

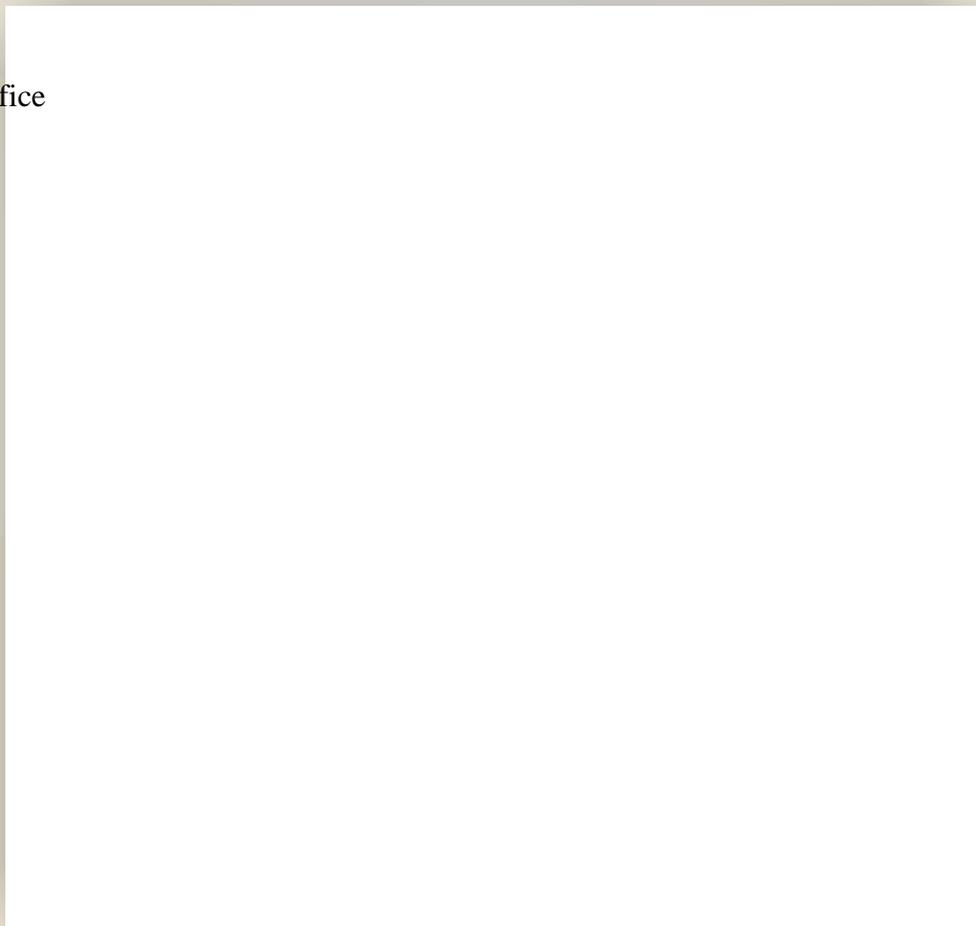
Old Salisbury Road Construction and Demolition Landfill Winston-Salem, North Carolina

Permit No.	Date	Document ID No.
34-12	June 19, 2009	7790

RECEIVED
June 17, 2009
Solid Waste Section
Asheville Regional Office

Permit Amendment June 2009

RECEIVED
June 08, 2009
Division of Air Quality
Mooresville Regional Office



Prepared for:



City/County Utility Commission
City of Winston-Salem
P.O. Box 2511
Winston-Salem, North Carolina 27102

Prepared by:



HDR Engineering, Inc. of the Carolinas
128 South Tryon Street, Suite 1400
Charlotte, North Carolina 28202
HDR Project No. 00162-13625-018

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SECTION 1 – INTRODUCTION

1.1 Background Information

The City/County Utility Commission of Forsyth County and Winston-Salem, North Carolina, (Winston-Salem) is proposing to amend the operations permit for the Old Salisbury Road Construction and Demolition Debris Landfill (C&DLF) in southern Forsyth County, North Carolina to allow continued operations through the next five year permitting cycle.

The site lies west of Old Salisbury Road (SR 3011) and north of Friedberg Road (SR 3132) at the Forsyth/Davidson County Line. The entire property consists of approximately 140 acres.

The information contained in this submittal is intended to fulfill the requirements of North Carolina Solid Waste Management Rule 15A NCAC 13B .0533(a)(2) for the amendment of the operating permit.

1.2 Regulatory History

The Site Plan Application was submitted to the North Carolina Department of Environment and Natural Resources (NCDENR) for review on April 6, 1995, and approved August 8, 1995. Following approval, Permit No. 34-12 was issued to Construct and Operate the C&DLF. The following is a history of the permits received by OSR which can be found in Appendix A.

Permit Type	Date Issued
Permit to Operate Phase I	July 3, 1996
Amendment 1 Permit to Construct Phase II	October, 15, 1999
Amendment 2 Permit to Operate Phase II	February 7, 2000
Amendment 3 Permit to Construct Phase III	August 2, 2000
Amendment 4 Permit to Operate Phase III	April 25, 2001
Amendment 5 Permit to Construct and Permit to Operate Vertical Expansion over Phases I – III	April 17, 2003
Amendment 6 Permit to Construct Phase IV, V, and VI	May 28, 2004
Amendment 7 Permit to Operate for Phase IV	October 7, 2004
Amendment 8 Permit to Operate for Phase V	February 8, 2008

1.3 Deed/Legal Description

The landfill site is comprised of one property. A copy of the deed with a legal description of the property is included in Appendix A. Following the Phase I Construction Plan Application submittal, Winston-Salem acquired a property adjacent to the northwest boundary of the existing site. This property is not intended for C&D disposal; however, the property has been used for stockpiling soil from excavation of the phases.

1.4 Responsible Party

The individual responsible for the operation and maintenance of the site is the Solid Waste Administrator for Winston-Salem:

Solid Waste Administrator
City/County Utility Commission
City of Winston-Salem
PO Box 2511
Winston – Salem, NC 27102
(336) 747-7310

1.5 Projected Use After Closure

After closure of the remaining Phases, the site will be maintained and monitored. No post-closure uses have been identified or are planned for the site at this time.

SECTION 2 – ENGINEERING AND DESIGN

2.1 Existing Features

A topographic map of the existing features of the site can be found on Drawing 04C-01. This drawing uses topography compiled by photogrammetric methods by Cartographic Aerial Mapping, dated January 1, 2009 for the entire site. An entrance road with a scale and scalehouse has been constructed to serve the site.

The United States Geological Survey (USGS) quadrangles for the property, Winston-Salem West, North Carolina, and Welcome, North Carolina, identify one stream located on the eastern edge of the property. The property is located on a ridge with drainage swales extending in several directions.

2.2 Facility Design

This site is required to maintain the following regulatory buffers:

- ◆ A 200-foot buffer between property line and waste (per Rule 15A NCAC 13B .0504 (1)(a)regulation).
- ◆ A 500-foot buffer from private dwellings and wells to waste (per Rule 15A NCAC 13B .0504 (1)(b)).
- ◆ A 50-foot buffer from streams and rivers to waste (per Rule 15A NCAC 13B .0504 (1)(c)).

The site is also required by the unified development ordinance to maintain a 200-foot buffer from all property lines to waste. The area within the first 100 feet from the property line is to remain undisturbed. Several private dwellings and two groundwater wells are located on the western edge of the property.

2.3 Final Grading Plan

The proposed final grades for the remaining uncapped portion of Phases I through VI can be found on Drawing 04C-02. The proposed grades are 3 horizontal to 1 vertical (3H:1V) with 15-foot benches every 30 vertical feet. These grades were modified and approved by NCDENR through previous submittals in 2002. Correspondence is attached in Appendix A verifying the expansion approval through the City's Zoning Department and the Board of Alderman. The final grade contours tie these proposed contours into the Phase I, II, and III areas that have been previously capped, certified and approved. In addition, we have included the recently approved stockpile contours over those closed Phase I, II, and III areas to depict the final contours.

2.4 Airspace Calculations

The total site volume is approximately 4,030,000 cubic yards. The overall airspace for the site increased by changing the exterior sideslopes for the entire landfill (Phases I through VI) from a 4H:1V to a 3H:1V slope when the Phase I-III Vertical Expansion was permitted. In addition the overall site volume was increased when permitting the Phase IV, V, and VI construction by lowering the basegrades after additional hydrogeologic investigation, and by getting a determination on a potential wetland feature by the Army Corp of Engineers allowing waste to be placed in a ravine in Phase VI. Neither the size of the original footprint, the final height of the landfill, or the operations of the landfill changed as a result of the increase in the overall airspace. For reference, the Local government approval of the 29 percent increase over total site capacity is attached in Appendix A.

The vertical expansion is expected to have an operational life of approximately 5 years. The estimated 5 year volume for waste for this phase (excluding final cover) is approximately 972,000 cubic yards. The estimated soil required for the remaining final cover is 121,000 cubic yards. Airspace calculations and landfill life calculations can be found in Appendix B. Detailed information regarding the vertical expansion can be found in Table 1. The estimated life assumes a filling rate of approximately 93,000 tons per year. A graph of the tonnage history for C&D disposal in Winston-Salem can be found in Figure A. The graph shows the monthly waste stream tonnage and a rolling 12-month waste stream average.

Table 1
OSR Construction and Demolition Landfill
Projected Operations

Phase	Gross Capacity	Estimated Volume		Final Cover Soil	Estimated	
		Waste	Cover Soil		Fill Rate	Life
	(cy)	(cy)	(cy)	(cy)	(tpy)	(years)
2009 Vertical Expansion	1,092,796	883,451	88,345	121,000	93,000	5.0

Notes:

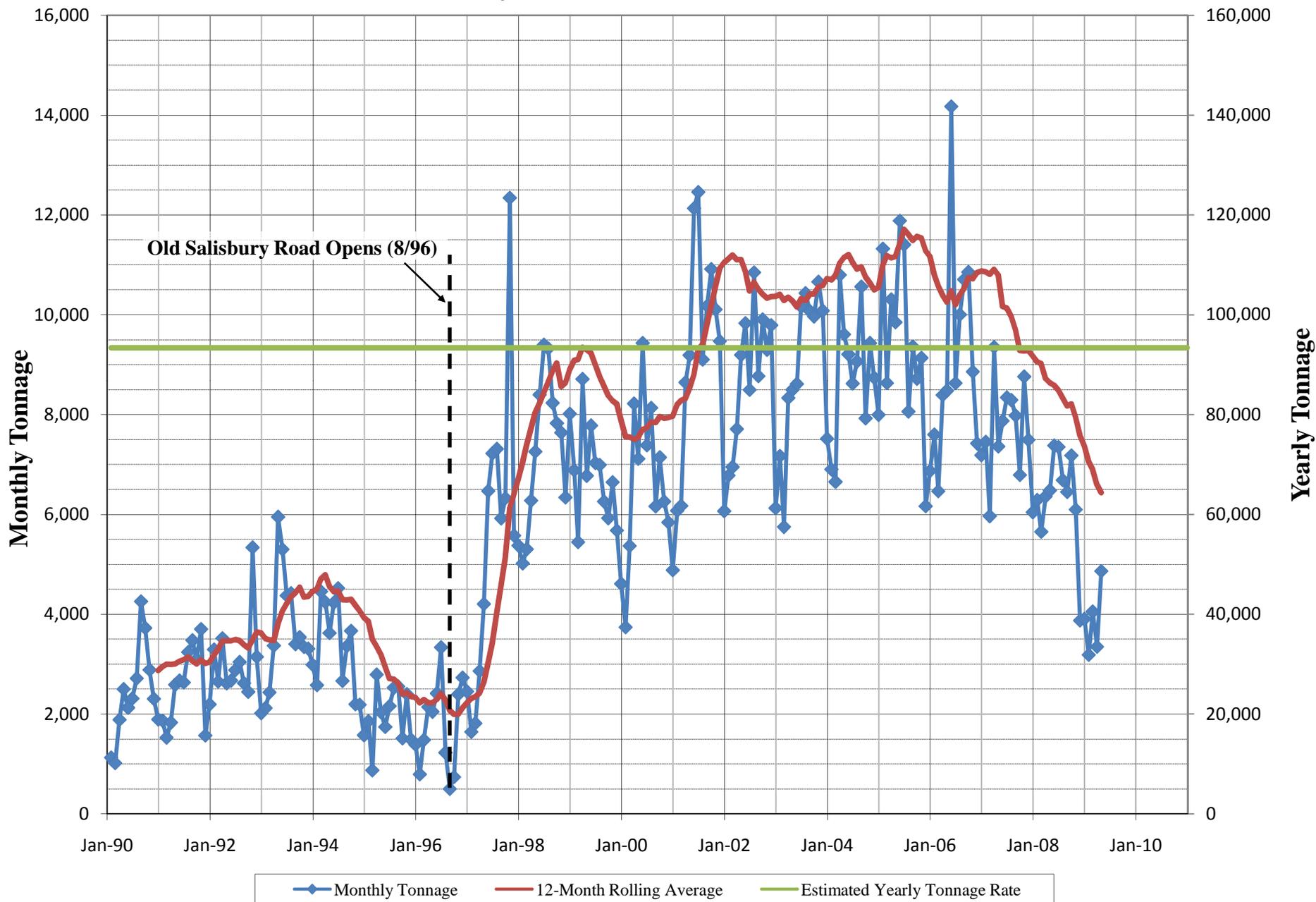
10:1 waste to cover ratio assumed

3 foot Final Cover thickness

961 lbs/cy waste density (Cumulative Waste Density for OSR, August 1996 to December 2008)

Fill Rate is assumed constant over the remaining life of the landfill.

Figure A Old Salisbury Road C&D Tonnage History



2.5 Ground-Water Monitoring

A Ground-Water Monitoring Plan was originally prepared and submitted by S&ME, Inc. (April 11, 1995). The plan was based on a conceptual layout of Phase I and required modification based on the revised drawings contained herewith. A revised plan was prepared by HDR in January 1996 and amended in August 1999, October 1999, October 2002, April 2003, July 2003 and June 2009. This plan is currently being used for ground-water monitoring events.

2.6 Gas Monitoring Plan

This Gas Monitoring Plan has been written in accordance with 15A NCAC 13B .0544(d). The purpose of this plan is to describe the gas monitoring program at OSR.

There are currently thirteen (13) permanent methane gas monitoring locations (MM-1 through MM-12 and the scalehouse) around the perimeter of OSR. Methane Station MM-2 and MM-4 are nested monitoring stations, while all other stations are constructed as single monitoring points. The locations of the methane monitoring wells are shown on Drawing 04C-03 which are sampled quarterly.

The City has implemented a routine methane monitoring program to endeavor that the standards below are met.

- ◆ the concentration of methane gas or other explosive gases generated by the facility does not exceed 25% of the lower explosive limit in on-site facility structures (excluding gas control or recovery system components);
- ◆ the concentration of methane gas or other explosive gases does not exceed the lower explosive limit for methane or other explosive gases at the facility property boundary; and
- ◆ the facility does not release methane gas or other explosive gases in any concentration that can be detected in offsite structures.

If methane or explosive gas levels exceed the limits specified, the City will:

- ◆ immediately take all steps necessary to ensure protection of human health and notify the Division;
- ◆ within seven days of detection, place in the operating record the methane or explosive gas levels detected and a description of the steps taken to protect human health; and

- ◆ within 60 days of detection, implement a remediation plan for the methane or explosive gas releases, place a copy of the plan in the operating record, and notify the Division that the plan has been implemented. The plan will describe the nature and extent of the problem and the proposed remedy.

2.7 Erosion Control

A history of Erosion Control Plans for the site is listed below:

Title	Submitted	Approved
Phase I and Entrance Road	February 1995 revised March 16, 1995	March 30, 1995
Cell 1A Stockpile	February 9, 1996	February 21, 1996
Modified Cell 1A Stockpile	September 10, 1997	October 9, 1997
North Stockpile	November 12, 1997	November 25, 1997
Modified North Stockpile	November 10, 1998	November 23, 1998
Off-Site Stockpile	March 24, 1999	January 7, 2000
Phases II and III Expansion	May 6, 1999	December 1, 1999
Phases IV, V, and VI Expansion	July 19, 2002	August 22, 2002

The Phase I and Entrance Road Erosion Control Plan was for the Entrance Road to the site and a portion of Phase I. The Cell 1A stockpile Erosion Control Plan was for the stockpile material from excavation of Cell 1 of Phase I located directly north of Phase I. The modified Cell 1A stockpile was for an additional one-acre stockpile on the northeast corner of the Cell 1A stockpile. These measures have been eliminated since the stockpile has been moved due to development of Phases I, II, and III. The North Stockpile Erosion Control Plan was for an additional stockpile for Phase I excavation located north of the Cell 1A stockpile. This stockpile covered most of Phase III and part of Phase IV. The Modified North Stockpile Erosion Control Plan provides erosion control for Phase II. This modification replaced Sediment Trap #1 (TST #1) in the North Stockpile Erosion Control Plan with SB #4. This new SB #4 is designed to handle runoff from Phase II during excavation and also runoff from Phase II and a portion of Phase III after closure of the two phases. An erosion control plan for 12 acres of the off-site stockpile property was approved, which covered the material excavated from Phase III. An Erosion Control Plan for SB #5 was submitted and approved. SB #5 was designed to handle the runoff from Phases II and III before closure and Phases III and IV after closure. The erosion control plan for Phases IV, V, and VI was submitted and approved. This Plan added SB#6 and SB#7 to handle the runoff from Phases IV, V, and VI. The vertical expansion will maintain the same drainage pattern for the final cap as previously approved. A system of sideslope diversion channels, slope drains, and perimeter channels are designed to convey the runoff to the sediment basins. Refer to Drawing ES-02 in the Erosion

Control Plan to see the proposed drainage divides at closure. With these erosion control plans in place, the site will comply with the Sedimentation Pollution Control Act.

SECTION 3 – CONSTRUCTION AND OPERATIONS

3.1 Construction and Operations

Winston-Salem will continue to develop the landfill in a manner that promotes runoff to the existing erosion control features. Benches will be graded to drain to sediment basins.

All aspects of the current operation of the facility are anticipated to continue. Operation hours are currently from 7:00 a.m. to 4:30 p.m., Monday through Friday, with Saturday hours from 8:00 a.m. to 12:00 p.m. These hours of operation are subject to change. Staff will be stationed in the scalehouse to handle incoming trucks, while an additional staff person will be responsible for handling the daily placement of waste. Information regarding on-site equipment and other operational issues is included in the Operations Plan in Appendix D.

The site currently has a lockable gate at the main entrance from Old Salisbury Road, which is locked at the end of each working day. Fencing has been constructed around the site to further control access.

In the event there is a period when the scales are temporarily out of operation, the incoming material will be handled on a cubic-yardage basis. The same scales and scale house will continue to be used for the vertical expansion. Please refer to the Operation Plan in Appendix D for more information on the operations of the facility.

3.2 Filling Procedures

Please see the Operation Plan in Appendix D for the filling procedures.

3.3 Site Development/Proposed Final Contours

An overall Master Plan of the site was developed by HDR. Please refer to Drawing 04C-02 for the proposed final contours for the entire site. Please refer to Appendix F for the Closure/Post Closure Plan for this site.

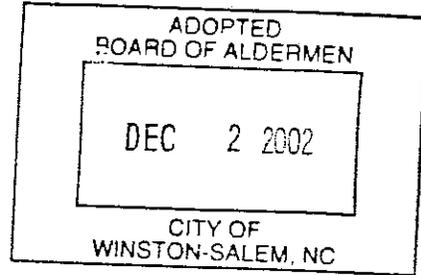
APPENDIX A

RELATED CORRESPONDENCE

D-26366

Summary of Minutes

November 18, 2002



A Regular Meeting of the Board of Aldermen was held on Monday, November 18, 2002 at 7:30 p.m. in the Board of Aldermen Chamber at City Hall, Mayor Allen Joines presiding and the following members present:

<p>Aldermen: Vernon Robinson Robert C. Clark Dan Besse Joycelyn V. Johnson</p>	<p>Vivian H. Burke Wanda Merschel Frederick N. Terry</p>
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Member Absent: Alderman Nelson L. Malloy, Jr.

