036,765	271	2,863,923	192			
2035	1,886,643	127	3,878,501	261	2,751,627	185			
2036	1,812,667	122	3,726,423	250	2,643,734	178			
2037	1,741,591	117	3,580,308	241	2,540,071	171			
2038	1,673,303	112	3,439,922	231	2,440,474	164			
2039	1,607,691	108	3,305,040	222	2,344,781	158			
2040	1,544,653	104	3,175,448	213	2,252,841	151			
2041	1,484,066	100	3,050,937	205	2,164,506	145			
2042	1,425,894	96	2,931,308	197	2,079,635	140			
2043	1,369,984	92	2,816,370	189	1,998,091	134			
2044	1,316,266	88	2,705,938	182	1,919,745	129			
2045	1,264,655	85	2,599,837	175	1,844,470	124			
2046	1,215,067	82	2,497,896	168	1,772,148	119			
2047	1,167,424	78	2,399,952	161	1,702,861	114			
2048	1,121,648	75	2,305,848	155	1,635,899	110			
2049	1,077,668	72	2,215,435	149	1,571,754	106			
2050	1,035,412	70	2,128,586	143	1,510,125	101			
2051	994,813	67	2,045,104	137	1,450,912	97			
2052	955,806	64	1,964,914	132	1,394,021	94			
2053	918,328	62	1,887,869	127	1,339,360	90			
2054	882,320	59	1,813,845	122	1,286,843	86			
2055	847,724	57	1,742,723	117	1,236,365	83			
2056	814,484	55	1,674,390	113	1,187,906	80			
Peak Year	2025	2,814,541 cu m/yr	189 cfm	2025	5,786,043 cu m/yr	389 cfm	2024	4,177,885 cu m/yr	281 cfm
Total (2007 to 2056)	77,889,319 cubic meters		116,953,780 cubic meters		113,585,529 cubic meters				

APPENDIX 8
Information from RW Beck on Equipment and Personnel

2.4.2 Proposed Operations

Customers of each facility are familiar with the current hours and days of operation. Therefore, R. W. Beck recommends, at a minimum, maintaining the current operating schedule – 7:00 a.m. to 4:00 p.m. Monday through Saturday at the Regional Landfill. This represents an extended schedule for only the Amherst County landfill.

Based on a review of historical data from the three landfills, it appears that operating hours from 7:00 a.m. to 4:00 p.m. Monday through Saturday should provide customers with sufficient access to the landfill. Also, the facility should be capable of accommodating the increase in waste tonnage during the current operating hours with proper staffing and equipment.

R. W. Beck also recommends that the regional landfill be closed on the four common holidays that each facility is currently closed: New Years, Independence Day, Thanksgiving and Christmas. The landfill should be open on Martin Luther King Day and President's Day.

2.5 Staffing

2.5.1 Current Landfill Staffing

Tables 2-7 through 2-9 summarize the current staffing at the City of Lynchburg, Campbell County and Amherst County landfills, respectively.

Table 2-7
City of Lynchburg Landfill Staff – Current

Position Title	Staff Positions	Allocation of Staff	
		Landfill	Non-LF
Waste Management Director	1	0.50	0.50
Civil Engineer	1	0.70	0.30
Waste Facility Operations Coordinator	1	0.90	0.10
Financial Coordinator	1	0.50	0.50
Administrative Associate	3	2.80	0.20
Landfill Cashier	1	1.00	0.00
Public Works Associate	13	7.80	5.20
Master Technician	2	0.80	1.20
TOTAL	23	15.00	8.00

The City of Lynchburg currently has 15 FTE dedicated to the landfill operations. The other eight FTE support other Waste Management Division functions such as residential waste collection. For example, of the 13 Public Works Associates (PWA),

two perform brush and bulk collection activities and three more support the City's recycling program part-time.

**Table 2-8
Campbell County Landfill Staff – Current**

Position Title	Staff Positions	Allocation of Staff	
		Landfill	Non-LF
Deputy Director	1	0.85	0.15
Office Manager	1	0.85	0.15
Administrative II	2	1.70	0.30
Equipment Operator	6	4.25	1.75
TOTAL	10	7.65	2.35

Campbell County allocates 7.65 FTE for landfill operations. The other 2.35 FTE assist with other county operations such as the building and maintenance of parks and roads.