Secretaries: Renée P. Rice, City Secretary; Paige Deal, Recording Secretary

Sergeant at Arms: Lieutenant Mike Wilkins

Invocation: Father Demetri Kangelaris of the Greek Orthodox Church

Pledge of Allegiance led by students from Paisley Middle School which is commemorating International Education Week.

Ms. Rice read the following resolution:

RESOLUTION HONORING THOMAS WATERS GRIFFIN

Alderman Merschel: Motion for adoption.

Alderman Burke: Second. Unanimous.

Mayor Joines presented a framed copy of the resolution to Mr. Griffin who accepted it with appreciation.

Mayor Joines stated that the Board would now consider the Consent Agenda and asked if anyone wished to remove any items for separate discussion. Alderman Johnson noted that she

wanted to make a brief comment regarding Item C-2 and Alderman Clark asked that Item C-6 be removed. No other items were removed from the Consent Agenda.

CONSENT AGENDA

Items listed below were enacted by one motion for approval or adoption, as appropriate, which motion is as follows:

Alderman Merschel made a motion that these items be approved/adopted at this meeting.

The motion was duly seconded by Alderman Burke and unanimously carried.

1. CONSIDERATION OF ITEMS RELATING TO THE ACQUISITION/DISPOSITION/LEASE OF PROPERTY: *[Recommended by Finance Committee.]*
 - a. RESOLUTION ACCEPTING OFFER OF A DEED OF GIFT FROM SHUGART ENTERPRISES - *Tax Lots 205D and 205K of Tax Block 3452 and containing 1.83 acres located off Shattalon Drive.*
 - b. RESOLUTION AUTHORIZING ACQUISITION OF PROPERTY IN THE LIBERTY-PATTERSON REDEVELOPMENT AREA THROUGH A NEGOTIATED SETTLEMENT - *1343 North Patterson Avenue.*
 - c. RESOLUTION AUTHORIZING ACQUISITION OF PROPERTY IN THE BROOKWOOD REDEVELOPMENT AREA THROUGH A NEGOTIATED SETTLEMENT - *3023 Claremont Avenue, 3105 Cleveland Avenue, and 3103 Claremont Avenue.*
 - d. RESOLUTION AUTHORIZING ACQUISITION OF PROPERTY IN THE BROOKWOOD REDEVELOPMENT AREA BY DEED - *1115 East 31st Street, 1117 East 31st Street, and 1119 East 31st Street.*
 - e. RESOLUTION EXTENDING PREVIOUSLY APPROVED OFFERS TO SELL CITY-OWNED PROPERTY TO THE GOLER-DEPOT STREET RENAISSANCE COMMUNITY DEVELOPMENT CORPORATION - *Two Tracts located on Martin Luther King, Jr. Drive and known as Tax Lots 207A and 207B (.75 acre) of Tax Block 203, and Tax Lots 303A, 303B, 304A and 304B (.40 acre) of Tax Block 202.*
 - f. RESOLUTION AUTHORIZING THE EXECUTION OF A RELEASE OF RIGHT OF FIRST REFUSAL AND TERMINATION OF OPTION TO PURCHASE PROPERTY - *.8 Acre Located at the Corner of Cloverdale Avenue and Miller Street. [Reviewed by Public Works Committee.]*

3. RESOLUTION AUTHORIZING THE CITY'S PARTICIPATION IN THE DEVELOPMENT OF STONE RIDGE SUBDIVISION. *[Recommended by Finance Committee.]*
4. RESOLUTION AUTHORIZING THE CITY TO APPLY FOR THE REDESIGNATION OF A STATE DEVELOPMENT ZONE FROM THE NORTH CAROLINA DEPARTMENT COMMERCE. *[Recommended by Community Development/Housing/General Government Committee.]*
5. ORDINANCE AMENDING SECTION 42-124(a) OF THE CITY CODE RELATING TO 25 MILES PER HOUR SPEED LIMITS IN SCHOOL ZONES - *Brewer Road from Peters Creek Parkway to Buchanan Street and Old Vineyard Road from Madelyn Drive to Creekside Terrace Court (private).* *[Recommended by Public Safety Committee.]*
7. ORDINANCES RENEWING THE CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY OF FOUR LIMOUSINE SERVICES, ONE HORSE CARRIAGE COMPANY, AND ONE TAXI SERVICE IN THE CITY OF WINSTON-SALEM. *[Recommended by Public Safety Committee.]*
8. CONSIDERATION OF ITEMS RELATING TO THE ISSUANCE OF SPECIAL OBLIGATION BONDS: *[Recommended by Finance Committee.]*
 - a. BOND ORDER AUTHORIZING THE ISSUANCE OF SPECIAL OBLIGATION BONDS (SOLID WASTE MANAGEMENT PROJECT) OF THE CITY OF WINSTON-SALEM
 - b. RESOLUTION AUTHORIZING THE APPROVAL, EXECUTION AND DELIVERY OF VARIOUS DOCUMENTS IN CONNECTION WITH THE ISSUANCE OF CITY OF WINSTON-SALEM SPECIAL OBLIGATION BONDS (SOLID WASTE MANAGEMENT PROJECT), SERIES 2002; PROVIDING FOR THE SALE OF THE BONDS; SETTING FORTH THE TERMS AND CONDITIONS UPON WHICH THE BONDS ARE TO BE ISSUED; AND PROVIDING FOR CERTAIN OTHER MATTERS IN CONNECTION WITH THE ISSUANCE, SALE AND DELIVERY OF THE BONDS.
9. CONSIDERATION OF ITEMS RELATING TO ISSUANCE OF WATER AND SEWER SYSTEM REVENUE AND REFUNDING REVENUE BONDS: *[Recommended by Finance Committee.]*
 - a. BOND ORDER AUTHORIZING THE ISSUANCE OF WATER AND SEWER SYSTEM REVENUE AND REFUNDING REVENUE BONDS OF THE CITY OF WINSTON-SALEM.

- b. RESOLUTION AUTHORIZING THE APPROVAL, EXECUTION AND DELIVERY OF VARIOUS DOCUMENTS IN CONNECTION WITH THE ISSUANCE OF CITY OF WINSTON-SALEM WATER AND SEWER SYSTEM REVENUE AND REFUNDING REVENUE BONDS; PROVIDING FOR THE SALE OF THE BONDS; SETTING FORTH THE TERMS AND CONDITIONS UPON WHICH THE BONDS ARE TO BE ISSUED; AND PROVIDING FOR CERTAIN OTHER MATTERS IN CONNECTION WITH THE ISSUANCE, SALE AND DELIVERY OF THE BONDS.
10. ORDINANCES AMENDING THE ANNUAL APPROPRIATION AND TAX LEVY AND PROJECT BUDGET ORDINANCES FOR THE CITY OF WINSTON-SALEM FOR THE FISCAL YEAR 2002-2003. *[Recommended by Finance Committee.]*
 11. RESOLUTION AUTHORIZING EXECUTION OF A CONTRACT WITH VERIZON WIRELESS TO PROVIDE CELLULAR TELEPHONE SERVICES. *[Recommended by Finance Committee.]*
 12. CONSIDERATION OF ITEMS RELATING TO BIDS: *[Recommended by Finance Committee.]*
 - a. RESOLUTION AWARDED CONTRACT FOR SALEM CREEK STREAM RESTORATION AT CENTRAL PARK - *North State Environmental, Inc. - \$190,307.51*
 - b. RESOLUTION AWARDED CONTRACT FOR 36 POLICE PATROL CARS - *Vic Bailey Ford, Inc. - \$737,100.00.*
 - c. RESOLUTION AWARDED CONTRACT FOR 11 FLEET CARS - *Sir Walter Chevrolet - \$162,657.00.*
 - d. RESOLUTION AWARDED CONTRACT FOR ONE FRONT END LOADER UNDER THE BID PROCEDURE WAIVER OF N.C.G.S. 143-129(g) - *Volvo and GMC Truck Center of Carolina - \$136,010.00.*
 13. RESOLUTION RENAMING "WINSTON-SALEM YOUTH ADVISORY COUNCIL" TO "WINSTON-SALEM YOUTH COUNCIL" AND APPROVING CERTAIN OTHER CHANGES TO THE COUNCIL. *[Recommended as amended by the Community Development/ Housing/General Government Committee.]*
 14. CONSIDERATION OF SUMMARIES OF MINUTES:
 - a. APPROVAL OF SUMMARY OF MINUTES - *October 7, 2002.*
 - b. APPROVAL OF SUMMARY OF MINUTES - *October 21, 2002.*

- c. APPROVAL OF SUMMARY OF MINUTES - *November 4, 2002.*
2. CONSIDERATION OF ITEMS RELATING TO ENCROACHMENT AGREEMENTS:
[Reviewed by Public Works Committee.]
 - a. RESOLUTION GRANTING AN ENCROACHMENT AGREEMENT TO THE COLUMBIAN HEIGHTS EXTENSION NEIGHBORHOOD ASSOCIATION FOR A BRICK SIGN IN THE PUBLIC RIGHT-OF-WAY OF VARGRAVE STREET AT DIGGS BOULEVARD.
 - b. RESOLUTION GRANTING AN ENCROACHMENT AGREEMENT TO THE EXCELSIOR STREET ASSOCIATION FOR A METAL SIGN IN THE PUBLIC RIGHT-OF-WAY OF EXCELSIOR STREET.

Alderman Johnson stated that the citizens in these neighborhoods will be glad to finally be able to erect their signs. She made a motion for adoption of both resolutions.

Alderman Burke: Second. Unanimous.

6. JOINT RESOLUTION OF THE CITY OF WINSTON-SALEM AND FORSYTH COUNTY FOR A FEASIBILITY STUDY FOR JOINT PUBLIC SAFETY TRAINING FACILITIES. *[Recommended by Public Safety Committee.]*

Alderman Clark expressed his appreciation to all who were involved in bringing this item to the Board. He stated that he was glad to see the County and City working together toward this critical need. He made a motion for adoption of the resolution.

Alderman Burke: Second.

Alderman Terry noted that this facility would also serve private law enforcement agencies such as university police departments, and he was very pleased at the efficiency which a joint training center would provide.

The motion for adoption was unanimously carried.

GENERAL AGENDA

1. PUBLIC HEARING TO CONSIDER AN AMENDMENT TO THE CITY CHARTER TO CHANGE "BOARD OF ALDERMEN" TO "CITY COUNCIL" AND "ALDERMAN" TO "COUNCIL MEMBER."

Appearing in opposition to the proposed amendment was Mr. Charlie Reece, 841 Reynolda Road. He stated that there are other major cities throughout the country who use "Board of Aldermen" and "Alderman" instead of "City Council," so he did not think that it was too archaic. He commented that he does not understand the argument that changing the name will help citizens understand the roles of elected officials. If education is needed, that education should occur regardless of what the government body is called. Mr. Reece stated that he could understand the argument of Council Member being a more gender neutral term, but he did not see it necessary to spend the funds to do so, nor does this symbolic gesture sit well when the City reduced its funding to the District Attorney's Domestic Violence program.

Mayor Joines asked if anyone else wished to be heard. Hearing no one, he declared the public hearing closed.

Mayor Joines asked the Board if it wanted to entertain a motion about putting this as an item on a future Board of Aldermen agenda.

Alderman Johnson made a motion to place this item on the December 2 Board of Aldermen agenda.

Alderman Burke: Second. Those voting in favor of the motion were Aldermen Besse, Johnson, Burke, and Merschel. Opposed: Aldermen Robinson, Clark, and Terry. The motion carried on a vote of four in favor and three opposed.

Alderman Burke clarified that this vote was to place the item on the December 2 agenda for action. It was not a vote for the matter itself.

Alderman Merschel asked Mr. Stuart to comment on the cost of making these changes.

Mr. Stuart stated that there would be some expense involved in changing some signage, stationery, and business cards. However, the stationery and business cards could be used until

supplies ran out and they then could be re-ordered with the revised language. He stated that these changes could be managed without incurring a great deal of expense.

2. PUBLIC HEARING AND RESOLUTION GRANTING APPROVAL OF SUBSTANTIAL AMENDMENTS PROPOSED IN THE OLD SALISBURY ROAD CONSTRUCTION AND DEMOLITION LANDFILL PERMIT APPLICATION. *[Recommended by Public Works Committee.]*

No one heard.

Alderman Johnson: Motion for adoption.

Alderman Clark: Second. Unanimous.

3. PUBLIC HEARING AND RESOLUTION AMENDING RESOLUTION ADOPTED MAY 15, 2000, BY THE BOARD OF ALDERMEN AUTHORIZING THE LEASE/ EXCHANGE/ACCEPTANCE OF CERTAIN CITY-OWNED PROPERTY FOR THAT OWNED BY THE WINSTON-SALEM/FORSYTH COUNTY BOARD OF EDUCATION PURSUANT TO N.C.G.S. 160A-274. *[Finance Committee forwarded this item to the Board of Aldermen without a recommendation. This item was continued from the October 21 Board of Aldermen meeting.]*

Appearing in opposition to the matter was Mr. Ed Engle, 1447 Old Town Road; Mr. Walter Marshall, Forsyth County Commissioners, 3246 Kittering Lane; and Ms. Elyse Jung, 521 Lynhaven Court. All speakers spoke about the need to preserve public park land and open space.

Also appearing was Ms. Elizabeth Ogburn, 750 Roslyn Road, who spoke on behalf of her father, Mr. Sam Ogburn, Sr. Ms. Ogburn stated that her father owns approximately 10.76 acres of property on Old Greensboro Road, which has been appraised at \$618,000. She advised that her father is willing to sell the property to the Winston-Salem/Forsyth County School Board for the appraised price. However, he is willing to make a donation of \$268,000, leaving the School Board to pay only \$350,000 of the sales price.

Alderman Burke asked Ms. Ogburn if this offer was made to the School Board prior to tonight's meeting.

Ms. Ogburn responded that the last communication was a verbal offer from Dr. Reginald Teague for \$350,000, which was later withdrawn. At the time, Mr. Ogburn did not feel that he could accept \$350,000 for the property; however, after consulting with his tax attorney, Mr. Ogburn offers the property as stated.

Mayor Joines asked if anyone else wished to be heard on this matter. Hearing no one, he declared the public hearing closed.

Alderman Robinson stated that it may be a good idea to delay action on this item at this time.

Alderman Johnson commented that when the school bonds were approved, citizens believed that there was property available to build the new high school on the Old Greensboro Road site. Unfortunately, as everyone later learned, all of the details had not been worked out. She stated that there is great interest in having the new high school in the East Winston community. Alderman Johnson remarked that she believed that there are options which need to be studied—Mr. Ogburn's offer, and perhaps consideration of some portion of the research park, to name a couple. She made a motion to postpone action on this matter.

Alderman Terry: Second.

Alderman Burke commended Mr. Ogburn for his offer. She noted, however, that the term "East Winston" should be clearly defined, especially as there is overwhelming support for a high school in that area. She stated that citizens have posed this questions to her on a number of occasions.

Appearing before the Board at this time was Mr. Victor Johnson, 2315 Manchester Street. He stated that he has lived in Winston-Salem all of his life and it is his understanding that anything east of US 52 is considered East Winston. He stated that he and others consider the Old

Greensboro Road site being part of East Winston and he believed that a new school will greatly enhance this community.

Alderman Burke asked for a comment from staff.

Mr. Derwick Paige, Director of Development, responded that the East Winston Area Plan was adopted in 1982, and does not include this property within its boundaries.

Alderman Clark asked if the motion postpones this matter indefinitely.

Mayor Joines responded that it was his understanding of Alderman Johnson's motion was that it would table this item until the School System has an opportunity to explore all of the options.

Alderman Besse agreed that this item was not ready for action this evening and it is apparent that there are alternatives which deserve attention from the School System. He noted, however, that the resolution listed on the Board's agenda does not take a position on the construction of a high school. The Board is charged only with making a decision on whether the gifting of the specified property would be in the best interest of the City as a whole. He stated that he believed that such a decision would be premature at this point, and he would be reluctant in any event to reduce existing park land.

Alderman Merschel expressed her opposition to giving away park land for any purpose and therefore would vote against the motion.

Mayor Joines called for the vote on the motion.

Those voting in favor of the motion to table this item were Aldermen Robinson, Clark, Besse, Johnson, Burke, and Terry. Opposed: Alderman Merschel. The motion carried on a vote of six in favor and one opposed.

4. CONSIDERATION OF ITEMS RELATING TO THE CITIZEN BUDGET ADVISORY COUNCIL: *[Finance Committee forwarded this item as amended to the Board of Aldermen with three in favor, none opposed, one abstaining.]*

a. RESOLUTION APPROVING GUIDELINES FOR CITIZEN BUDGET ADVISORY COUNCIL.

Alderman Burke: Motion for adoption.

Alderman Merschel: Second.

Voting in favor of the motion were Aldermen Clark, Besse, Johnson, Burke, Merschel, and Terry. Opposed: Alderman Robinson. The motion carried on a vote of six in favor and one opposed.

b. ORDINANCE AMENDING CHAPTER 2, DIVISION 2 OF THE WINSTON-SALEM CITY CODE ENTITLED "CITIZEN BUDGET ADVISORY COUNCIL."

At the request of Alderman Robinson, Mrs. Ann Jones, Budget and Evaluation Director, explained that there was a replacement ordinance before the Board which more accurately reflects the intent of the Finance Committee which would shift the duties of the Council as more task force oriented as opposed to an advisory group.

Alderman Merschel: Motion for adoption of the replacement ordinance.

Alderman Terry: Second.

Alderman Robinson expressed his opposition to this matter because he believes that it will return the Citizen Budget Advisory Council to its former status as a "rubber-stamp" group.

Alderman Clark stated that he supported this item because he would like to see this group narrow its focus on specific line items.

Voting in favor of the motion were Aldermen Clark, Besse, Johnson, Burke, Merschel, and Terry. Opposed: Alderman Robinson. The motion carried on a vote of six in favor and one opposed.

5. MAYOR JOINES' RECOMMENDATIONS FOR APPOINTMENTS/
REAPPOINTMENTS:

a. CABLE REVIEW COMMITTEE

W. Shedrick Adams - *Appointment - Term Expiring October, 2005*
R. Ray Macera - *Appointment - Term Expiring October, 2005*

Alderman Johnson: Motion for approval.

Alderman Burke: Second. Unanimous.

b. CITIZEN POLICE REVIEW BOARD

Wandalyn Isaac Teague - *Appointment - Term Expiring April, 2004*

Alderman Burke: Motion for approval.

Alderman Johnson: Second. Unanimous.

c. EMERGENCY MANAGEMENT ADVISORY COUNCIL

Alderman Vernon Robinson - *Ex-Officio Appointment*
Elwyn B. Thompson - *Appointment - Term expiring September, 2005*

Alderman Burke: Motion for approval.

Alderman Terry: Second. Unanimous.

d. WINSTON-SALEM TRANSIT AUTHORITY

Kathleen B. Pounds - *Reappointment - Term Expiring July, 2005*

Alderman Burke: Motion for approval.

Alderman Besse: Second. Unanimous.

Mr. Stuart commented that the City's longtime Recreation and Parks Director, Mr. Nick Jamison, has recently announced his retirement and he advised that a proper farewell will be organized for him.

Alderman Merschel reminded the citizens of the Northwest Ward "Talk of the Town" meeting with Mayor Joines on November 19, at 6:30 p.m. at the Reynolda Manor Library. She invited all interested citizens to attend.

Alderman Johnson stated that the North Carolina League of Municipalities has a program to recognize individuals who have retired from public service or former employees who have passed away. She asked staff to make sure that the proper information is provided to the League office.

ADJOURNMENT: 8:29 p.m.



Memorandum

TO: Ed Gibson, Solid Waste Administrator

FROM: Aubrey Smith, Director of Inspections/Zoning Officer *AS*

DATE: November 18, 2002

SUBJECT: Zoning Compliance for Phases 4, 5, and 6 in the Old Salisbury Road Landfill

The Old Salisbury Road Construction and Demolition Landfill was originally approved by the City-County Planning Board (CCPB) on March 9, 1995. An expansion of this landfill for soil storage was approved by the City-County Planning Board on January 14, 1999. Both of these approvals were in accordance with the requirements in the Unified Development Ordinances (UDO) for Winston-Salem and Forsyth County.

Phases 4, 5, and 6 are located in the original approval area. If these landfill areas are developed in accordance with the "Old Salisbury Road Construction and Demolition Landfill Construction Permit Application, Phases IV, V, and VI Prepared by HDR Engineering, Inc. of the Carolinas Dated October 2002", this project will conform to the requirements in the UDO.

Feel free to call me if you have any additional questions.

Board of Aldermen — Action Request Form

G-2

Date: November 18, 2002

To: The City Manager

From: Tom Griffin, Assistant City Manager/Public Works

Board Action Requested:

Consideration of a resolution approving substantial amendments to the Old Salisbury Road Construction and Demolition Landfill

Summary of Information:

The City/County Utility Commission has operated a construction and demolition landfill at its Old Salisbury Road location since 1996. The approval for the facility was granted in 1995 after a series of public hearings and review of the site study by the North Carolina Department of Environment and Natural Resources (NCDENR). The original site study previously approved consisted of six phases of the landfill. Three of the phases have now been constructed, and it is anticipated that the next phases will need to be operational by the summer of 2003.

The North Carolina Department of Environment and Natural Resources has informed the City/County Utility Commission that in order to construct Phases 4, 5, and 6, a permit application must be submitted and approved. The City-County Utility Commission has therefore submitted a permit application to the North Carolina Department of Environment and Natural Resources for the construction of Phases 4, 5, and 6, and it identifies improvements to the original site plan that could increase the usable space of the facility by approximately 29%. This increase in space for waste does so without increasing either the acreage of the facility, the overall height of the facility, or the operating conditions.

Because space for waste would be increased by more than 10% over the original volume, State Statutes identify this as a substantial amendment and therefore requires a public hearing and approval by the Board of Aldermen.

Committee Action:

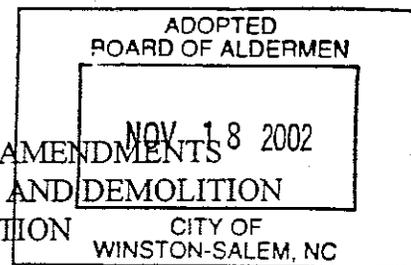
Committee	<u>Public Works 10/15/02</u>	Action	<u>Approval</u>
For	<u>Unanimous</u>	Against	<u></u>

Remarks:

cc: Tom Griffin, Greg Turner, David Saunders, Ed Gibson, Chuck Green

D-26352

RESOLUTION GRANTING APPROVAL OF SUBSTANTIAL AMENDMENTS
PROPOSED IN THE OLD SALISBURY ROAD CONSTRUCTION AND
LANDFILL CONSTRUCTION PERMIT APPLICATION



WHEREAS, the City/County Utility Commission needs to construct Phases 4, 5, and 6 of the existing Old Salisbury Road Construction and Demolition Landfill located at 3336 Old Salisbury Road, Winston-Salem, NC, on property owned by the City of Winston-Salem; all within the city limits of Winston-Salem; and

WHEREAS, the North Carolina Department of Environment and Natural Resources has informed the City/County Utility Commission that in order to construct Phases 4, 5, and 6, a permit application must be submitted and approved; and

WHEREAS, the City-County Utility Commission has submitted a permit application to the North Carolina Department of Environment and Natural Resources for the construction of Phases 4, 5, and 6; and

WHEREAS, this permit application identifies improvements to the originally approved site plan that would increase the space for waste by more than 10% over the original volume; and

WHEREAS, that this increase in space for waste does so without increasing either the acreage of the facility, the overall height of the facility, or the operating conditions; and

WHEREAS, this increased space for waste constitutes a substantial amendment under North Carolina General Statute §130A-294(b1)(1) and requires a public hearing and approval from each local government having jurisdiction over the land on which such amendments are to take place.

NOW, THEREFORE, BE IT ORDAINED by the Board of Aldermen of the City of Winston-Salem as follows:

That a public hearing was held on November 18, 2002 at 7:30 p.m. before the Board of Aldermen for consideration of a resolution approving the proposed substantial amendments to the Old Salisbury Road Construction and Demolition Landfill located at 3336 Old Salisbury Road, Winston-Salem, NC;

That the permit application for Phases 4, 5, and 6 identifies improvements to the originally approved site plan that would increase the space for waste by more than 10% over the original volume;

That this increase in space for waste does so without increasing either the acreage of the facility, the overall height of the facility, or the operating conditions;

That these substantial amendments are in the best interest of the City of Winston-Salem and are therefore approved.

Board of Aldermen — Action Request Form

Item 6

Date: October 9, 2002

To: The City Manager

From Tom Griffin, Assistant City Manager/Public Works

Board Action Requested:

Consideration of a resolution granting a franchise to the City of Winston-Salem and the City/County Utility Commission to construct and operate the Old Salisbury Road Construction and Demolition Landfill

Summary of Information:

The City/County Utility Commission has operated a construction and demolition landfill at its Old Salisbury Road location since 1996. The approval for the facility was granted in 1995 after a series of public hearings and review of the site study by the North Carolina Department of Environment and Natural Resources (NCDENR). The original site study previously approved consisted of six phases of the landfill. Three of the phases have now been constructed, and it is anticipated that the next phase will need to be operational by the summer of 2003.

In making preparations to submit construction drawings to the State for this next phase, staff has been informed that because of recent legal actions against NCDENR regarding other landfills, NCDENR now requires a franchise be granted to the City and the Utility Commission for the operation of this facility before any additional construction can be permitted. This franchise must be approved by the Board of Aldermen at two consecutive readings.

Committee Action:

Committee	<u>Public Works 10/15/02</u>	Action	<u>Approval</u>
For	<u>Unanimous</u>	Against	<u></u>

Remarks:

pc: Tom Griffin, Greg Turner, Dave Saunders, Ed Gibsen, Chuck Green

D-26352

ORDINANCE GRANTING A FRANCHISE TO THE CITY OF WINSTON-SALEM AND THE CITY/COUNTY UTILITY COMMISSION FOR THE OPERATION OF THE OLD SALISBURY ROAD CONSTRUCTION AND DEMOLITION LANDFILL FACILITY

WHEREAS, the City /County Utility Commission needs to construct Phases 4, 5, and 6 of the existing Old Salisbury Road Construction and Demolition Landfill located at 3336 Old Salisbury Road, Winston-Salem, NC, on property owned by the City of Winston-Salem, all within the city limits of Winston-Salem; and

WHEREAS, the North Carolina Department of Environment and Natural Resources has informed the City/County Utility Commission that in order to construct Phases 4, 5, and 6, a permit application must be submitted and approved; and

WHEREAS, this permit application must include evidence that a franchise has been granted from each local government having jurisdiction over the land on which such landfill is to be located; this being required by North Carolina General Statutes §130A-294(b1)(3); and

WHEREAS, both the City of Winston-Salem and the City/County Utility Commission shall be applicants for the permit application; and

WHEREAS, North Carolina General Statutes §160A-319 authorizes the City to grant a franchise for the operation within the City of "solid waste collection and disposal systems and facilities."

NOW, THEREFORE, BE IT ORDAINED by the Board of Aldermen of the City of Winston-Salem as follows:

Section 1. This ordinance is enacted to promote and protect the health, safety, and welfare of the residents of the City of Winston-Salem. The Board of Aldermen of the City of Winston-Salem intends that the provisions of this Ordinance will encourage the establishment of a secure, safe, and economical system of solid waste disposal in the City at the aforesaid Old Salisbury Road Construction and Demolition Landfill property, in compliance with state, federal and local laws, rules and regulations.

Section 2. A non-exclusive franchise is hereby granted to the City of Winston-Salem and the City/County Utility Commission for a term of thirty (30) years to operate and maintain a construction and demolition landfill at the location described hereinabove pursuant to the terms and provisions of this Ordinance.

The geographical area proposed to be served by the Old Salisbury Road Construction and Demolition landfill expansion is Forsyth County. The estimated total population of Forsyth County is projected to be 314,745 in 2002. The population is expected to increase over the life of this franchise. The franchise shall not be deemed void if the population to be served increases over the life of the franchise.

BOARD OF ALDERMEN

OCT 21 2002

First Reading 2

CITY OF
WINSTON-SALEM, NC

BOARD OF ALDERMEN

NOV 4 2002

Second Reading

CITY OF
WINSTON-SALEM, NC

The volume of the waste stream is projected to be 110,000 tons per year but such volume can be expected to rise or fall over the life of the franchise. The characteristics of the waste stream are expected to consist of construction and demolition debris and excluding regulated hazardous and radioactive waste, all in accordance with applicable environmental laws, rules and regulations as amended from time to time. This franchise shall not be deemed void if the volume or characteristics of the waste stream changes, so long as the characteristics of the waste stream comply with all applicable statutes, laws, rules and regulations.

The projected useful life of the landfill is approximately 10 to 14 years. This projected is subject to three variables: (1) the volume of the waste disposed of, (2) the compaction of the waste, and (3) the amount of space available for waste.

Section 3. The franchise granted by this ordinance shall be in effect upon its adoption and upon execution by the City of Winston-Salem and the City/County Utility Commission of their acceptance of the terms of said franchise ordinance. The City Manager or his designee and the City Secretary are hereby authorized to execute such acceptance and agreement on behalf of the City of Winston-Salem.

Section 4. This franchise ordinance shall be deemed adopted when it has been approved by the Winston-Salem Board of Aldermen at two regular meetings.

The franchise approved by the above-recited ordinance is hereby accepted this the 18th day of November, 2002.

CITY OF WINSTON-SALEM

CITY/COUNTY UTILITY COMMISSION

By: [Signature]

By: [Signature]

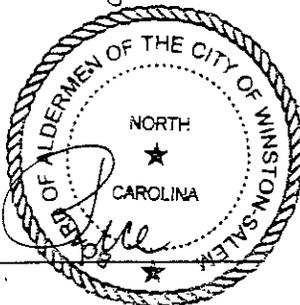
Title: City Manager

Title: Commission Chairman

ATTEST:

ATTEST:

[Signature]
City Secretary



[Signature]
CCUC Secretary

MEMO

HAND DELIVERED

DATE: November 6, 2002

TO: Renée Rice
City Secretary

FROM: Ed Gibson 
Solid Waste Administrator

SUBJECT: OLD SALISBURY ROAD LANDFILL (OSR) - CONSTRUCTION PERMIT
APPLICATION FOR PHASES 4, 5, AND 6

To Aubrey Smith
11/6/02

Please consider this as a request for documentation. It is related to the enclosed Construction Permit Application (CPA) for the above referenced landfill.

BACKGROUND

The City-County Utility Administration (CCUA) has submitted the enclosed application to the North Carolina Department of Environment and Natural Resources in order to obtain a Permit to Construct for Phases 4,5, and 6 of the OSR Landfill. This permit application indicates a "substantial amendment" to the originally permitted plan, as defined by §130A-294 (b1) 4, copy enclosed. The "substantial amendment" in this application consists of the following: the usable space for waste will increase by approximately 29% over the original volume (this will be done without increasing the size of the original footprint, the final height of the landfill, or the operations).

REQUIREMENTS

Because this permit application contains a "substantial amendment", the CCUA needs to receive documentation from the City-County Inspections Department addressing the following:

- 1.) Does the City have a development ordinance (i.e the "UDO") that is applicable to Phases 4, 5 and 6 of the OSR landfill?
- 2.) If so, is the enclosed application consistent with the development ordinance?

If there is any additional information that you may need in order to provide this documentation, please feel free to contact me at 747-7310. Thanks!



City of Winston-Salem
Old Salisbury Road CDLF
Facility Permit No: 34-12
Permit to Operate C&D Landfill
February 6, 2008
Page 1 of 8
Doc Id No 3707

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
Dexter R. Matthews, Director

Division of Waste Management

Michael F. Easley, Governor
William G. Ross Jr., Secretary

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

**MUNICIPAL SOLID WASTE FACILITY
PERMIT NO. 34-12**

**THE City of Winston-Salem (Owner) and
City/County Utility Commission (Operator)**
are hereby issued a
Permit to Operate

Old Salisbury Road Landfill Construction and Demolition Landfill Facility
Phase V

located on Old Salisbury Road in Forsyth County, North Carolina, in accordance with Article 9, Chapter 130A, of the General Statutes of North Carolina and all rules promulgated thereunder and subject to the conditions set forth in this permit. The facility is located and described by the legal description found in the approved application.

Edward F. Mussler, III, P.E.,
Permitting Branch Supervisor
Solid Waste Section

ATTACHMENT 3

Part A Permitting History

Permit Type	Date Issued
Permit to Operate Phase I	3 July 1996
Amendment 1 Permit to Construct Phase II	15 October 1999
Amendment 2 PTO Phase II	7 February 2000
Amendment 3 PTC Phase III	2 August 2000
Amendment 4 PTO Phase III	25 April 2001
Amendment 5 PTC and PTO Vertical Expansion over Phases I-III	17 April 2003
Amendment 6 PTC Phases IV, V, and VI	28 May 2004
Amendment 7 PTO for Phase IV	7 October 2004
Amendment 8 PTO for Phase V	February 8, 2008

Part B List of Documents for the Approved Facility Plan

1. Site Plan Application; submitted by HDR Engineering, Inc. April, 1995
2. Construction Plan Application; submitted by HDR Engineering, Inc. June, 1995
3. Legal Description of the Facility
4. Letter dated 17 June 1997 submitted to the Section by HDR Engineering, Inc. certifying the western-half of Phase 1A.
5. Letter dated 12 January 1998 submitted to the Section by HDR Engineering, Inc. providing Certification No.3 for Phase I.
6. Letter dated 1 April 1998 submitted to the Section by HDR Engineering, Inc. providing Certification No. 4 for the Phase 1 Area.
7. Letter dated 30 July 1998 submitted to the Section by HDR Engineering, Inc. providing Certification No. 5 for the Phase 1 Area.
8. Construction Plan Application Phase II & III; submitted by HDR Engineering, Inc. April 1999
9. Letter dated 11 May 1999 submitted to the Section by HDR Engineering, Inc. providing Certification No. 6 for Phase I and II Areas.
10. Letter Dated 8 October 1999 submitted to the Section by HDR Engineering, Inc. providing amendments to the Groundwater Monitoring Plan.
11. Letter dated 30 December 1999 submitted to the Section by HDR Engineering, Inc. providing Certification No. 7 for Phase I and II Areas.
12. Letter dated 17 April 2000 submitted to the Section by HDR Engineering, Inc. providing revisions to Document #8 (Construction Plan Application, Phase II & III) for Phase III development.
13. Letter dated 1 February 2001 submitted to the Section by HDR Engineering, Inc. providing

Certification No. 8 for all of Phase III.

14. Document titled, "Old Salisbury Road Construction and Demolition Landfill, Winston- Salem, North Carolina, Construction Permit Application Phases I, II, III - Vertical Expansion." Prepared for the City of Winston-Salem City/County Utilities Commission by HDR Engineering, Inc. and dated December 2002.
15. Document titled, "Old Salisbury Road Construction and Demolition Landfill, Winston- Salem, North Carolina, Construction Permit Application Phases IV, V, and VI." Prepared for the City of Winston-Salem City/County Utilities Commission by HDR Engineering, Inc. and dated October 2002 and revised through December 2003.
16. Letter dated 20 August 2004 submitted to the Section by HDR Engineering, Inc. providing base grade Certification No. 9 for Phase IV and portions of Phase V and VI. Includes a survey drawing titled "Forsyth County Landfill, Landfill Expansion Phase IV, V, & VI, Finish Grade As-built Certification" prepared by MSS Land Consultants.
17. Letter dated 27 July 2007 submitted to the Section by HDR Engineering, Inc. providing revisions to Document #10 for Phase V and a portion of Phase VI development. (Doc. Id. Nos. 3701 and 3702)

- End of Section -

ATTACHMENT 4 CONDITIONS OF PERMIT

General Conditions

1. This permit shall expire 7 October 2009. Pursuant to 15A NCAC 13B .0201(e), no later than 7 June 2009, the permittee must submit an application for amendment or modification to the permit for review to the North Carolina Department of Environment and Natural Resources (Department), Division of Waste Management (Division), Solid Waste Section (Section). The application must be prepared in accordance with 15A NCAC 13B .0533, as applicable.
2. The person(s) to whom this permit is issued (“permittee”) are the owner(s) and operator(s) of the solid waste management facility.
3. This condition is not applicable for this permit.
4. This condition is not applicable for this permit.
5. By receiving waste at this facility the permittee shall be considered to have accepted the terms and conditions of this permit.
6. Operation of this solid waste management facility must be in accordance with the Solid Waste Management Rules, 15A NCAC 13B, Article 9 of the Chapter 130A of the North Carolina General Statutes (NCGS 130A-290, et seq.), the conditions contained in this permit; and the approved plan. Should the approved plan and the rules conflict, the Solid Waste Management Rules shall take precedence unless specifically addressed by permit condition.
7. This permit is issued based on the documents submitted in support of the permit application for the facility including those identified in Attachment 1, “List of Documents for Approved Plan,” and which constitute the approved plan for the facility. Where discrepancies exist, the most recent submittals and the Conditions of Permit shall govern.
8. This permit may be transferred only with the approval of the Section and through the issuance of a new or substantially amended permit in accordance with applicable statutes and rules.
9. The permittee is responsible for obtaining all permits and approvals necessary for the development of this project including approval from appropriate agencies for a General or Individual NPDES Stormwater Discharge Permit. Issuance of this permit does not remove the permittee’s responsibilities for compliance with any other local, state or federal rule, regulation or statute.

Permit to Operate

Pre-Operation

1. Authorization to operate the facility shall not be in effect until the permittee demonstrates to the Section that the facility has been constructed in accordance with the approved documents shown in Attachment 1.
2. In addition to the other conditions contained in this permit and the NC Solid Waste Rules, the following requirements must be met prior to the issuance of a Permit to Operate:
 - a. Site preparation must be in accordance with the approved site plan and the conditions specified herein, and construction must be certified to be constructed in accordance with the approved plans.
 - b. The permittee must arrange with a representative of the Section for a site inspection with the permittee when facility construction is complete in accordance with this permit. The permittee must demonstrate during the site inspection that the facility was constructed in accordance with this permit and approved documents.
3. Prior to operation, the permittee must acquire and maintain all other permits, licenses and authorizations necessary to properly operate the facility. All other permits, licenses and authorizations must be maintained current during the term of this Permit to Operate and subsequent Permits to Operate.
4. This permit approves the operation of Phase V, and the continued operation of Phases I, II, III and IV. Operation of any C&D landfill future phases or cells requires written approval of the Section and must be constructed in accordance with the applicable statutes and rules.
5. This facility is permitted to receive solid waste generated within the following counties: Forsyth County including the municipalities contained within Forsyth County.
6. The landfill has a total permitted disposal capacity of approximately 2,980,000 cubic yards of total gross capacity in approximately 56 acres. Total gross capacity is defined as the volume measured from the bottom of waste through the top of final cover.

Phase/Cell	Phases I through VI (Total Capacity)	Phase V (This Permit)
Size, acres	54	4
Permitted Capacity, cy	2,980,000	225,642

7. The permitted annual waste disposal rate is approximately 105,000 tons per year. This rate is approximately 350 tons per day, 6 days per week.
8. Financial assurance must be established in accordance with 15A NCAC 13B .0547 (2) and submitted to the Section by July 1, 2008. The financial assurance must be continuously maintained for the duration of the facility in accordance with the applicable rules and statutes and annually updated by November 1 of each year.