**Table 2-9
Amherst County Landfill Staff – Current**

Position Title	Staff Positions	Allocation of Staff	
		Landfill	Non-LF
Solid Waste Director	1	0.70	0.30
Account Clerk	1	0.75	0.25
Landfill Attendant	1	0.80	0.20
Scale House Attendant	1	1.00	0.00
TOTAL	4	3.25	0.75

Amherst County also provides a part-time scale attendant. Equipment operators and laborers are provided under contract. Two equipment operators and one laborer are on site each weekday; typically only two of these contract staff work on Saturday.

2.5.2 Proposed Staffing

Based on the anticipated tonnage to be received at the regional facility from each of the participating communities and the Regional Entity's other responsibilities at the active and inactive landfills, Table 2-10 identifies the proposed staff needed to operate the regional solid waste utility. Each FTE represents one 40-hour work shift. Staffing projections include a contingency to account for vacations, sick leave, training, and other absences.

Table 2-10
Regional Solid Waste Utility Staff

Position	FTE
Management	
Director	1
Environmental Compliance and Engineering Manager	1
Business and Human Resources Manager	1
Administrative Assistant	3
Subtotal	6
Operations	
Operations Supervisor	2
Scale House Attendant	2
Equipment Operator II	2
Equipment Operator I	4
Site Maintenance Worker	4
Mechanic	1
Subtotal	15
Total	21

The Regional Entity should evaluate the need for hiring part-time staff to ensure that all required operations are performed without the use of significant overtime.

2.5.3 Overview of Staff Positions and Responsibilities

Management staff for the utility will consist of the Director, Environmental Compliance Officer and Engineering Manager, Business and Human Resources Manager, and Administrative Assistants. The management staff will typically work five 8-hour shifts, Monday through Friday, but will be on-call as required. Although the existing administration staff for each facility is not dedicated to landfill operations 100 percent of the time, the administration staff of the Regional Entity will be a full time responsibility.

A brief description of the responsibilities of each position is provided below.

- **Director:** responsible for the overall management of the utility – overseeing the performance of the utility in meeting its responsibilities to the participating communities and customers.
- **Environmental Compliance and Engineering Manager:** responsible for ensuring compliance with permit conditions with respect to environmental monitoring and reporting and management of capital improvement projects and consultant contracts.
- **Business and Human Resources Manager:** responsible for utility accounting, including customer billing and collections, coordinate human resource functions

performed by another entity for the utility, and supervision of the Scale House Attendants.

- **Administrative Assistants:** responsible for supporting all other management staff, provide receptionist services, and serve as back-up staff for the scale house.

Operations staff consists of the Operations Supervisors, Scale House Attendants and Equipment Operators. It is assumed that operations staff will work four 10-hour shifts. The proposed operations staff is designed to accommodate the needs at all three facilities. A brief description of the responsibilities of each position is provided below.

- **Operations Supervisors:** responsible for providing direction of all operations activities and supervision of Equipment Operators and Site Maintenance Workers; Supervisors should be capable of performing the duties of an equipment operator; Supervisors should obtain state landfill operator certification.

Supervisors can typically manage about six employees effectively. R. W. Beck recommends staffing two Operations Supervisors for the ten Equipment Operators and Site Maintenance Workers, and one Mechanic. In addition, two Supervisors will be better able to manage the operations at all three facilities. However, one of the Supervisors should take the lead in scheduling staff and ensuring operations are being conducted efficiently while the other should perform functions of the Equipment Operators and Site Maintenance Workers to account for vacations and sick leave, and ensure that all necessary operations activities are addressed. The Supervisors schedules will be staggered such that two days a week, only one Supervisor will be present on site.

- **Scale House Attendants:** responsible for all landfill customer transactions and waste tracking data management. R. W. Beck recommends that two Scale House Attendants be available on site to efficiently process customers and minimize traffic queues during peak operating periods. With the anticipated traffic volume of residential customers on Saturdays, it is likely that two attendants will be necessary. The Regional Entity may evaluate staffing a second attendant, when necessary, with one of the Administrative Assistants or possibly cross-training Site Maintenance Workers or Equipment Operators. Cross-training employees to perform multiple functions will provide flexibility in meeting staffing needs. When two attendants are present, one will work the inbound scale while the other works the outbound scale.
- **Equipment Operator II:** lead operators capable of effectively operating all equipment. Typically, the Equipment Operator II will perform many different jobs each day. The Equipment Operator II should obtain or maintain state landfill operator certification. In addition, the Equipment Operator II should be capable of performing the responsibilities of an Operations Supervisor to account for vacations and sick leave, and as required to successfully manage the regional facilities and operations.
- **Equipment Operator I:** responsible for equipment operation; primarily at the active landfill. May perform duties of Site Maintenance Work, as required. As

necessary, depending on experience and qualifications, can fill in as Equipment Operator II as needed.