Operational Conditions

9. The permittee must not knowingly dispose of C&D waste that is generated within the boundaries of a unit of local government that by ordinance:
 - a. Prohibits generators or collectors of C&D waste from disposing of that type or form of C&D waste.
 - b. Requires generators or collectors of C&D waste to recycle that type or form of C&D waste.
10. The facility operator must complete an approved operator training course in compliance with G.S. 130A-309.25.
 - a. A responsible individual certified in landfill operations must be on-site during all operating hours of the facility at all times while open for public use to ensure compliance with operational requirements.
 - b. All pertinent landfill-operating personnel must receive training and supervision necessary to properly operate the C&D landfill unit in accordance with G.S. 130A-309.25.
11. The C&D landfill units are permitted to receive the following waste types:
 - a. “Construction or demolition debris” as defined in G.S. 130A-290 (a)(4) means solid waste resulting solely from construction, remodeling, repair or demolition operations on pavement, buildings, or other structures, but does not include inert debris, land-clearing debris or yard debris.
 - b. “Inert debris” as defined in G.S. 130A-290(a)(14) means solid waste that consists solely of material such as concrete, brick, concrete block, uncontaminated soil, rock, and gravel.
 - c. “Land-clearing debris” as defined in G.S. 130A-290(a)(15) means solid waste that is generated solely from land-clearing activities, such as stumps and tree trunks.
 - d. “Asphalt” in accordance with G.S. 130-294(m).
12. Those wastes listed in 15A NCAC 13B .0542(e) must not be accepted for disposal including but not limited to municipal solid waste, liquid or industrial wastes, and yard trash.
13. Asbestos waste must be managed in accordance with 40 CFR 61. Disposal of asbestos waste must be in accordance with 15 NCAC 13B .0542(c).
14. The Permittee must actively employ a training and screening program at the facility prepared in accordance with Section .0544(e) for detecting and preventing the disposal of excluded or unauthorized wastes. At a minimum, the program must include:
 - a. Random inspections of incoming loads or other comparable procedures.
 - b. Records of any inspections.

- c. Training of personnel to recognize hazardous, liquid, and other excluded waste types.
 - d. Development of a contingency plan to properly manage any identified hazardous, liquid, MSW, asbestos, or other excluded or unauthorized wastes. The plan must address identification, removal, storage and final disposition of these wastes.
15. All sedimentation/erosion control activities must be conducted in accordance with the Sedimentation Control Act N.C.G.S. 113A-50, et seq., and rules promulgated there under at 15A NCAC 4.
16. A closure and post-closure plan must be submitted for approval at least 90 days prior to closure or partial closure of any landfill unit. The plan must include all steps and measures necessary to close and maintain the C&D unit in accordance with all rules in effect at that time. At a minimum, the plan must address the following:
- a. Design of a final cover system in accordance with 15 NCAC 13B .0543(c), or the solid waste management rules in effect at the time of closure;
 - b. Construction and maintenance/operation of the final cover system and erosion control structures; and
 - c. Surface water, ground water, and explosive gas monitoring.

Monitoring and Reporting Requirements

17. The following are groundwater monitoring requirements for the C&D landfill facility:
- a. Groundwater and surface water monitoring locations must be established as identified in the approved plans.
 - b. The owner or operator must sample the monitoring wells semi-annually or as otherwise directed in writing by the Section Hydrogeologist.
 - c. A licensed geologist must be present to supervise the installation of groundwater monitoring wells. The exact locations, screened intervals, and nesting of the wells must be established after consultation with the SWS Hydrogeologist at the time of well installation.
 - d. All well construction records and soil boring logs for new wells must be submitted to the Section Hydrogeologist for review within 30 days of completion.
18. Copies of this permit, the approved plans, and all records required to be maintained by the permittee must be maintained at the facility and made available to the Section upon request during normal business hours.
19. The owner or operator must maintain a record of the amount of solid waste received at the C&D units compiled on a monthly basis. Scales must be used to weigh the amount of waste received.

20. On or before August 1 of each year, the Permittee must submit an annual facility report to the Section, on forms prescribed by the Section.
 - a. The reporting period shall be for the previous year beginning July 1 and ending June 30.
 - b. The annual facility report must list the amount of waste received and landfilled in tons and be compiled:
 - i. On a monthly basis.
 - ii. By county, city or transfer station of origin.
 - iii. By specific waste type.
 - iv. By disposal location within the facility.
 - v. By diversion to alternative management facilities.
 - c. A measurement of the volume utilized in the C&D cells must be performed during the first or second quarter of the calendar year. The date and volumes in cubic yards must be included in the report.
 - d. The amount of C&D waste in tons from scale records disposed in landfill cells since 3 July 1996 through the date of the annual volume survey must be included in the report.
 - e. The tons of C&D waste recycled, recovered or diverted from disposal including a description of how and where the material was ultimately managed.
 - f. The completed report must be forwarded to the Environmental Senior Specialist for the facility by the date due on the prescribed annual facility report form.
 - g. A copy of the completed report must be forwarded to each county manager for each county from which waste was received at the facility. Documentation that a copy of the report has been forwarded to the county managers must be sent to the Environmental Senior Specialist by the date due on the prescribed annual facility report form.

- End of Permit Conditions -



North Carolina Department of Environment and Natural Resources

Dexter R. Matthews, Director

Division of Waste Management

Michael F. Easley, Governor
William G. Ross Jr., Secretary

October 7, 2004

Ms. Jan McHargue, Utilities Supervisor
City of Winston-Salem
P.O. Box 2511
Winston-Salem, North Carolina 27102

Re: Solid Waste Permit No. 34-12: Permit to Operate (PTO) for Phase IV of the Old Salisbury Road C&D Landfill, Winston-Salem, Forsyth County, North Carolina

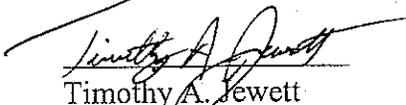
Dear Ms. McHargue:

The above referenced PERMIT TO OPERATE is issued in accordance with N.C.G.S. 130A-294 and the N.C. Solid Waste Management Rules 15A NCAC 13B. The letter dated 20 August 2004 providing base grade Certification No. 9 for Phase IV and portions of Phase V and VI including a survey drawing prepared for the City of Winston-Salem City/County Utilities Commission by HDR Engineering, Inc. will be listed in Attachment 1 as item #16 and is included in the Approved Plans for this facility. This permit to operate is valid for a five year period **and shall expire on 7 October 2009**, as per 15A NCAC 13B .0201(c).

Please refer to the Conditions of the Permit, GENERAL section, for the definition of the approved plan and for general terms of the Solid Waste Permit. The CONSTRUCTION AND OPERATION conditions describe permitted fill areas, acceptable waste types, landfill operation, and requirements which must be satisfied prior to operation of the facility as a C&D landfill. Specific requirements for groundwater monitoring and facility record keeping and reporting are described in the MONITORING AND REPORTING conditions.

Please review the Conditions of Permit thoroughly. If you need further clarification, please contact me at (336) 771-4608 ext. 337 or the Waste Management Specialist for this area at (336) 771-4608 ext. 338.

Sincerely,


Timothy A. Jewett
Western Area Engineer
Solid Waste Section

cc: Jim Barber, SWS Brent Rockett, SWS
Michael D. Plummer, HDR Engineering, Inc.
Raleigh Central File: Forsyth County, Permit No. 34-12

1646 Mail Service Center, Raleigh, North Carolina 27699-1646
Phone 919-733-0692 \ FAX 919-733-4810 \ Internet <http://wastenotnc.org>

PERMIT NUMBER 34-12
PHASE I PERMIT ISSUED 3 JULY 1996 (PTO)
AMENDMENT 6: 28 MAY 2004 (PTC PHASE IV, V, AND VI)
AMENDMENT 7: 7 OCTOBER 2004 (PTO FOR PHASE IV)

CITY OF WINSTON-SALEM

**SOLID WASTE PERMIT
CONSTRUCTION AND DEMOLITION LANDFILL**

CONDITIONS OF PERMIT

General:

1. This permit shall not be effective unless the certified copy is filed in the Register of Deeds office and indexed in the grantor index under the name of the owner of the land in the county or counties in which the land is located. The certified copy of the permit, affixed with the Register's seal and the date, book, and page number of recording shall be returned to the Division of Solid Waste Management (the Division).
2. When this property is sold, leased, transferred or conveyed, the deed or other instrument of transfer shall contain in the description section in no smaller type than that used in the body of the deed or instrument, a statement that the property has been used as a sanitary landfill.
3. The approved plan for this facility is described in Attachment 1, "List of Documents for Approved Plan". Where discrepancies exist, the most recent submittal and these Conditions shall govern. Some components of the approved plan may be reiterated in these Conditions.
4. This permit is not transferable.
5. A copy of this permit and the approved plan shall be maintained at the facility.
6. The owner/operator is responsible for obtaining any and all permits and approvals necessary for the development of this project including approval from appropriate agencies for a General or Individual NPDES Stormwater Discharge Permit.
7. This permit is for the operation of Phase IV and the small portions of Phase V and VI as reflected in the base grade certification, item #16 referenced in ATTACHMENT 1-list of Approved Documents. This permit to operate is valid for a five year period **and shall expire on 7 October 2009**, as per 15A NCAC 13B .0201(c), according to the issuance date of the permit to operate. Modifications may be required in accordance with the rules in effect at the time of review.

- iii. Construction and demolition debris defined as solid waste resulting solely from construction, remodeling, repair or demolition operations on pavement, buildings, or other structures;
- iv. Inert debris defined as solid waste which is virtually inert, such as brick, concrete, rock and uncontaminated soil.

Note: Yard trash defined as solid waste consisting solely of vegetative matter resulting from landscaping maintenance (see G.S. 130A-290) is banned from disposal in this facility as per NC General Statutes.

- b. Waste shall be restricted to the smallest area feasible and compacted as densely as practical into cells.
- c. No municipal solid waste, hazardous waste, industrial waste, or liquid waste shall be accepted for disposal.
- d. The permittee shall implement a program for detecting and preventing the disposal of unacceptable wastes. The program shall include, at a minimum:
 - i. Random inspections of incoming loads or other comparable procedures;
 - ii. Record keeping that documents these inspections;
 - iii. Training of personnel to recognize hazardous and other unauthorized waste types;
 - iv. Development of a contingency plan to properly manage any identified problem wastes; including provisions for removal, storage, and final disposition of these wastes.

Cover Material Requirements

- e. Operational soil cover of at least six inches shall be placed at least once per week or when the active area reaches ½ acre in size or more often as necessitated by the nature of the waste so as to prevent the site from becoming a visual nuisance and to prevent fire, windblown materials, vectors or water infiltration.
- f. Areas which will not have additional waste placed on them for 12 months or more, but where final elevations have not been reached, shall be covered with one foot of soil cover.
- g. After final termination of disposal operations at the site, or major part thereof, or upon revocation of a permit, the final cover system shall be installed.

Access and Safety

- h. The facility shall be adequately secured by means of gates, chains, berms, fences, or other security measures approved by the Division to prevent unauthorized entry.
- i. An attendant shall be on duty at the site at all times while it is open for public use to ensure compliance with operational requirements.

13. A closure and post-closure plan must be submitted for approval at least 90 days prior to closure or partial closure of any landfill unit. The plan must include all steps and measures necessary to close and maintain the facility in accordance with all rules in effect at that time. At a minimum, the plan shall address the following:
- a. Design of a final cover system;
 - b. Construction and maintenance/operation of the final cover system and erosion control structures;
 - c. Surface water, ground water, and explosive gas monitoring.

Monitoring and Reporting

14. Groundwater quality at this facility is subject to the classification and remedial action provisions of 15 NCAC 2L. Water quality monitoring shall occur in accordance with the following specific conditions:
- a. The permittee shall sample the monitoring wells on a semi-annual basis, or as directed by the Section Hydrogeologist.
 - b. Sampling methods and equipment shall conform to specifications found in Attachment 2, "North Carolina Water Quality Monitoring Guidance Document for Solid Waste Facilities". Sampling parameters shall conform to those found in Attachment 3, "Sampling and Analysis Requirements".
 - c. The permittee shall maintain a record of all monitoring events and analytical data. Reports of the analytical data for each sampling event shall be submitted to the Division in a timely manner.
 - d. Prior to the acceptance of waste, a background sampling event shall be performed. The results of this sampling event shall be submitted to the Section Hydrogeologist in a timely manner. (See Construction and Operation Condition 10(d).)
 - e. Well completion records and boring logs shall be submitted to the Division at the same time as the results of the initial sampling event. (See Construction and Operation Condition 10(d).)
 - f. A geologist shall be in the field to supervise well installation. The exact locations, screened intervals, and nesting of the wells shall be established after consultation with the SWS Hydrogeologist at the time of well installation.
 - g. A readily accessible unobstructed path shall be initially cleared and maintained so that four-wheel drive vehicles may access the monitoring wells at all times.
 - h. The permittee shall establish locations for surface water sampling. Surface water shall be sampled and analyzed semi-annually according to the protocol and parameters required by the Division at the time of sampling.
15. Explosive gas monitoring shall be performed as needed to ensure compliance with the standards in Rule .0503 (2)(a).

PERMIT NUMBER 34-12
PHASE I PERMIT ISSUED 3 JULY 1996 (PTO)
AMENDMENT 6: 28 MAY 2004 (PTC PHASE IV, V, AND VI)
AMENDMENT 7: 7 OCTOBER 2004 (PTO FOR PHASE IV)

ATTACHMENT 1

List of Documents for the Approved Plan

1. Site Plan Application; submitted by HDR Engineering, Inc. April, 1995
2. Construction Plan Application; submitted by HDR Engineering, Inc. June, 1995
3. Legal Description of the Facility
4. Letter dated 17 June 1997 submitted to the Section by HDR Engineering, Inc. certifying the western half of Phase 1A.
5. Letter dated 12 January 1998 submitted to the Section by HDR Engineering, Inc. providing Certification No.3 for Phase I.
6. Letter dated 1 April 1998 submitted to the Section by HDR Engineering, Inc. providing Certification No. 4 for the Phase 1 Area.
7. Letter dated 30 July 1998 submitted to the Section by HDR Engineering, Inc. providing Certification No. 5 for the Phase 1 Area.
8. Construction Plan Application Phase II & III; submitted by HDR Engineering, Inc. April 1999
9. Letter dated 11 May 1999 submitted to the Section by HDR Engineering, Inc. providing Certification No. 6 for Phase I and II Areas.
10. Letter Dated 8 October 1999 submitted to the Section by HDR Engineering, Inc. providing amendments to the Groundwater Monitoring Plan.
11. Letter dated 30 December 1999 submitted to the Section by HDR Engineering, Inc. providing Certification No. 7 for Phase I and II Areas.
12. Letter dated 17 April 2000 submitted to the Section by HDR Engineering, Inc. providing revisions to Document #8 (Construction Plan Application, Phase II & III) for Phase III development.

August 20, 2004

AUG 23 2004

Winston-Salem
Regional Office

Mr. Tim Jewett
North Carolina Division of Solid Waste Management
Solid Waste Section
585 Waughtown Street
Winston-Salem, NC 28107-2241

Re: City of Winston-Salem Solid Waste Permit No. 34-12
Forsyth County
Old Salisbury C&D Landfill Certification
Certification No. 9
HDR Project No. 00162-10597-018-002

Dear Mr. Jewett:

This letter is provided regarding Certification No. 9 for the Old Salisbury Construction and Demolition C&D Landfill. This certification addresses the base grades in Phase IV and a portion of Phases V and VI. The permit to construct and operate the Old Salisbury Road C&D Landfill was originally issued November 9, 1995. The permit to construct Phase IV, V, and VI was issued May 28, 2004. Drawing C-2, entitled "Excavation Plan," of the Phase IV, V, and VI permit application submitted October 22, 2002 is the basis of the proposed base grade elevations.

The as-built survey elevations are consistent with the design intent and maintain the minimum 4-foot vertical separation from the predicted seasonal high groundwater elevation shown on Drawing C-5 entitled "Existing and Proposed Groundwater Monitoring Well Locations."

A portion of the as-built shows an area of Phase IV, along the Phase III side near Sediment Basin No. 5, as being high due to waste placement. The base grades for this area are shown on the November 30, 2000 as-built survey. These base grades are well above the permitted base grades with the required 4-foot separation. Based on the information depicted on this as-built and the as-built drawing entitled "Landfill Expansion Phase IV, V, and VI Finish Grade As-Built Certification", HDR hereby certifies that, within the area indicated, the subgrade is substantially in compliance with the lines, grades, and separation depicted in the Construction Plan application for Phases IV, V, and VI. We hereby request that the operating permit be amended to reflect this additional area.

A copy of the amended Operating Permit sent to HDR would be appreciated.

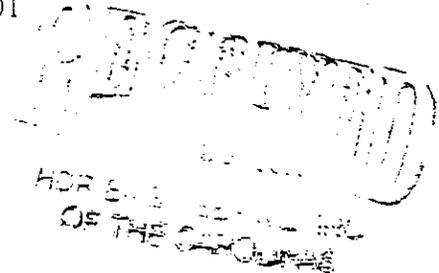
North Carolina
Department of Environment and Natural Resources



Division of Waste Management

Michael F. Easley, Governor
William G. Ross Jr., Secretary
William L. Meyer, Director

April 25, 2001



Mr. Dave Saunders, Utilities Supervisor
City of Winston-Salem
P.O. Box 2511
Winston-Salem, North Carolina 27102

Re: Solid Waste Permit No. 34-12: Phase III Permit to Operate (PTO), for the City of Winston-Salem C&D Landfill on Old Salisbury Road, Winston-Salem, Forsyth County, North Carolina

Dear Mr. Saunders:

The above referenced PERMIT TO OPERATE is issued in accordance with N.C.G.S. 130A-294 and the N.C. Solid Waste Management Rules 15A NCAC 13B. The revisions to the Construction Plan Application, Phase II & III submitted to the Section, dated 17 April 2000 by Eric Wright of HDR, will be listed in Attachment 1 as item #12 and is included in the Approved Plans for this facility. This permit amendment is to add Phase III into the operations permit (Phase I & II already included).

Please refer to the Conditions of the Permit, GENERAL section, for the definition of the approved plan and for general terms of the Solid Waste Permit. The CONSTRUCTION AND OPERATION conditions describe permitted fill areas, acceptable waste types, landfill operation, and requirements which must be satisfied prior to operation of the facility as a C&D landfill. Specific requirements for groundwater monitoring and facility record keeping and reporting are described in the MONITORING AND REPORTING conditions.

Please review the Conditions of Permit thoroughly. If you need further clarification, please contact me at (336) 771-4608 ext. 204 or Ms. Wendy Simmons, the Waste Management Specialist for this area, at (336) 771-4608 ext. 208.

Sincerely,

Timothy A. Jewett
Western Area Engineer
Solid Waste Section

cc: Jim Coffey, SWS
Brent Rockett, SWS
Wendy Simmons, SWS
Michael D. Plummer, HDR Engineering, Inc.
Raleigh Central File: Forsyth County, Permit No. 34-12

1646 Mail Service Center, Raleigh, North Carolina 27699-1646
Phone: 919-733-4996 \ FAX: 919-715-3605 \ Internet: www.enr.state.nc.us

Division of Waste Management

Michael F. Easley, Governor
William G. Ross Jr., Secretary
William L. Meyer, Director



PERMIT NUMBER 34-12
PHASE I PERMIT ISSUED 3 JULY 1996 (PTO)
AMENDMENT 1: 15 OCTOBER 1999 (PTC PHASE II, PTO Cert. #6)
AMENDMENT 2: 7 FEBRUARY 2000 (PTO Cert. #7)
AMENDMENT 3: 2 AUGUST 2000 (PTC PHASE III)
AMENDMENT 4: 25 APRIL 2001 (PTO PHASE III)

SOLID WASTE PERMIT

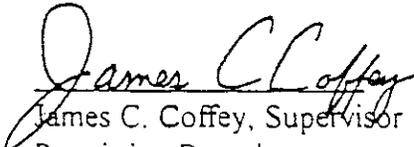
THE CITY OF WINSTON-SALEM

is hereby issued a PERMIT TO OPERATE for Phase III of a

CONSTRUCTION AND DEMOLITION LANDFILL

located within the Old Salisbury Road C&D Landfill Facility

located on Old Salisbury Road in Forsyth County, North Carolina based on the site plan submitted to the Section dated April 2000 and referenced as item #12 and #13 of the approved documents; in accordance with Article 9, Chapter 130A, of the General Statutes of North Carolina and all rules promulgated thereunder and subject to the conditions set forth in this permit.


James C. Coffey, Supervisor
Permitting Branch
Solid Waste Section

1646 Mail Service Center, Raleigh, North Carolina 27699-1646
Phone: 919-733-4996 \ FAX: 919-715-3605 \ Internet: www.enr.state.nc.us

PERMIT NUMBER 34-12
PHASE I PERMIT ISSUED 3 JULY 1996 (PTO)
AMENDMENT 1: 15 OCTOBER 1999 (PTC PHASE II, PTO Cert. #6)
AMENDMENT 2: 7 FEBRUARY 2000 (PTO Cert. #7)
AMENDMENT 3: 2 AUGUST 2000 (PTC PHASE III)
AMENDMENT 4: 25 APRIL 2001 (PTO PHASE III)

CITY OF WINSTON-SALEM

SOLID WASTE PERMIT
CONSTRUCTION AND DEMOLITION LANDFILL

CONDITIONS OF PERMIT

General:

1. This permit shall not be effective unless the certified copy is filed in the Register of Deeds office and indexed in the grantor index under the name of the owner of the land in the county or counties in which the land is located. The certified copy of the permit, affixed with the Register's seal and the date, book, and page number of recording shall be returned to the Division of Solid Waste Management (the Division).
2. When this property is sold, leased, transferred or conveyed, the deed or other instrument of transfer shall contain in the description section in no smaller type than that used in the body of the deed or instrument, a statement that the property has been used as a sanitary landfill.
3. The approved plan for this facility is described in Attachment 1, "List of Documents for Approved Plan". Where discrepancies exist, the most recent submittal and these Conditions shall govern. Some components of the approved plan may be reiterated in these Conditions.
4. This permit is not transferable.
5. A copy of this permit and the approved plan shall be maintained at the facility.
6. The owner/operator is responsible for obtaining any and all permits and approvals necessary for the development of this project including approval from appropriate agencies for a General or Individual NPDES Stormwater Discharge Permit.
7. This permit is subject to review every five years, on or before 15 October 2004, as per 15A NCAC 13B .0201(c), according to the issuance date of the permit. Modifications may be required in accordance with the rules in effect at the time of review.

Construction and Operation:

8. This permit is for the development of the landfill within the approved facility description, Document 8 and Document 12 (revisions) of the approved plan. Within the approved facility, development of the landfill unit is approved in Phase II and III. Operation is approved for the Phase I, II, & III areas according to Certification No. 8 as shown on Drawing CERT-8 of Document 13.
9. All sedimentation and erosion control measures shall be conducted in accordance with the Sedimentation Control Act codified at 15 NCAC 4. Native vegetation shall be established on the completed landfill.
10. The following requirements shall be met prior to operation of this facility:
 - a. The City of Winston-Salem or its consultant shall provide documentation to the Division that site preparation (grading, placement of fill if applicable, etc.) has occurred in accordance with the construction plan and the conditions specified herein.
 - b. Site inspection shall be made by a representative of the Division.
 - c. Signs shall be posted at the facility in accordance with the NC Solid Waste Management Rules.
 - d. Groundwater monitoring wells shall be installed in accordance with the approved groundwater monitoring plan, as described in *Appendix E: Groundwater Monitoring Plan* of Document 8, and the modifications described in Document 10. A baseline sampling event for background water quality shall be performed. (See Monitoring and Reporting Conditions 1(d) and 1(e).)
 - e. Recordation shall be implemented as described in General Conditions 1 and 2.
 - f. The existing monitoring wells that will be replaced with new wells, MW-3 and MW-6, will be properly abandoned in accordance with 15A NCAC 2C .0113(a)(2). The new MW-8 will be constructed according to the plan and added to the semiannual sampling schedule prior to construction of Phase III.
 - g. A comprehensive operations plan shall be submitted to the Division.
11. Operation of the facility shall occur in accordance with the NC Solid Waste Management Rules 15A NCAC 13B .0505, "Operational Requirements for Sanitary Landfills", the approved Operations Plan, and the following specific conditions:

Waste Acceptance and Disposal

- a. This solid waste management facility is approved to receive only the following:
 - i. Land-clearing debris as defined in G.S. 130A-290;
 - ii. Asphalt in accordance with G.S. 130A-294(m);

- iii. Construction and demolition debris defined as solid waste resulting solely from construction, remodeling, repair or demolition operations on pavement, buildings, or other structures;
- iv. Inert debris defined as solid waste which is virtually inert, such as brick, concrete, rock and uncontaminated soil.

Note: Yard trash defined as solid waste consisting solely of vegetative matter resulting from landscaping maintenance (see G.S. 130A-290) is banned from disposal in this facility as per NC General Statutes.

- b. Waste shall be restricted to the smallest area feasible and compacted as densely as practical into cells.

The permittee shall implement a program for detecting and preventing the disposal of unacceptable wastes. The program shall include, at a minimum:

- i. Random inspections of incoming loads or other comparable procedures;
- ii. Record keeping that documents these inspections;
- iii. Training of personnel to recognize hazardous and other unauthorized waste types;
- iv. Development of a contingency plan to properly manage any identified problem wastes; including provisions for removal, storage, and final disposition of these wastes.

Cover Material Requirements

- d. Operational soil cover of at least six inches shall be placed at least once per week or when the active area reaches ½ acre in size or more often as necessitated by the nature of the waste so as to prevent the site from becoming a visual nuisance and to prevent fire, windblown materials, vectors or water infiltration.
- e. Areas which will not have additional waste placed on them for 12 months or more, but where final elevations have not been reached, shall be covered with one foot of soil cover.
- f. Within six months of termination of disposal operations the final cover system shall be installed.

Miscellaneous Operational

- g. All pertinent landfill operating personnel shall receive training and supervision necessary to carry out their duties in a safe manner.
- h. Upon closure of this facility, the closure and post-closure plan that is included in the approved plan must be implemented. The soils that are to be utilized for the

eighteen inch compacted soil layer must be tested and construction specifications for the placement of this soil be submitted to the Section for approval. All measures necessary shall be taken to close the facility in accordance with all rules in effect at that time.

Monitoring and Reporting

12. Groundwater quality at this facility is subject to the classification and remedial action provisions of 15 NCAC 2L. Water quality monitoring shall occur in accordance with the following specific conditions:
 - a. The permittee shall sample the monitoring wells on a semi-annual basis, or as directed by the Section Hydrogeologist.
 - b. Sampling methods and equipment shall conform to specifications found in Attachment 2, "North Carolina Water Quality Monitoring Guidance Document for Solid Waste Facilities". Sampling parameters shall conform to those found in Attachment 3, "Sampling and Analysis Requirements".
 - c. The permittee shall maintain a record of all monitoring events and analytical data. Reports of the analytical data for each sampling event shall be submitted to the Division in a timely manner.
 - d. Prior to the acceptance of waste, a background sampling event shall be performed. The results of this sampling event shall be submitted to the Section Hydrogeologist in a timely manner. (See Construction and Operation Condition 3(d).)
 - e. Well completion records and boring logs shall be submitted to the Division at the same time as the results of the initial sampling event. (See Construction and Operation Condition 3(d).)
13. Explosive gas monitoring shall be performed as needed to ensure compliance with the standards in Rule .0503 (2)(a).
14. The permittee shall maintain a record of the amount of waste (in tons) that is received at the facility, compiled on a monthly basis by type and county of origin.
15. On or before 01 August of each year the permittee shall report the amount of waste received at this facility and disposed of in the landfill to the Division and to all counties from which waste was accepted, on forms prescribed by the Division.
16. All pertinent records and reports shall be kept on site and made available to the Division upon request.

PERMIT NUMBER 34-12
PHASE I PERMIT ISSUED 3 JULY 1996 (PTO)
AMENDMENT 1: 15 OCTOBER 1999 (PTC PHASE II, PTO Cert. #6)
AMENDMENT 2: 7 FEBRUARY 2000 (PTO Cert. #7)
AMENDMENT 3: 2 AUGUST 2000 (PTC PHASE III)
AMENDMENT 4: 25 APRIL 2001 (PTO PHASE III)

ATTACHMENT 1

List of Documents for the Approved Plan

1. Site Plan Application; submitted by HDR Engineering, Inc. April, 1995
2. Construction Plan Application; submitted by HDR Engineering, Inc. June, 1995
3. Legal Description of the Facility
4. Letter dated 17 June 1997 submitted to the Section by HDR Engineering, Inc. certifying the western half of Phase 1A.
5. Letter dated 12 January 1998 submitted to the Section by HDR Engineering, Inc. providing Certification No.3 for Phase I.
6. Letter dated 1 April 1998 submitted to the Section by HDR Engineering, Inc. providing Certification No. 4 for the Phase 1 Area.
7. Letter dated 30 July 1998 submitted to the Section by HDR Engineering, Inc. providing Certification No. 5 for the Phase 1 Area.
8. Construction Plan Application Phase II & III; submitted by HDR Engineering, Inc. April 1999
9. Letter dated 11 May 1999 submitted to the Section by HDR Engineering, Inc. providing Certification No. 6 for Phase I and II Areas.
10. Letter Dated 8 October 1999 submitted to the Section by HDR Engineering, Inc. providing amendments to the Groundwater Monitoring Plan.
11. Letter dated 30 December 1999 submitted to the Section by HDR Engineering, Inc. providing Certification No. 7 for Phase I and II Areas.
12. Letter dated 17 April 2000 submitted to the Section by HDR Engineering, Inc. providing revisions to Document #8 (Construction Plan Application, Phase II & III) for Phase III development.
13. Letter dated 1 February 2001 submitted to the Section by HDR Engineering, Inc. providing Certification No. 8 for all of Phase III.



RECEIVED
AUG 7 2000

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

DIVISION OF WASTE MANAGEMENT

August 2, 2000

HDR ENGINEERING, INC
OF THE CAROLINAS
Mr. Dave Saunders, Utilities Supervisor
City of Winston-Salem
P.O. Box 2511
Winston-Salem, North Carolina 27102

JAMES B. HUNT JR.
GOVERNOR

BILL HOLMAN
SECRETARY

WILLIAM L. MEYER
DIRECTOR

Re: Solid Waste Permit No. 34-12: Phase III Permit to Construct (PTC), for the City of Winston-Salem C&D Landfill on Old Salisbury Road, Winston-Salem, Forsyth County, North Carolina

Dear Mr. Saunders:

The above referenced PERMIT TO CONSTRUCT is issued in accordance with N.C.G.S. 130A-294 and the N.C. Solid Waste Management Rules 15A NCAC 13B. The revisions to the Construction Plan Application, Phase II & III submitted to the Section, dated 17 April 2000 by Eric Wright of HDR, will be listed in Attachment 1 as item #12 and is included in the Approved Plans for this facility. This permit is for the construction and development of Phase III. Operation of areas within Phase II have previously been approved in the Permit to Operate dated 7 February 2000.

Please refer to the Conditions of the Permit, GENERAL section, for the definition of the approved plan and for general terms of the Solid Waste Permit. The CONSTRUCTION AND OPERATION conditions describe permitted fill areas, acceptable waste types, landfill operation, and requirements which must be satisfied prior to operation of the facility as a C&D landfill. Specific requirements for groundwater monitoring and facility record keeping and reporting are described in the MONITORING AND REPORTING conditions.

Please review the Conditions of Permit thoroughly. If you need further clarification, please contact me at (336) 771-4608 ext. 204 or Mr. Danny Hockett, the Waste Management Specialist for this area, at (336) 771-4608 ext. 208.

Sincerely,

Timothy A. Jewett
Western Area Engineer
Solid Waste Section

cc: Jim Coffey, SWS
Brent Rockett, SWS
Danny Hockett, SWS
Eric Wright, HDR Engineering, Inc.
Raleigh Central File: Forsyth County, Permit No. 34-12



1646 MAIL SERVICE CENTER, RALEIGH, NORTH CAROLINA 27699-1646
401 OBERLIN ROAD, SUITE 150, RALEIGH, NC 27605
PHONE 919-733-4996 FAX 919-715-3605



NORTH CAROLINA DEPARTMENT OF
ENVIRONMENT AND NATURAL RESOURCES

DIVISION OF WASTE MANAGEMENT

PERMIT NUMBER 34-12

PHASE I PERMIT ISSUED 3 JULY 1996 (PTO)

AMENDMENT 1: 15 OCTOBER 1999 (PTC PHASE II, PTO Cert. #6)

AMENDMENT 2: 7 FEBRUARY 2000 (PTO Cert. #7)

AMENDMENT 3: 2 AUGUST 2000 (PTC PHASE III)

JAMES B. HUNT JR.
GOVERNOR

BILL HOLMAN
SECRETARY

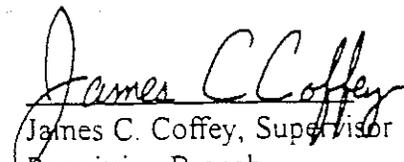
WILLIAM L. MEYER
DIRECTOR

SOLID WASTE PERMIT

THE CITY OF WINSTON-SALEM

is hereby issued a PERMIT TO CONSTRUCT for Phase III of a
CONSTRUCTION AND DEMOLITION LANDFILL
located within the Old Salisbury Road C&D Landfill Facility

located on Old Salisbury Road in Forsyth County, North Carolina based on the site plan submitted to the Section dated April 2000 and referenced as item #12 of the approved documents; in accordance with Article 9, Chapter 130A, of the General Statutes of North Carolina and all rules promulgated thereunder and subject to the conditions set forth in this permit.


James C. Coffey, Supervisor
Permitting Branch
Solid Waste Section



1546 MAIL SERVICE CENTER, RALEIGH, NORTH CAROLINA 27699-1646
401 OBERLIN ROAD, SUITE 150, RALEIGH, NC 27605
PHONE 919-733-4996 FAX 919-715-3605

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PERMIT NUMBER 34-12
PHASE I PERMIT ISSUED 3 JULY 1996 (PTO)
AMENDMENT 1: 15 OCTOBER 1999 (PTC PHASE II, PTO Cert. #6)
AMENDMENT 2: 7 FEBRUARY 2000 (PTO Cert. #7)
AMENDMENT 3: 2 AUGUST 2000 (PTC PHASE III)

CITY OF WINSTON-SALEM

SOLID WASTE PERMIT
CONSTRUCTION AND DEMOLITION LANDFILL

CONDITIONS OF PERMIT

General:

1. This permit shall not be effective unless the certified copy is filed in the Register of Deeds office and indexed in the grantor index under the name of the owner of the land in the county or counties in which the land is located. The certified copy of the permit, affixed with the Register's seal and the date, book, and page number of recording shall be returned to the Division of Solid Waste Management (the Division).
2. When this property is sold, leased, transferred or conveyed, the deed or other instrument of transfer shall contain in the description section in no smaller type than that used in the body of the deed or instrument, a statement that the property has been used as a sanitary landfill.
3. The approved plan for this facility is described in Attachment 1, "List of Documents for Approved Plan". Where discrepancies exist, the most recent submittal and these Conditions shall govern. Some components of the approved plan may be reiterated in these Conditions.
4. This permit is not transferable.
5. A copy of this permit and the approved plan shall be maintained at the facility.
6. The owner/operator is responsible for obtaining any and all permits and approvals necessary for the development of this project including approval from appropriate agencies for a General or Individual NPDES Stormwater Discharge Permit.
7. This permit is subject to review every five years, on or before 15 October 2004, as per 15A NCAC 13B .0201(c), according to the issuance date of the permit. Modifications may be required in accordance with the rules in effect at the time of review.

Construction and Operation:

8. This permit is for the development of the landfill within the approved facility description, Document 8 and Document 12 (revisions) of the approved plan. Within the approved facility, development of the landfill unit is approved in Phase II and III. Operation is approved for the Phase I & II areas according to Certification No. 7 as shown on Drawing CERT-7 of Document 11.
9. All sedimentation and erosion control measures shall be conducted in accordance with the Sedimentation Control Act codified at 15 NCAC 4. Native vegetation shall be established on the completed landfill.
10. The following requirements shall be met prior to operation of this facility:
 - a. The City of Winston-Salem or its consultant shall provide documentation to the Division that site preparation (grading, placement of fill if applicable, etc.) has occurred in accordance with the construction plan and the conditions specified herein.
 - b. Site inspection shall be made by a representative of the Division.
 - c. Signs shall be posted at the facility in accordance with the NC Solid Waste Management Rules.
 - d. Groundwater monitoring wells shall be installed in accordance with the approved groundwater monitoring plan, as described in *Appendix E: Groundwater Monitoring Plan* of Document 8, and the modifications described in Document 10. A baseline sampling event for background water quality shall be performed. (See Monitoring and Reporting Conditions 1(d) and 1(e).)
 - e. Recordation shall be implemented as described in General Conditions 1 and 2.
 - f. The existing monitoring wells that will be replaced with new wells, MW-3 and MW-6, will be properly abandoned in accordance with 15A NCAC 2C .0113(a)(2). The new MW-8 will be constructed according to the plan and added to the semiannual sampling schedule prior to construction of Phase III.
 - g. A comprehensive operations plan shall be submitted to the Division.
11. Operation of the facility shall occur in accordance with the NC Solid Waste Management Rules 15A NCAC 13B .0505, "Operational Requirements for Sanitary Landfills", the approved Operations Plan, and the following specific conditions:

Waste Acceptance and Disposal

- a. This solid waste management facility is approved to receive only the following:
 - i. Land-clearing debris as defined in G.S. 130A-290;
 - ii. Asphalt in accordance with G.S. 130A-294(m);

- iii. Construction and demolition debris defined as solid waste resulting solely from construction, remodeling, repair or demolition operations on pavement, buildings, or other structures;
- iv. Inert debris defined as solid waste which is virtually inert, such as brick, concrete, rock and uncontaminated soil.

Note: Yard trash defined as solid waste consisting solely of vegetative matter resulting from landscaping maintenance (see G.S. 130A-290) is banned from disposal in this facility as per NC General Statutes.

- b. Waste shall be restricted to the smallest area feasible and compacted as densely as practical into cells.
- c. The permittee shall implement a program for detecting and preventing the disposal of unacceptable wastes. The program shall include, at a minimum:
 - i. Random inspections of incoming loads or other comparable procedures;
 - ii. Record keeping that documents these inspections;
 - iii. Training of personnel to recognize hazardous and other unauthorized waste types;
 - iv. Development of a contingency plan to properly manage any identified problem wastes, including provisions for removal, storage, and final disposition of these wastes.

Cover Material Requirements

- d. Operational soil cover of at least six inches shall be placed at least once per week or when the active area reaches ½ acre in size or more often as necessitated by the nature of the waste so as to prevent the site from becoming a visual nuisance and to prevent fire, windblown materials, vectors or water infiltration.
- e. Areas which will not have additional waste placed on them for 12 months or more, but where final elevations have not been reached, shall be covered with one foot of soil cover.
- f. Within six months of termination of disposal operations the final cover system shall be installed.

Miscellaneous Operational

- g. All pertinent landfill operating personnel shall receive training and supervision necessary to carry out their duties in a safe manner.
- h. Upon closure of this facility, the closure and post-closure plan that is included in the approved plan must be implemented. The soils that are to be utilized for the

eighteen inch compacted soil layer must be tested and construction specifications for the placement of this soil be submitted to the Section for approval. All measures necessary shall be taken to close the facility in accordance with all rules in effect at that time.