- **Site Maintenance Worker:** responsible for site and grounds maintenance at the active and inactive landfill sites. Site Maintenance Workers will also perform site inspections and support the Compliance Officer with environmental monitoring (for groundwater, surface water, air and landfill gas), assist in the operation and maintenance of the environmental control systems, and haul leachate. Site Maintenance Workers should be able to operate a variety of heavy equipment such as a dozer and loader, and should be capable of performing some of the duties of an Equipment Operator as needed.
- **Mechanic:** responsible for routine and preventative maintenance, as well as minor repairs, for all landfill equipment and vehicles. It is anticipated that one Mechanic will be able to perform the majority of equipment and vehicle maintenance activities; however, Equipment Operators and Site Maintenance Workers should be capable of performing minor equipment maintenance functions, such as oil changes, to support the Mechanic.

Table 2-11 identifies typical daily operations staff needed, based on the work to be performed. R. W. Beck would mention that on some days of the week, the number of staff would be fewer. For example, there would only be one supervisor at the site two days per week, as the supervisors would work on different days of the week (e.g. one would be Monday – Thursday, while the other would be Wednesday – Saturday).

Table 2-11
Typical Daily Operating Staff by Function

Function	FTE
Supervisor	1.5
Refuse Compactor	2
Track Loader	1
Dozer	0.25
Pan Scraper	0.25
Site Maintenance	2
Scale Attendant	2
Mechanic	1
Total	10

2.5.4 Staff Hiring Process

Currently there are approximately 26 FTE City and County employees dedicated to landfill operations at the three existing disposal sites. By consolidating operations, it is anticipated that 21 FTE will be required to run the new regional disposal utility. Staff currently employed at the existing disposal facilities should be considered first for staff positions with the Regional Entity. The Regional Entity should develop a fair hiring process to select staff.

It is likely that some employees of the existing disposal facilities will prefer to remain with the City or County. R. W. Beck recommends that these employees be considered for staff vacancies or new positions within the local government.

2.5.5 Contracting Regional Entity Staff to Local Governments

The City of Lynchburg currently provides staff to other City departments during adverse weather conditions, when the landfill is closed or operating at a minimum level, to perform other duties. For example, during snow events, operators plow snow from City streets and at the airport. The Regional Entity may consider developing an inter-governmental agreement to provide staff for a variety of services with the City and Counties. However, providing staff to assist the local governments would only occur when staff have the availability. The Regional Entity would be compensated for the amount of time worked by staff for the City/County.

The Regional Entity will need to address a few issues prior to establishing such an agreement with the City and Counties since the staff will not be working for the same organization. The Regional Entity will need to understand the liability issues with respect to employees working for other organizations. For example, employees of the Regional Entity may be operating City equipment or operating at a County facility. An employee may also be injured while on loan to the City or Counties, so the Regional Entity should understand the workers compensation issues as well.

2.5.6 Hire Initial Staff

In order to begin the planning and implementation of the Regional Entity, several of the staff members should be hired in advance of formal creation of the Regional Entity. R. W. Beck recommends the following positions be filled before operations start:

- Director
- Environmental Compliance and Engineering Manager
- Business and Human Resources Manager

The Director and Environmental Compliance and Engineering Manager should be appointed by the Regional Entity approximately one year before the Regional Entity takes control of the three landfills. These two individuals will be responsible for the planning and implementation of the Regional Entity, including but not limited to:

- Permitting
- Regulatory requirements for “mothballing” inactive landfills
- Facilitating the transition of assets
- Arranging any debt that may be required
- Development of Regional Plan

The Business and Human Resources Manager should be appointed three to six months before the Regional Entity begins operations. This will provide time for the hiring of

operations personnel as well as any training that may need to occur. This individual should also be responsible for establishing the accounting and reporting functions.