Monitoring and Reporting

12. Groundwater quality at this facility is subject to the classification and remedial action provisions of 15 NCAC 2L. Water quality monitoring shall occur in accordance with the following specific conditions:
 - a. The permittee shall sample the monitoring wells on a semi-annual basis, or as directed by the Section Hydrogeologist.
 - b. Sampling methods and equipment shall conform to specifications found in Attachment 2, "North Carolina Water Quality Monitoring Guidance Document for Solid Waste Facilities". Sampling parameters shall conform to those found in Attachment 3, "Sampling and Analysis Requirements".
 - c. The permittee shall maintain a record of all monitoring events and analytical data. Reports of the analytical data for each sampling event shall be submitted to the Division in a timely manner.
 - d. Prior to the acceptance of waste, a background sampling event shall be performed. The results of this sampling event shall be submitted to the Section Hydrogeologist in a timely manner. (See Construction and Operation Condition 3(d).)
 - e. Well completion records and boring logs shall be submitted to the Division at the same time as the results of the initial sampling event. (See Construction and Operation Condition 3(d).)
13. Explosive gas monitoring shall be performed as needed to ensure compliance with the standards in Rule .0503 (2)(a).
14. The permittee shall maintain a record of the amount of waste (in tons) that is received at the facility, compiled on a monthly basis by type and county of origin.
15. On or before 01 August of each year the permittee shall report the amount of waste received at this facility and disposed of in the landfill to the Division and to all counties from which waste was accepted, on forms prescribed by the Division.
16. All pertinent records and reports shall be kept on site and made available to the Division upon request.

PERMIT NUMBER 34-12
PHASE I PERMIT ISSUED 3 JULY 1996 (PTO)
AMENDMENT 1: 15 OCTOBER 1999 (PTC PHASE II, PTO Cert. #6)
AMENDMENT 2: 7 FEBRUARY 2000 (PTO Cert. #7)
AMENDMENT 3: 2 AUGUST 2000 (PTC PHASE III)

ATTACHMENT I

List of Documents for the Approved Plan

1. Site Plan Application; submitted by HDR Engineering, Inc. April, 1995
2. Construction Plan Application; submitted by HDR Engineering, Inc. June, 1995
3. Legal Description of the Facility
4. Letter dated 17 June 1997 submitted to the Section by HDR Engineering, Inc. certifying the western half of Phase 1A.
5. Letter dated 12 January 1998 submitted to the Section by HDR Engineering, Inc. providing Certification No.3 for Phase I.
6. Letter dated 1 April 1998 submitted to the Section by HDR Engineering, Inc. providing Certification No. 4 for the Phase 1 Area.
7. Letter dated 30 July 1998 submitted to the Section by HDR Engineering, Inc. providing Certification No. 5 for the Phase 1 Area.
8. Construction Plan Application Phase II & III; submitted by HDR Engineering, Inc. April 1999
9. Letter dated 11 May 1999 submitted to the Section by HDR Engineering, Inc. providing Certification No. 6 for Phase I and II Areas.
10. Letter Dated 8 October 1999 submitted to the Section by HDR Engineering, Inc. providing amendments to the Groundwater Monitoring Plan.
11. Letter dated 30 December 1999 submitted to the Section by HDR Engineering, Inc. providing Certification No. 7 for Phase I and II Areas.
12. Letter dated 17 April 2000 submitted to the Section by HDR Engineering, Inc. providing revisions to Document #8 (Construction Plan Application, Phase II & III) for Phase III development.



RECEIVED

NORTH CAROLINA DEPARTMENT OF
ENVIRONMENT AND NATURAL RESOURCES

DIVISION OF WASTE MANAGEMENT

October 15, 1999

HDR ENGINEERING INC
OF THE CAROLINAS

JAMES B. HUNT JR.
GOVERNOR

Mr. Dave Saunders, Utilities Supervisor
City of Winston-Salem
P.O. Box 2511
Winston-Salem, North Carolina 27102

BILL HOLMAN
SECRETARY

Re: Solid Waste Permit No. 34-12: Phase II, Certification No. 7 for the City of
Winston-Salem C&D Landfill on Old Salisbury Road, Winston-Salem, Forsyth
County, North Carolina

WILLIAM L. MEYER
DIRECTOR

Dear Mr. Saunders:

The referenced PERMIT TO OPERATE is issued in accordance with N.C.G.S. 130A-294 and the N.C. Solid Waste Management Rules 15A NCAC 13B. The certification letter submitted to the Section, dated 30 December 1999 by Joe Reading of HDR, will be listed in Attachment 1 as item #11 and is included in the Approved Plans for this facility. This permit is for a five-year period and will be reviewed on 15 October 2004, consistent with Solid Waste Management Rules. At the end of this five-year period, the City of Winston-Salem may apply for an expansion for the use of additional cells, but will be subject to all rules in effect at that time. This permit is issued to the City of Winston-Salem as the owner and operator of the facility.

Please refer to the Conditions of the Permit, GENERAL section, for the definition of the approved plan and for general terms of the Solid Waste Permit. The CONSTRUCTION AND OPERATION conditions describe permitted fill areas, acceptable waste types, landfill operation, and requirements which must be satisfied prior to operation of the facility as a C&D landfill. Specific requirements for groundwater monitoring and facility record keeping and reporting are described in the MONITORING AND REPORTING conditions.

As stated previously, this permit is for the development of Phase II only and for the operation of areas within Phase II as they are constructed and certified. Portions of the Construction Plan Application for Phase II & III, date April 1999 by HDR Engineering, did not supply all of the information necessary to grant approval for Phase III construction. The Section is still awaiting revisions to the Construction Plan Application that would allow Phase III to be approved and thereby incorporated into the Permit to Construct.



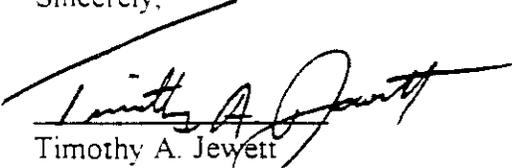
1646 MAIL SERVICE CENTER, RALEIGH, NORTH CAROLINA 27699-1646
401 OBERLIN ROAD, SUITE 150, RALEIGH, NC 27605
PHONE 919-733-4996 FAX 919-715-3605

AN EQUAL OPPORTUNITY / AFFIRMATIVE ACTION EMPLOYER - 50% RECYCLED/10% POST-CONSUMER PAPER

Mr. Saunders
Page 8
February 7, 2000

Please review the Conditions of Permit thoroughly. If you need further clarification, please contact me at (336) 771-4608 ext. 204 or Mr. Danny Hockett, the Waste Management Specialist for this area, at (336) 771-4608 ext. 208.

Sincerely,



Timothy A. Jewett
Western Area Engineer
Solid Waste Section

cc: Jim Coffey, SWS
Brent Rockett, SWS
Danny Hockett, SWS
Joe Readling, HDR Engineering, Inc.
Raleigh Central File: Forsyth County, Permit No. 34-12



JAMES B. HUNT JR.
GOVERNOR

WAYNE MCDEVITT
SECRETARY

WILLIAM L. MEYER
DIRECTOR

NORTH CAROLINA DEPARTMENT OF
ENVIRONMENT AND NATURAL RESOURCES

DIVISION OF WASTE MANAGEMENT

PERMIT NUMBER 34-12
PHASE I PERMIT ISSUED 3 JULY 1996
PHASE II PERMIT ISSUED 15 OCTOBER 1999
AMENDED 7 FEBRUARY 2000

SOLID WASTE PERMIT

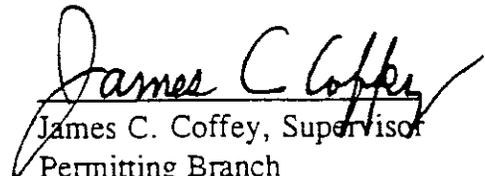
THE CITY OF WINSTON-SALEM

is hereby issued a PERMIT TO OPERATE for Phase II of a

CONSTRUCTION AND DEMOLITION LANDFILL

located within the Old Salisbury Road C&D Landfill Facility

located on Old Salisbury Road in Forsyth County, North Carolina based on the site plan submitted to the Section dated April 1995 and referenced as item #1 of the approved documents; in accordance with Article 9, Chapter 130A, of the General Statutes of North Carolina and all rules promulgated thereunder and subject to the conditions set forth in this permit.


James C. Coffey, Supervisor
Permitting Branch
Solid Waste Section

PERMIT NUMBER 34-12
PHASE I PERMIT ISSUED 3 JULY 1996
PHASE II PERMIT ISSUED 15 OCTOBER 1999
AMENDED 7 FEBRUARY 2000

CITY OF WINSTON-SALEM

SOLID WASTE PERMIT
CONSTRUCTION AND DEMOLITION LANDFILL

CONDITIONS OF PERMIT

General:

1. This permit shall not be effective unless the certified copy is filed in the Register of Deeds office and indexed in the grantor index under the name of the owner of the land in the county or counties in which the land is located. The certified copy of the permit, affixed with the Register's seal and the date, book, and page number of recording shall be returned to the Division of Solid Waste Management (the Division).
2. When this property is sold, leased, transferred or conveyed, the deed or other instrument of transfer shall contain in the description section in no smaller type than that used in the body of the deed or instrument, a statement that the property has been used as a sanitary landfill.
3. The approved plan for this facility is described in Attachment 1, "List of Documents for Approved Plan". Where discrepancies exist, the most recent submittal and these Conditions shall govern. Some components of the approved plan may be reiterated in these Conditions.
4. This permit is not transferable.
5. A copy of this permit and the approved plan shall be maintained at the facility.
6. The owner/operator is responsible for obtaining any and all permits and approvals necessary for the development of this project including approval from appropriate agencies for a General or Individual NPDES Stormwater Discharge Permit.
7. This permit is subject to review every five years, on or before 15 October 2004, as per 15A NCAC 13B .0201(c), according to the issuance date of the permit. Modifications may be required in accordance with the rules in effect at the time of review.

Construction and Operation:

8. This permit is for the development of the landfill within the approved facility description. Document 8 of the approved plan. Within the approved facility, development of the landfill unit is approved in Phase II only and operation is approved for the Phase I & II areas according to Certification No. 7 as shown on Drawing CERT-7 of Document 11.
9. All sedimentation and erosion control measures shall be conducted in accordance with the Sedimentation Control Act codified at 15 NCAC 4. Native vegetation shall be established on the completed landfill.
10. The following requirements shall be met prior to operation of this facility:
 - a. The City of Winston-Salem or its consultant shall provide documentation to the Division that site preparation (grading, placement of fill if applicable, etc.) has occurred in accordance with the construction plan and the conditions specified herein.
 - b. Site inspection shall be made by a representative of the Division.
 - c. Signs shall be posted at the facility in accordance with the NC Solid Waste Management Rules.
 - d. Groundwater monitoring wells shall be installed in accordance with the approved groundwater monitoring plan, as described in *Appendix E: Groundwater Monitoring Plan* of Document 8, and the modifications described in Document 10. A baseline sampling event for background water quality shall be performed. (See Monitoring and Reporting Conditions 1(d) and 1(e).)
 - e. Recordation shall be implemented as described in General Conditions 1 and 2.
 - f. The existing monitoring wells that will be replaced with new wells, MW-3 and MW-6, will be properly abandoned in accordance with 15A NCAC 2C .0113(a)(2). The new MW-8 will be constructed according to the plan and added to the semiannual sampling schedule prior to construction of Phase III.
 - g. A comprehensive operations plan shall be submitted to the Division.
11. Operation of the facility shall occur in accordance with the NC Solid Waste Management Rules 15A NCAC 13B .0505, "Operational Requirements for Sanitary Landfills", the approved Operations Plan, and the following specific conditions:

Waste Acceptance and Disposal

- a. This solid waste management facility is approved to receive only the following:
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 - ii. Asphalt in accordance with G.S. 130A-294(m);

- iii. Construction and demolition debris defined as solid waste resulting solely from construction, remodeling, repair or demolition operations on pavement, buildings, or other structures;
- iv. Inert debris defined as solid waste which is virtually inert, such as brick, concrete, rock and uncontaminated soil.

Note: Yard trash defined as solid waste consisting solely of vegetative matter resulting from landscaping maintenance (see G.S. 130A-290) is banned from disposal in this facility as per NC General Statutes.

- b. Waste shall be restricted to the smallest area feasible and compacted as densely as practical into cells.
- c. The permittee shall implement a program for detecting and preventing the disposal of unacceptable wastes. The program shall include, at a minimum:
 - i. Random inspections of incoming loads or other comparable procedures;
 - ii. Record keeping that documents these inspections;
 - iii. Training of personnel to recognize hazardous and other unauthorized waste types;
 - iv. Development of a contingency plan to properly manage any identified problem wastes; including provisions for removal, storage, and final disposition of these wastes.

Cover Material Requirements

- d. Operational soil cover of at least six inches shall be placed at least once per week or when the active area reaches ½ acre in size or more often as necessitated by the nature of the waste so as to prevent the site from becoming a visual nuisance and to prevent fire, windblown materials, vectors or water infiltration.
- e. Areas which will not have additional waste placed on them for 12 months or more, but where final elevations have not been reached, shall be covered with one foot of soil cover.
- f. Within six months of termination of disposal operations the final cover system shall be installed.

Miscellaneous Operational

- g. All pertinent landfill operating personnel shall receive training and supervision necessary to carry out their duties in a safe manner.
- h. Upon closure of this facility, the closure and post-closure plan that is included in the approved plan must be implemented. The soils that are to be utilized for the

eighteen inch compacted soil layer must be tested and construction specifications for the placement of this soil be submitted to the Section for approval. All measures necessary shall be taken to close the facility in accordance with all rules in effect at that time.

Monitoring and Reporting

12. Groundwater quality at this facility is subject to the classification and remedial action provisions of 15 NCAC 2L. Water quality monitoring shall occur in accordance with the following specific conditions:
 - a. The permittee shall sample the monitoring wells on a semi-annual basis, or as directed by the Section Hydrogeologist.
 - b. Sampling methods and equipment shall conform to specifications found in Attachment 2, "North Carolina Water Quality Monitoring Guidance Document for Solid Waste Facilities". Sampling parameters shall conform to those found in Attachment 3, "Sampling and Analysis Requirements".
 - c. The permittee shall maintain a record of all monitoring events and analytical data. Reports of the analytical data for each sampling event shall be submitted to the Division in a timely manner.
 - d. Prior to the acceptance of waste, a background sampling event shall be performed. The results of this sampling event shall be submitted to the Section Hydrogeologist in a timely manner. (See Construction and Operation Condition 3(d).)
 - e. Well completion records and boring logs shall be submitted to the Division at the same time as the results of the initial sampling event. (See Construction and Operation Condition 3(d).)
13. Explosive gas monitoring shall be performed as needed to ensure compliance with the standards in Rule .0503 (2)(a).
14. The permittee shall maintain a record of the amount of waste (in tons) that is received at the facility, compiled on a monthly basis by type and county of origin.
15. On or before 01 August of each year the permittee shall report the amount of waste received at this facility and disposed of in the landfill to the Division and to all counties from which waste was accepted, on forms prescribed by the Division.
16. All pertinent records and reports shall be kept on site and made available to the Division upon request.

PERMIT NUMBER 34-12
PHASE I PERMIT ISSUED 3 JULY 1996
PHASE II PERMIT ISSUED 15 OCTOBER 1999
AMENDED 7 FEBRUARY 2000

ATTACHMENT 1

List of Documents for the Approved Plan

1. Site Plan Application; submitted by HDR Engineering, Inc. April, 1995
2. Construction Plan Application; submitted by HDR Engineering, Inc. June, 1995
3. Legal Description of the Facility
4. Letter dated 17 June 1997 submitted to the Section by HDR Engineering, Inc. certifying the western half of Phase 1A.
5. Letter dated 12 January 1998 submitted to the Section by HDR Engineering, Inc. providing Certification No.3 for Phase I.
6. Letter dated 1 April 1998 submitted to the Section by HDR Engineering, Inc. providing Certification No. 4 for the Phase 1 Area.
7. Letter dated 30 July 1998 submitted to the Section by HDR Engineering, Inc. providing Certification No. 5 for the Phase 1 Area.
8. Construction Plan Application Phase II & III; submitted by HDR Engineering, Inc. April 1999
9. Letter dated 11 May 1999 submitted to the Section by HDR Engineering, Inc. providing Certification No. 6 for Phase I and II Areas.
10. Letter Dated 8 October 1999 submitted to the Section by HDR Engineering, Inc. providing amendments to the Groundwater Monitoring Plan.
11. Letter dated 30 December 1999 submitted to the Section by HDR Engineering, Inc. providing Certification No. 7 for Phase I and II Areas.

NORTH CAROLINA DEPARTMENT OF
ENVIRONMENT AND NATURAL RESOURCES
DIVISION OF WASTE MANAGEMENT

October 15, 1999

RECEIVED
OCT 20 1999

Mr. Dave Saunders, Utilities Supervisor
City of Winston-Salem
P.O. Box 2511
Winston-Salem, North Carolina 27102

HDR ENGINEERING, INC.
OF THE CAROLINAS

Re: Solid Waste Permit No. 34-12
~~Phase II of the City of Winston-Salem Construction and Demolition Landfill~~
located on Old Salisbury Road, Winston-Salem, Forsyth County, North Carolina

Dear Mr. Saunders:

The referenced PERMIT TO CONSTRUCT for Phase II is issued in accordance with N.C.G.S. 130A-294 and the N.C. Solid Waste Management Rules 15A NCAC 13B. The Construction Plan Application submitted to the Section, dated 14 April 1999 by Eric Wright of HDR Engineering, Inc., will be listed as item #8 in Attachment 1- List of Documents for the Approved Plans for this facility. The referenced PERMIT TO OPERATE, also issued in accordance with the above statutes and rules, is specifically for the area described as Certification Number 6 in the letter from HDR Engineering dated 11 May 1999 (designated as item #9 in Attachment 1).

This permit is for a five-year period and will be reviewed on 15 October 2004, consistent with Solid Waste Management Rules. At the end of this five-year period, the City of Winston-Salem may apply for an expansion for the use of additional cells, but will be subject to all rules in effect at that time. This permit is issued to the City of Winston-Salem as the owner and operator of the facility.

Please refer to the Conditions of the Permit, GENERAL section, for the definition of the approved plan and for general terms of the Solid Waste Permit. The CONSTRUCTION AND OPERATION conditions describe permitted fill areas, acceptable waste types, landfill operation, and requirements which must be satisfied prior to operation of the facility as a C&D landfill. Specific requirements for groundwater monitoring and facility record keeping and reporting are described in the MONITORING AND REPORTING conditions.

As stated previously, this permit is for the development of Phase II only and for the operation of areas within Phase II as they are constructed and certified. Portions of the Construction Plan Application for Phase II & III, date April 1999 by HDR Engineering, did not supply all of the information necessary to grant approval for Phase

Mr. Saunders

Page 2

October 15, 1999

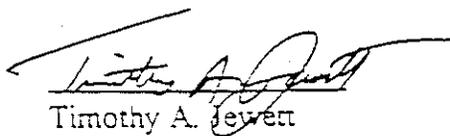
III construction. The following items corresponding to the appropriate section of the Rules will need to be addressed for the next and future phases of construction.

1. .0503(2)(a and c) are not addressed in the application. Also, for future reference, the 50-foot minimum buffer requirement between property lines and disposal areas (.0503(2)(f)), as stated in section 2.2 of the application, has been increased to 200 feet per a Section Policy Memo.
2. Section 2.3 of the application indicates that a 10 foot separation will be maintained between the potentiometric lines depicted on the drawings and the proposed subgrade. However, the cross-section drawing (Dwg C-4) only shows a 4 to 5 foot separation for most of X-Section B and the low area of X-section A is less than four feet. Please address this discrepancy and show the location of the cross sections on the proposed Excavation Plan (.0503(2)(d)).
3. Existing site conditions shown on drawing C-1 depict site conditions that existed prior to the development of Phase I. Stock Pile areas, access roads, and bench marks to illustrate current site activities are not shown as required by .0504(2).
4. The proposed Excavation Plan drawing C-2 does not show the staged subcell development as described in the text of the application. Please provide a plan showing the planned subcells of each phase, tie-in and removal of the stock pile in relation to subgrade preparation, and temporary diversions related to subcells and overall phase development (.0504(2)(b, d, & g)).
5. The proposed final grades shown on drawing C-3 show contours that tie into proposed excavation grades of future phases. How will the existing stock pile be managed in conjunction with proposed final grades? Also, no slope drains, berms, or other drop structures are shown for removal of stormwater from proposed final grades on drawings C-3 and C-6? How will surface water be managed once final grades are reached for this phase of development (.0504(2)(c))?
6. Please provide a copy of the Sediment and Erosion Control Plan submitted to the Division of Land Quality (DLQ) (.0504(2)(d)). Section 2.7 (p. 9) of the application indicates that an erosion control plan for Phase III is being prepared and will be submitted. Has the plan been submitted? Please provide a copy of DLQ's approval letter with the plan. Also, are temporary control measures shown and is a seeding schedule provided (.0504(2)(d)(I & ii))?
7. According to .0504(2)(e), please provide a copy of pertinent details with the drawing set.
8. The Solid Waste Section normally issues permits based on a five year review cycle according to Section .0201 of the Rules. The anticipated life span of Phase II and III combined is 7.5 years. Please modify the drawings and application to reflect five year phase development based on the anticipated waste disposal of the facility (.0504(2)(g)).

Mr. Saunders
Page 3
October 15, 1999

Please address the above comments at your earliest convenience and submit revisions based on the comments with the next application for phase development. Also, please review the Conditions of Permit thoroughly. Some changes have been made that differentiate these conditions from the ones attached to the Phase I permit. If you need further clarification, please contact me at (336) 771-4608 ext. 204 or Mr. Danny Hockett, the Waste Management Specialist for this area, at (336) 771-4608 ext. 208.

Sincerely,



Timothy A. Jewett
Western Area Engineer
Solid Waste Section

cc: Jim Coffey
Julian Foscue
Danny Hockett
Raleigh Central File: Forsyth County, Permit No. 34-12



JAMES B. HUNT JR.
GOVERNOR

WAYNE MCDEVITT
SECRETARY

WILLIAM L. MEYER
DIRECTOR



NORTH CAROLINA DEPARTMENT OF
ENVIRONMENT AND NATURAL RESOURCES
DIVISION OF WASTE MANAGEMENT

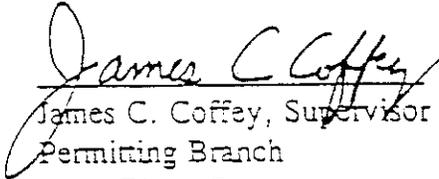
PERMIT NUMBER 34-12
ISSUED 09 NOVEMBER 1995
AMENDED 15 OCTOBER 1999

SOLID WASTE PERMIT

THE CITY OF WINSTON-SALEM

is hereby issued a PERMIT TO CONSTRUCT for Phase II of a
CONSTRUCTION AND DEMOLITION LANDFILL
located within the Old Salisbury Road C&D Landfill Facility

located on Old Salisbury Road in Forsyth County, North Carolina based on the site plan submitted to the Section dated April 1995 and referenced as item #1 of the approved documents; in accordance with Article 9, Chapter 130A, of the General Statutes of North Carolina and all rules promulgated thereunder and subject to the conditions set forth in this permit.


James C. Coffey, Supervisor
Permitting Branch
Solid Waste Section

NORTH CAROLINA DEPARTMENT OF
ENVIRONMENT AND NATURAL RESOURCES
DIVISION OF WASTE MANAGEMENT

PERMIT NUMBER 34-12
ISSUED 03 JULY 1996
AMENDED 15 OCTOBER 1999



NCDENR

JAMES B. HUNT JR.
GOVERNOR

WAYNE MCDEVITT
SECRETARY

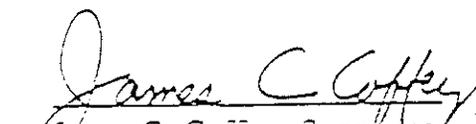
WILLIAM L. MEYER
DIRECTOR

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James C. Coffey, Supervisor
Permitting Branch
Solid Waste Section

PERMIT NUMBER 34-12
ISSUED 3 JULY 1996
AMENDED 15 OCTOBER 1999

CITY OF WINSTON-SALEM

SOLID WASTE PERMIT
CONSTRUCTION AND DEMOLITION LANDFILL

CONDITIONS OF PERMIT

General:

1. This permit shall not be effective unless the certified copy is filed in the Register of Deeds office and indexed in the grantor index under the name of the owner of the land in the county or counties in which the land is located. The certified copy of the permit, affixed with the Register's seal and the date, book, and page number of recording shall be returned to the Division of Solid Waste Management (the Division).
2. When this property is sold, leased, transferred or conveyed, the deed or other instrument of transfer shall contain in the description section in no smaller type than that used in the body of the deed or instrument, a statement that the property has been used as a sanitary landfill.
3. The approved plan for this facility is described in Attachment 1, "List of Documents for Approved Plan". Where discrepancies exist, the most recent submittal and these Conditions shall govern. Some components of the approved plan may be reiterated in these Conditions.
4. This permit is not transferable.
5. A copy of this permit and the approved plan shall be maintained at the facility.
6. The owner/operator is responsible for obtaining any and all permits and approvals necessary for the development of this project including approval from appropriate agencies for a General or Individual NPDES Stormwater Discharge Permit.
7. This permit is subject to review every five years, on or before 15 October 2004, as per 15A NCAC 13B .0201(c), according to the issuance date of the permit. Modifications may be required in accordance with the rules in effect at the time of review.

Construction and Operation:

8. This permit is for the development of the landfill within the approved facility description, Document 8 of the approved plan. Within the approved facility, development of the landfill unit is approved in Phase II only and operation is approved for the Phase I & II areas according to Certification No. 6 as shown on Drawing CERT-6 of Document 9.
9. All sedimentation and erosion control measures shall be conducted in accordance with the Sedimentation Control Act codified at 15 NCAC 4. Native vegetation shall be established on the completed landfill.
10. The following requirements shall be met prior to operation of this facility:
 - a. The City of Winston-Salem or its consultant shall provide documentation to the Division that site preparation (grading, placement of fill if applicable, etc.) has occurred in accordance with the construction plan and the conditions specified herein.
 - b. Site inspection shall be made by a representative of the Division.
 - c. Signs shall be posted at the facility in accordance with the NC Solid Waste Management Rules.
 - d. Groundwater monitoring wells shall be installed in accordance with the approved groundwater monitoring plan, as described in *Appendix E: Groundwater Monitoring Plan* of Document 8, and the modifications described in Document 10. A baseline sampling event for background water quality shall be performed. (See Monitoring and Reporting Conditions 1(d) and 1(e).)
 - e. Recordation shall be implemented as described in General Conditions 1 and 2.
 - f. The existing monitoring wells that will be replaced with new wells, MW-3 and MW-6, will be properly abandoned in accordance with 15A NCAC 2C .0113(a)(2). The new MW-8 will be constructed according to the plan and added to the semiannual sampling schedule prior to construction of Phase III.
 - g. A comprehensive operations plan shall be submitted to the Division.
11. Operation of the facility shall occur in accordance with the NC Solid Waste Management Rules 15A NCAC 13B .0505, "Operational Requirements for Sanitary Landfills", the approved Operations Plan, and the following specific conditions:

Waste Acceptance and Disposal

- a. This solid waste management facility is approved to receive only the following:
 - i. Land-clearing debris as defined in G.S. 130A-290;
 - ii. Asphalt in accordance with G.S. 130A-294(m);

- iii. Construction and demolition debris defined as solid waste resulting solely from construction, remodeling, repair or demolition operations on pavement, buildings, or other structures;
- iv. Inert debris defined as solid waste which is virtually inert, such as brick, concrete, rock and uncontaminated soil.

Note: Yard trash defined as solid waste consisting solely of vegetative matter resulting from landscaping maintenance (see G.S. 130A-290) is banned from disposal in this facility as per NC General Statutes.

- b. Waste shall be restricted to the smallest area feasible and compacted as densely as practical into cells.
- c. The permittee shall implement a program for detecting and preventing the disposal of unacceptable wastes. The program shall include, at a minimum:
 - i. Random inspections of incoming loads or other comparable procedures;
 - ii. Record keeping that documents these inspections;
 - iii. Training of personnel to recognize hazardous and other unauthorized waste types;
 - iv. Development of a contingency plan to properly manage any identified problem wastes; including provisions for removal, storage, and final disposition of these wastes.

Cover Material Requirements

- a. Operational soil cover of at least six inches shall be placed at least once per week or when the active area reaches 1/2 acre in size or more often as necessitated by the nature of the waste so as to prevent the site from becoming a visual nuisance and to prevent fire, windblown materials, vectors or water infiltration.
- b. Areas which will not have additional waste placed on them for 12 months or more, but where final elevations have not been reached, shall be covered with one foot of soil cover.
- c. Within six months of termination of disposal operations the final cover system shall be installed.

Miscellaneous Operational

- a. All pertinent landfill operating personnel shall receive training and supervision necessary to carry out their duties in a safe manner.
- b. Upon closure of this facility, the closure and post-closure plan that is included in the approved plan must be implemented. The soils that are to be utilized for the

eighteen inch compacted soil layer must be tested and construction specifications for the placement of this soil be submitted to the Section for approval. All measures necessary shall be taken to close the facility in accordance with all rules in effect at that time.

Monitoring and Reporting

12. Groundwater quality at this facility is subject to the classification and remedial action provisions of 15 NCAC 2L. Water quality monitoring shall occur in accordance with the following specific conditions:
 - a. The permittee shall sample the monitoring wells on a semi-annual basis, or as directed by the Section Hydrogeologist.
 - b. Sampling methods and equipment shall conform to specifications found in Attachment 2, "North Carolina Water Quality Monitoring Guidance Document for Solid Waste Facilities". Sampling parameters shall conform to those found in Attachment 3, "Sampling and Analysis Requirements".
 - c. The permittee shall maintain a record of all monitoring events and analytical data. Reports of the analytical data for each sampling event shall be submitted to the Division in a timely manner.
 - d. Prior to the acceptance of waste, a background sampling event shall be performed. The results of this sampling event shall be submitted to the Section Hydrogeologist in a timely manner. (See Construction and Operation Condition 3(d).)
 - e. Well completion records and boring logs shall be submitted to the Division at the same time as the results of the initial sampling event. (See Construction and Operation Condition 3(d).)
13. Explosive gas monitoring shall be performed as needed to ensure compliance with the standards in Rule .0503 (2)(a).
14. The permittee shall maintain a record of the amount of waste (in tons) that is received at the facility, compiled on a monthly basis by type and county of origin.
15. On or before 01 August of each year the permittee shall report the amount of waste received at this facility and disposed of in the landfill to the Division and to all counties from which waste was accepted, on forms prescribed by the Division.
16. All pertinent records and reports shall be kept on site and made available to the Division upon request.

PERMIT NUMBER 34-12
ISSUED 3 JULY 1996
AMENDED 15 OCTOBER 1999

ATTACHMENT I

List of Documents for the Approved Plan

1. Site Plan Application; submitted by HDR Engineering, Inc. April, 1995
2. Construction Plan Application; submitted by HDR Engineering, Inc. June, 1995
3. Legal Description of the Facility
4. Letter dated 17 June 1997 submitted to the Section by HDR Engineering, Inc. certifying the western half of Phase 1A.
5. Letter dated 12 January 1998 submitted to the Section by HDR Engineering, Inc. providing Certification No. 3 for Phase I.
6. Letter dated 1 April 1998 submitted to the Section by HDR Engineering, Inc. providing Certification No. 4 for the Phase 1 Area.
7. Letter dated 30 July 1998 submitted to the Section by HDR Engineering, Inc. providing Certification No. 5 for the Phase 1 Area.
8. Construction Plan Application Phase II & III; submitted by HDR Engineering, Inc. April 1999
9. Letter dated 11 May 1999 submitted to the Section by HDR Engineering, Inc. providing Certification No. 6 for Phase I and II Areas.
10. Letter Dated 8 October 1999 submitted to the Section by HDR Engineering, Inc. providing amendments to the Groundwater Monitoring Plan.

March 8, 1999



Mr. Bobby Lutfy
North Carolina Department of Environment
and Natural Resources
Division of Solid Waste Management
Solid Waste Section
P. O. Box 27687
Raleigh, North Carolina 27611-7687

Re: Modifications to Ground-Water Monitoring Well Network
Winston-Salem Construction and Demolition Landfill (#34-12)
Forsyth County, North Carolina
HDR Project No. 00162-090-018

Dear Mr. Lutfy:

HDR Engineering, Inc. of the Carolinas (HDR) is hereby submitting, on behalf of the City of Winston-Salem Utilities Division, a request to modify the existing ground-water monitoring well network at the C&D Landfill located in Forsyth County, North Carolina. This request is being submitted for the following reasons:

- 1) The current location of existing ground-water monitoring wells MW-3 and MW-6 (see attached site drawing) are within the footprints of Phase II and III of the proposed landfill expansion plan. Therefore, these wells must be abandoned and replaced.
- 2) The permitting of Phase III requires the installation of a new ground-water monitoring well to monitor the quality of the ground water downgradient of this phase. The permitting of Phases II and III is ongoing at this time

At this time, there are seven wells in the C&D Landfill monitoring network. Please see attached Drawing D-1. During the most recent semiannual ground-water sampling event performed at the landfill in November 1998, earthwork had begun in the vicinity of monitoring well MW-3 for the preparation of base grades for Phase II. At present, stockpiled soil from the excavation of Phase II is located within the limits of Phase III. However, HDR is currently working on the permit application for both Phase II and Phase III. In addition, HDR has estimated that the life expectancy of Phase II would be 3.2 years and the life expectancy of Phase III would be 4.8 years.

HDR is proposing the following modifications to the existing ground-water monitoring well network at the C&D Landfill:

- 1) Abandon existing ground-water monitoring well MW-3 and install ground-water monitoring well MW-3R outside the limits of construction, just to the south of sedimentation basin No. 4 (approximately 75 feet from the edge of Phase II).

Mr. Bobby Lutfy

March 8, 1999

Page 2

- 2) Abandon existing ground-water monitoring well MW-6 and install ground-water monitoring well MW-6R east of its present location at a distance of approximately 75 feet from the edge of Phase II.
- 3) Install ground-water monitoring well MW-8 outside the limits of construction, just west of sedimentation basin No. 5 at a distance of approximately 75 feet from the edge of Phase III.
- 4) Modify the existing Ground-Water Monitoring Plan to reflect these changes to the monitoring well network.

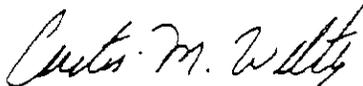
All wells installed would be constructed with 15-foot well screens and in accordance with the North Carolina Well Construction Standards, Subchapter 2C, Section .0100 utilizing a North Carolina-certified well driller. Well installation diagrams, abandonment records, soil boring, and survey coordinate data will be submitted to the Solid Waste Section upon completion of the work.

The sampling of the proposed ground-water monitoring well MW-8 would not be implemented until approximately 3 years after initiation of landfilling activities in Phase II. Water level measurements would be collected from this well on a semiannual basis until sampling is initiated. Adjustments to this implementation schedule may be made as airspace monitoring of Phase II is performed.

Please review this submittal and offer any comments you may have. If you have any questions or comments concerning the information summarized in this request, please do not hesitate to contact me at (704) 338-6832.

Sincerely,

HDR Engineering, Inc. of the Carolinas



for John R. Isham, P.G.
Project Hydrogeologist

JRI/nt

Attachments: Existing and Proposed Ground-Water Monitoring Well Locations

cc: Ed Gibson, Winston-Salem Solid Waste Administrator

NORTH CAROLINA DEPARTMENT OF
ENVIRONMENT AND NATURAL RESOURCES

DIVISION OF WASTE MANAGEMENT

August 13, 1998



Mr. Barry Shearin, Utilities Supervisor
City of Winston-Salem
P.O. Box 2511
Winston-Salem, North Carolina 27102

Re: Solid Waste Permit No. 34-12
City of Winston-Salem Construction and Demolition Landfill located on
Old Salisbury Road, Winston-Salem, Forsyth County, North Carolina

Dear Mr. Shearin:

The referenced PERMIT TO OPERATE is issued in accordance with N.C.G.S. 130A-294 and the N.C. Solid Waste Management Rules 15A NCAC 13B. The letter submitted to the Section, dated 30 July 1998 by Joe Readling of HDR, will be listed in Attachment 1, list of documents as item #7 and is included in the Approved Plans for this facility.

This permit is for a five-year period and will be reviewed on 9 November 2000, consistent with Solid Waste Management Rules. At the end of this five-year period, the City of Winston-Salem may apply for an expansion for the use of additional cells, but will be subject to all rules in effect at that time. This permit is issued to the City of Winston-Salem as the owner and operator of the facility.

Please refer to the GENERAL Conditions of the Permit to Construct (PTC), issued 9 November 1995, for the definition of the approved plan and for general terms of the Solid Waste Permit. The CONSTRUCTION AND OPERATION conditions, in the PTC issued 9 November 1995, describe permitted fill areas, acceptable waste types, landfill operation, and requirements which must be satisfied prior to operation of the facility as a C&D landfill. Specific requirements for groundwater monitoring and facility record keeping and reporting are described in the MONITORING AND REPORTING conditions.

Mr. Shearin
Page 2
August 13, 1998

Please review the Conditions of Permit thoroughly. If you need further clarification, please contact me at (336) 771-4608 ext. 204 or Mr. Brent Rockett, the Waste Management Specialist for this area, at (336) 771-4608 ext. 208.

Sincerely,



Timothy A. Jewett
Western Area Engineer
Solid Waste Section

cc: Jim Coffey
Julian Foscue
Brent Rockett
Central File: Forsyth County; Permit file #34-12



NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

DIVISION OF WASTE MANAGEMENT

PERMIT NUMBER 34-12
ISSUED 9 NOVEMBER 1995
MODIFIED 13 AUGUST 1998



AMES B. HUNT JR.
GOVERNOR

KAYNE MCDEVITT
SECRETARY

WILLIAM L. MOYER
DIRECTOR

SOLID WASTE PERMIT

THE CITY OF WINSTON-SALEM

is hereby issued a PERMIT TO OPERATE a

CONSTRUCTION AND DEMOLITION LANDFILL

Certification No. 5 of the Phase I Area located within the Old Salisbury Road C&D Landfill Facility

located on Old Salisbury Road in Forsyth County, North Carolina based on the site plan submitted to the Section dated April 1995 and referenced as item #1 of the approved documents; in accordance with Article 9, Chapter 130A, of the General Statutes of North Carolina and all rules promulgated thereunder and subject to the conditions set forth in this permit.

James C. Coffey
James C. Coffey, Supervisor
Permitting Branch
Solid Waste Section

State of North Carolina
Department of Environment,
Health and Natural Resources
Winston-Salem Regional Office



James B. Hunt, Jr., Governor
Jonathan B. Howes, Secretary
Leesha Fuller, Regional Manager

July 3, 1996

RECEIVED

JUL 8 1996

CHARLOTTE, N.C.

Mr. Thomas Griffin
City of Winston-Salem
Utilities Division
P.O. Box 2511
Winston-Salem, NC 27102

Subject: City of Winston-Salem
Solid Waste Permit #34-12
Forsyth County

Dear Mr. Griffin:

Enclosed please find a solid waste permit and the accompanying conditions for the subject facility, issued in accordance with N.C.G.S. 130A-294 and the NC Solid Waste Management Rules, subject to the Conditions of Permit. This permit is issued for a five year period or until the approved capacity of the certified area of Phase 1 (Drawing CERT-1 dated June 28, 1996) is exhausted.