As discussed in Section 4, the salary and benefits for these individual should be paid for by the participating communities until the Regional Entity begins operations. Based on the estimated salaries and benefits, R. W. Beck estimated the cost to the communities.

Table 2-12
Cost of Initial Regional Entity Staff

Position	Time	Annual Salary ^[1]	Annual Benefits ^[2]	Total
Director	1 year	\$60,411	\$14,067	\$74,478
Environmental Compliance and Engineering Manager	1 year	\$55,158	\$12,922	\$68,080
Business and Human Resources Manager	3-6 months	\$42,025	\$10,058	\$13,021 - \$26,042
Total				\$155,579 - \$168,599

[1] Estimate of FY 2007 salary. Amounts are based on the mid-point of estimated salary ranges.

[2] Includes share of all benefits discussed in Section 4.2.1. These costs may increase given recent increases in pension and health insurance costs.

Based on the information presented in Table 2-12, the three communities would be responsible for approximately \$155,000 to \$170,000 in salary and benefits for the initial Regional Entity staff.

2.6 Equipment

2.6.1 Existing Facility Equipment

The equipment currently owned by and in operation at the three disposal sites is outlined in Table 2-13.

Table 2-13
City and County Owned Equipment

Equipment	City of Lynchburg	Campbell County	Amherst County
Compactor	3	1	1
Dozer	2		
Track Loader	1	2	
Wheel Loader	2		
Hoe		1	
Scraper	1	1	
Dump Truck	1		
Hook-lift Truck	3		
Open-top Bins	10	3	
Recycling Bins		4	
Street Flusher	1		
Fuel Truck	1		
Service Truck	1		
Forklift	1		
Tank Trailer		1	
Lowboy Trailer		1	
Flatbed Trailer	1		
Mad Vac Trailer		1	
Tractor w/ Bushhog	1	1	
Brush Chipper		1	
Riding Mower	1		
Personnel Vehicles	5	3	2
Communication Radios	21		3
Freon Remover	1		1

2.6.2 Proposed Equipment for Active Landfill Operations

Table 2-14 provides a list of equipment required to operate the regional landfill and perform other responsibilities of the Regional Entity. The equipment will be purchased from each of the jurisdictions. When multiple pieces of equipment are available to choose from, R. W. Beck recommends reviewing the equipment age, hours in operation, preventative maintenance history, and repair history. Table 2-14 also indicates the typical uses for each piece of equipment.

Table 2-14
Regional Entity Equipment for Landfill Operation

Equipment	Number	Typical Uses
Refuse Compactor	3	Waste placement and compaction
Dozer, D8	1	Ripping borrow area soil; spreading cover soils; pushing waste
Dozer, D3	1	Placement of intermediate cover soils; cover repair; site maintenance
Track Loader	1	Pushing waste at the working face; tipping floor maintenance
Rubber Wheel Loader	1	Loading special waste bins; cleanup at residential receiving area
Scraper	1	Hauling borrow materials for daily cover to working face and stockpile
Fuel Truck	1	Refueling equipment
Street Flusher	1	Site road maintenance
Dump Truck	1	Hauling debris from site maintenance activities
Hook-Lift Truck	1	Servicing of residential bins at the on-site customer convenience station ³
Forklift	1	Unloading materials and supplies
Personnel Vehicles	6	Transporting operations staff on site and between sites
Equipment and Portable Radios	21	Communication between operating staff
Open-top bins	10	Allows residents and small haulers to dump loads at the drop-off site, and not at the working face

Typical operations will require two compactors. Each compactor should be used on a rotating basis such that each logs a similar number of hours in operation. The third compactor will be available as a spare in case of a breakdown. The third compactor may also be used during peak operating times to handle the quantity of waste without extending the work day.

2.6.3 Proposed Equipment for Other Operations

The Regional Entity will also require equipment to maintain the inactive landfills and perform site maintenance at the closed landfills. The equipment can be purchased from the jurisdictions which own the equipment. The following is a list of equipment that will be required.

- Riding mower

³ When the Regional Entity needs to replace the hook-lift truck, there may be a need to consider retaining the existing unit as a spare.

- Tractor with bushhog mower
- Truck and tank trailer
- Lowboy trailer
- Flatbed trailer
- Freon remover

The small dozer will be used only about 25 percent of the time at the active landfill. Similar uses will be required at the inactive and closed landfills. The rubber tire loader can also be used at each of the disposal facilities to load white goods and tires in open top bins. This equipment can be rotated between disposal facilities using the lowboy trailer.

The truck and tank trailer will be used for hauling leachate from the Campbell and Amherst County landfills.

The Regional Entity will also require other tools such as shovels and chain saws. These tools may be available for purchase from each jurisdiction or can be purchased new.

2.6.4 Equipment Summary

The Regional Entity would purchase all equipment from the City and Counties and sell equipment that is not needed for operations of the active and inactive landfills. The Regional Entity should evaluate the age of existing equipment and determine whether the equipment value is worth more to keep, use and maintain or to sell. Table 2-15 summarizes the number of existing equipment and proposed equipment.

**Table 2-15
Existing and Proposed Equipment**

Equipment	Existing Equipment	Proposed Equipment
Compactor	5	3
Dozer	2	2
Track Loader	3	1
Wheel Loader	2	1
Hoe	1	0
Pan Scraper	2	1
Dump Truck	1	1
Hook-lift Truck	1	1
Open-top Bins	17	10
Street Flusher	1	1
Fuel Truck	1	1
Service Truck	1	0
Forklift	1	1
Tank Trailer	1	1
Lowboy Trailer	1	1
Flatbed Trailer	1	1
Mad Vac Trailer	1	1
Tractor w/ Bushhog	2	1
Brush Chipper	1	0
Riding Mower	1	1
Personnel Vehicles	9	6
Communication Radios	24	20
Freon Remover	2	1

2.6.5 Equipment Maintenance

Proposed staffing for the Regional Entity includes one full-time mechanic for equipment and vehicle maintenance in addition to training equipment operators and site maintenance workers to perform routine maintenance activities, such as oil changes. R. W. Beck recommends the Regional Entity contract with the City of Lynchburg, at least while operating the Lynchburg landfill, for additional equipment maintenance staffing needs as necessary. These additional staffing needs should be minimized since the Regional Entity will have its own mechanic and other trained staff. However, the Regional Entity will benefit by having access to the City's experienced landfill equipment mechanics when needed. While the Regional Entity would need to compensate the City of Lynchburg for this service, it should be more

cost effective than hiring part-time master technicians that work exclusively for the Regional Entity or contracting from private parties.

The City already has a system in place where the Fleet Department charges other City departments like Waste Management for equipment maintenance services. The following are the surcharge rates used by the Fleet Department for Fiscal Year 2006.

Labor Rate	\$35.19
Parts	26.9%
Sublet	13.0%
Fuel	\$0.074

The Regional Entity will need to develop an inter-governmental agreement with the City concerning the basis for the costs of providing this service.

The City also owns a maintenance facility at the Lynchburg landfill that is used for preventative maintenance and minor repair of both landfill equipment and refuse collection vehicles. The City has a software system in place to track maintenance, repairs and costs. Since the City will continue to have a need for the maintenance building, the City will retain ownership and include the use of the building for landfill equipment maintenance in the inter-governmental agreement. During the time period when the Regional Entity will operate at the Lynchburg site, the Regional Entity and the City should proportionally share the costs of the use of this facility. R. W. Beck has calculated the proportional cost for the sharing of this facility between the City and the Regional Entity in Section 3. All major equipment repairs should continue to be performed by the equipment manufacturer, especially when covered by the warranty.

In the future, the Regional Entity will need to evaluate options to determine the most cost-effective way to provide equipment maintenance when transferring operations to the other landfills. Options include:

- Hiring another part- or full-time mechanic
- Contracting for services with the other jurisdictions, if available⁴
- Contracting for services with a third party

The Campbell County landfill includes an equipment maintenance building; however, unlike Lynchburg, the maintenance facility is used exclusively to support landfill operations. R. W. Beck recommends that the Regional Entity purchase the equipment building from Campbell County. With the significant increase of on-site landfill operations equipment, a maintenance facility will need to be constructed at the Amherst County landfill before it is prepared to operate as the regional disposal facility.

⁴ The issue with this option is that it is not similar to Lynchburg where they have the maintenance staff on site also performing other vehicle maintenance activities, therefore this is not a likely option.