Please review the conditions of permit carefully and contact me if you have questions about them. Please contact Jim Bateson at (919) 733-0692 (extension 342) for assistance with issues concerning the groundwater monitoring plan for the site, or me at (910) 771-4608 (extension 204) for questions about other aspects of the permit.

Sincerely,

Matthew E. Ganti, E.I.T.
Western Area Engineer
Solid Waste Section

cc: Jim Coffey Brent Rockett
 Julian Foscue ↘ Joe Reading

PERMIT #34-12
ISSUED 3 JULY 1996

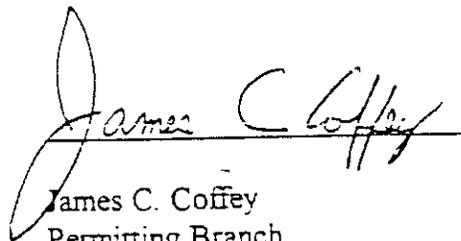
SOLID WASTE PERMIT

CITY OF WINSTON-SALEM

is hereby issued a permit to operate a

CONSTRUCTION AND DEMOLITION LANDFILL

located on Old Salisbury Road in Forsyth County, North Carolina in accordance with Article 9, Chapter 130A, of the General Statutes of North Carolina and all rules promulgated thereunder and subject to the conditions set forth in this permit.

A handwritten signature in cursive script, reading "James C. Coffey", is written over a horizontal line.

James C. Coffey
Permitting Branch
Solid Waste Section

Post-it® Fax Note	7571	Date	4/5/99	# of pages	9
To	PHILLIP WESTMORELAND	From	TIM DEWETT		
Co./Dept	HOR, ENGINEERING	Co.	NC SOLID WASTE SECT		
Phone #	(704) 338-6743	Phone #	(336) 771-4600		
Fax #	(704) 338-6760	Fax #	(336) 771-4631		

PERMIT #34-12
ISSUED 3 JULY 1996
MODIFIED 12 JANUARY 1998

STATE OF NORTH CAROLINA
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
DIVISION OF SOLID WASTE MANAGEMENT
P.O. BOX 27687 RALEIGH, NC 27611

SOLID WASTE PERMIT

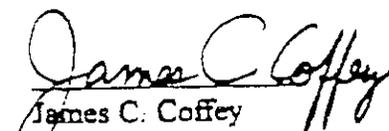
THE CITY OF WINSTON-SALEM

is hereby issued a PERMIT TO OPERATE a

CONSTRUCTION AND DEMOLITION LANDFILL

Certification No. 3 Area of Phase I located within the Old Salisbury Road C&D Landfill Facility

located on Old Salisbury Road in Forsyth County, North Carolina based on the site plan submitted to the Section dated April 1995 and referenced as item #1 of the approved documents; in accordance with Article 9, Chapter 130A, of the General Statutes of North Carolina and all rules promulgated thereunder and subject to the conditions set forth in this permit.


James C. Coffey
Permitting Branch
Solid Waste Section

PERMIT #34-12
ISSUED 3 JULY 1996
MODIFIED 12 JANUARY 1998

CITY OF WINSTON-SALEM

**SOLID WASTE PERMIT
CONSTRUCTION AND DEMOLITION LANDFILL**

CONDITIONS OF PERMIT

General:

1. This permit shall not be effective unless the certified copy is filed in the Register of Deeds office and indexed in the grantor index under the name of the owner of the land in the county or counties in which the land is located. The certified copy of the permit, affixed with the Register's seal and the date, book, and page number of recording shall be returned to the Division of Solid Waste Management (the Division).
2. When this property is sold, leased, transferred or conveyed, the deed or other instrument of transfer shall contain in the description section in no smaller type than that used in the body of the deed or instrument, a statement that the property has been used as a sanitary landfill.
3. The approved plan for this facility is described in Attachment 1, "List of Documents for Approved Plan". Where discrepancies exist, the most recent submittal and these Conditions shall govern. Some components of the approved plan may be reiterated in these Conditions.
4. This permit is not transferable.
5. A copy of this permit and the approved plan shall be maintained at the facility.
6. The owner/operator is responsible for obtaining any and all permits and approvals necessary for the development of this project including approval from appropriate agencies for a General or Individual NPDES Stormwater Discharge Permit.
7. This permit is subject to review every five years, on or before 3 July 2001, as per 15A NCAC 13B .0201(c), according to the issuance date of the permit. Modifications may be required in accordance with the rules in effect at the time of review.

Page Two of Four
Conditions of Permit #34-12

Construction and Operation:

1. This permit is for the development of the landfill within the approved facility description, Document 3 of the approved plan. Within the approved facility, development of the landfill unit is approved in Phase 1 - Certification Area No. 3 as shown on Drawing CERT-3 of Document 5.
2. All sedimentation and erosion control measures shall be conducted in accordance with the Sedimentation Control Act codified at 15 NCAC 4. Native vegetation shall be established on the completed landfill.
3. The following requirements shall be met prior to operation of this facility:
 - a. The City of Winston-Salem or its consultant shall provide documentation to the Division that site preparation (grading, placement of fill if applicable, etc.) has occurred in accordance with the construction plan and the conditions specified herein.
 - b. Site inspection shall be made by a representative of the Division.
 - c. Signs shall be posted at the facility in accordance with the NC Solid Waste Management Rules.
 - d. Groundwater monitoring wells shall be installed in accordance with the approved groundwater monitoring plan, as described in *First Attachment of Additions and Modifications to Groundwater Monitoring Plan, October, 1995*, of Document 1, and as shown on Drawing C-6 of Document 1. A baseline sampling event for background water quality shall be performed. (See Monitoring and Reporting Conditions 1(d) and 1(e).)
 - e. Recordation shall be implemented as described in General Conditions 1 and 2.
 - f. The three existing monitoring wells that will be replaced with new wells, MW-1, MW-4, and MW-5, and the old bored water supply well near the southeast corner of the site, will be properly abandoned in accordance with 15A NCAC 2C .0113(a)(2).
 - g. A comprehensive operations plan shall be submitted to the Division.
4. Operation of the facility shall occur in accordance with the NC Solid Waste Management Rules 15A NCAC 13B .0505, "Operational Requirements for Sanitary Landfills", the approved Operations Plan, and the following specific conditions:

Waste Acceptance and Disposal

- a. This solid waste management facility is approved to receive only the following:
 - i. Land-clearing debris as defined in G.S. 130A-290;
 - ii. Asphalt in accordance with G.S. 130A-294(m);

Page Three of Four
Conditions of Permit #34-12

- iii. Construction and demolition debris defined as solid waste resulting solely from construction, remodeling, repair or demolition operations on pavement, buildings, or other structures;
- iv. Inert debris defined as solid waste which is virtually inert, such as brick, concrete, rock and uncontaminated soil.

Note: Yard trash defined as solid waste consisting solely of vegetative matter resulting from landscaping maintenance (see G.S. 130A-290) is banned from disposal in this facility as per NC General Statutes.

- b. Waste shall be restricted to the smallest area feasible and compacted as densely as practical into cells.
- c. The permittee shall implement a program for detecting and preventing the disposal of unacceptable wastes. The program shall include, at a minimum:
 - i. Random inspections of incoming loads or other comparable procedures;
 - ii. Recordkeeping which documents these inspections;
 - iii. Training of personnel to recognize hazardous and other unauthorized waste types;
 - iv. Development of a contingency plan to properly manage any identified problem wastes; including provisions for removal, storage, and final disposition of these wastes.

Cover Material Requirements

- a. Operational soil cover of at least six inches shall be placed at least once per week or when the active area reaches 1/2 acre in size or more often as necessitated by the nature of the waste so as to prevent the site from becoming a visual nuisance and to prevent fire, windblown materials, vectors or water infiltration.
- b. Areas which will not have additional waste placed on them for 12 months or more, but where final elevations have not been reached, shall be covered with one foot of soil cover.
- c. Within six months of termination of disposal operations the final cover system shall be installed.

Miscellaneous Operational

- a. All pertinent landfill operating personnel shall receive training and supervision necessary to carry out their duties in a safe manner.
- b. Upon closure of this facility, the closure and post-closure plan that is included in the approved plan must be implemented. The soils that are to be utilized for the eighteen

Page Four of Four
Conditions of Permit #34-12

inch compacted soil layer must be tested and construction specifications for the placement of this soil be submitted to the Section for approval. All measures necessary shall be taken to close the facility in accordance with all rules in effect at that time.

Monitoring and Reporting

1. Groundwater quality at this facility is subject to the classification and remedial action provisions of 15 NCAC 2L. Water quality monitoring shall occur in accordance with the following specific conditions:
 - a. The permittee shall sample the monitoring wells on a semi-annual basis, or as directed by the Section Hydrogeologist.
 - b. Sampling methods and equipment shall conform to specifications found in Attachment 2, "North Carolina Water Quality Monitoring Guidance Document for Solid Waste Facilities". Sampling parameters shall conform to those found in Attachment 3, "Sampling and Analysis Requirements".
 - c. The permittee shall maintain a record of all monitoring events and analytical data. Reports of the analytical data for each sampling event shall be submitted to the Division in a timely manner.
 - d. Prior to the acceptance of waste, a background sampling event shall be performed. The results of this sampling event shall be submitted to the Section Hydrogeologist in a timely manner. (See Construction and Operation Condition 3(d).)
 - e. Well completion records and boring logs shall be submitted to the Division at the same time as the results of the initial sampling event. (See Construction and Operation Condition 3(d).)
2. Explosive gas monitoring shall be performed as needed to ensure compliance with the standards in Rule .0503 (2)(a).
3. The permittee shall maintain a record of the amount of waste (in tons) that is received at the facility, compiled on a monthly basis by type and county of origin.
4. On or before 01 August 1997, and each year thereafter, the permittee shall report the amount of waste received at this facility and disposed of in the landfill to the Division and to all counties from which waste was accepted, on forms prescribed by the Division.
5. All pertinent records and reports shall be kept on site and made available to the Division upon request.

PERMIT #34-12
ISSUED 3 JULY 1996
MODIFIED 12 JANUARY 1998

ATTACHMENT 1

List of Documents for the Approved Plan

1. Site Plan Application; submitted by HDR Engineering, Inc. April, 1995
2. Construction Plan Application; submitted by HDR Engineering, Inc. June, 1995
3. Legal Description of the Facility
4. Letter dated 17 June 1997 submitted to the Section by HDR Engineering, Inc. certifying the western half of Phase 1A.
5. Letter dated 12 January 1998 submitted to the Section by HDR Engineering, Inc. providing Certification No.3 for Phase I.

State of North Carolina
Department of Environment,
Health and Natural Resources
Winston-Salem Regional Office



James B. Hunt, Jr., Governor
Jonathan B. Howes, Secretary
Leesha Fuller, Regional Manager

November 9, 1995

Mr. Thomas Griffin
City of Winston-Salem
Utilities Division
P.O. Box 2511
Winston-Salem, NC 27102

RECEIVED
NOV 10 1995
DEPARTMENT OF ENVIRONMENT,
HEALTH AND NATURAL RESOURCES
Winston-Salem, NC

Subject: City of Winston-Salem
Solid Waste Permit #34-12
Forsyth County

Dear Mr. Griffin:

Enclosed please find a solid waste permit and the accompanying conditions for the subject facility, issued in accordance with N.C.G.S. 130A-294 and the NC Solid Waste Management Rules, subject to the Conditions of Permit. This permit is issued for a five year period or until the approved capacity of Phase 1 is exhausted.

Please review the conditions of permit carefully and contact me if you have questions about them. Note in particular Construction and Operation Condition No. 3 which establishes the requirements which must be met before the Section can issue approval to operate this landfill. Please contact Jim Bateson at (919) 733-0692 (extension 342) for assistance with issues concerning the groundwater monitoring plan for the site, or me at (910) 771-4608 (extension 204) for questions about other aspects of the permit.

Sincerely,

Janis D. McHargue, PE
Western Area Engineer
Solid Waste Section

cc: Jim Coffey
Julian Foscue

State of North Carolina
Department of Environment,
Health and Natural Resources
Division of Solid Waste Management



James B. Hunt, Jr., Governor
Jonathan B. Howes, Secretary
William L. Meyer, Director

PERMIT #34-12
ISSUED 9 NOVEMBER 1995

SOLID WASTE PERMIT

CITY OF WINSTON-SALEM

is hereby issued a permit to construct and operate a
CONSTRUCTION AND DEMOLITION LANDFILL

located on Old Salisbury Road in Forsyth County, North Carolina in accordance with Article 9, Chapter 130A, of the General Statutes of North Carolina and all rules promulgated thereunder and subject to the conditions set forth in this permit.

James C. Coffey
Permitting Branch
Solid Waste Section

Permit #34-12
Issued 9 November 1995

CITY OF WINSTON-SALEM

**SOLID WASTE PERMIT
CONSTRUCTION AND DEMOLITION LANDFILL**

CONDITIONS OF PERMIT

General:

1. This permit shall not be effective unless the certified copy is filed in the Register of Deeds office and indexed in the grantor index under the name of the owner of the land in the county or counties in which the land is located. The certified copy of the permit, affixed with the Register's seal and the date, book, and page number of recording shall be returned to the Division of Solid Waste Management (the Division).
2. When this property is sold, leased, transferred or conveyed, the deed or other instrument of transfer shall contain in the description section in no smaller type than that used in the body of the deed or instrument, a statement that the property has been used as a sanitary landfill.
3. The approved plan for this facility is described in Attachment 1, "List of Documents for Approved Plan". Where discrepancies exist, the most recent submittal and these Conditions shall govern. Some components of the approved plan may be reiterated in these Conditions.
4. This permit is not transferable.
5. A copy of this permit and the approved plan shall be maintained at the facility.
6. The owner/operator is responsible for obtaining any and all permits and approvals necessary for the development of this project including approval from appropriate agencies for a General or Individual NPDES Stormwater Discharge Permit.
7. This permit is subject to review every five years as per 15A NCAC 13B .0201(c), according to the issuance date of the permit. Modifications may be required in accordance with the rules in effect at the time of review.

Construction and Operation:

1. This permit is for the development of the landfill within the approved facility description, Document 3 of the approved plan. Within the approved facility, development of the landfill unit is approved in Phase 1, as shown on Drawing C-2 of Document 2.
2. All sedimentation and erosion control measures shall be conducted in accordance with the Sedimentation Control Act codified at 15 NCAC 4. Native vegetation shall be established on the completed landfill.
3. The following requirements shall be met prior to operation of this facility:
 - a. The City of Winston-Salem or its consultant shall provide documentation to the Division that site preparation (grading, placement of fill if applicable, etc.) has occurred in accordance with the construction plan and the conditions specified herein.
 - b. Site inspection shall be made by a representative of the Division.
 - c. Signs shall be posted at the facility in accordance with the NC Solid Waste Management Rules.
 - d. Groundwater monitoring wells shall be installed in accordance with the approved groundwater monitoring plan, as described in *First Attachment of Additions and Modifications to Groundwater Monitoring Plan, October, 1995*, of Document 1, and as shown on Drawing C-6 of Document 1. A baseline sampling event for background water quality shall be performed. (See Monitoring and Reporting Conditions 1(d) and 1(e).)
 - e. Recordation shall be implemented as described in General Conditions 1 and 2.
 - f. The three existing monitoring wells that will be replaced with new wells, MW-1, MW-4, and MW-5, and the old bored water supply well near the southeast corner of the site, will be properly abandoned in accordance with 15A NCAC 2C .0113(a)(2).
 - g. A comprehensive operations plan shall be submitted to the Division.
4. Operation of the facility shall occur in accordance with the NC Solid Waste Management Rules 15A NCAC 13B .0505, "Operational Requirements for Sanitary Landfills", the approved Operations Plan, and the following specific conditions:

Waste Acceptance and Disposal

- a. This solid waste management facility is approved to receive only the following:
 - i. Land-clearing debris as defined in G.S. 130A-290;
 - ii. Asphalt in accordance with G.S. 130A-294(m);
 - iii. Construction and demolition debris defined as solid waste resulting solely

from construction, remodeling, repair or demolition operations on pavement, buildings, or other structures;

- iv. Inert debris defined as solid waste which is virtually inert, such as brick, concrete, rock and uncontaminated soil.

Note: Yard trash defined as solid waste consisting solely of vegetative matter resulting from landscaping maintenance (see G.S. 130A-290) is banned from disposal in this facility as per NC General Statutes.

- b. Waste shall be restricted to the smallest area feasible and compacted as densely as practical into cells.
- c. The permittee shall implement a program for detecting and preventing the disposal of unacceptable wastes. The program shall include, at a minimum:
 - i. Random inspections of incoming loads or other comparable procedures;
 - ii. Recordkeeping which documents these inspections;
 - iii. Training of personnel to recognize hazardous and other unauthorized waste types;
 - iv. Development of a contingency plan to properly manage any identified problem wastes; including provisions for removal, storage, and final disposition of these wastes.

Cover Material Requirements

- a. Waste shall be covered once per week with at least 6 inches of suitable cover, or more frequently if necessary to prevent a public health nuisance.
- b. Areas which will not have additional waste placed on them for 12 months or more, but where final elevations have not been reached, shall be covered with one foot of soil cover.
- c. Within six months of termination of disposal operations the final cover system shall be installed.

Miscellaneous Operational

- a. All pertinent landfill operating personnel shall receive training and supervision necessary to carry out their duties in a safe manner.
- b. Upon closure of this facility, the closure and post-closure plan that is included in the approved plan must be implemented. The soils that are to be utilized for the eighteen inch compacted soil layer must be tested and construction specifications for the placement of this soil be submitted to the Section for approval. All measures

necessary shall be taken to close the facility in accordance with all rules in effect at that time.

Monitoring and Reporting

1. Groundwater quality at this facility is subject to the classification and remedial action provisions of 15 NCAC 2L. Water quality monitoring shall occur in accordance with the following specific conditions:
 - a. The permittee shall sample the monitoring wells on a semi-annual basis, or as directed by the Section Hydrogeologist.
 - b. Sampling methods and equipment shall conform to specifications found in Attachment 2, "North Carolina Water Quality Monitoring Guidance Document for Solid Waste Facilities". Sampling parameters shall conform to those found in Attachment 3, "Sampling and Analysis Requirements".
 - c. The permittee shall maintain a record of all monitoring events and analytical data. Reports of the analytical data for each sampling event shall be submitted to the Division in a timely manner.
 - d. Prior to the acceptance of waste, a background sampling event shall be performed. The results of this sampling event shall be submitted to the Section Hydrogeologist in a timely manner. (See Construction and Operation Condition 3(d).)
 - e. Well completion records and boring logs shall be submitted to the Division at the same time as the results of the initial sampling event. (See Construction and Operation Condition 3(d).)
2. Explosive gas monitoring shall be performed as needed to ensure compliance with the standards in Rule .0503 (2)(a).
3. The permittee shall maintain a record of the amount of waste (in tons) that is received at the facility, compiled on a monthly basis by type and county of origin.
4. On or before 01 August 1997, and each year thereafter, the permittee shall report the amount of waste received at this facility and disposed of in the landfill to the Division and to all counties from which waste was accepted, on forms prescribed by the Division.
5. All pertinent records and reports shall be kept on site and made available to the Division upon request.

Permit #34-12
Issued 9 Nov 1995

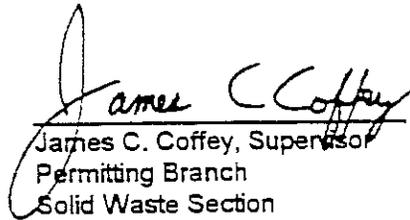
ATTACHMENT 1

List of Documents for the Approved Plan

1. Site Plan Application; submitted by HDR Engineering, Inc. April, 1995
2. Construction Plan Application; submitted by HDR Engineering, Inc. June, 1995
3. Legal Description of the Facility

CERTIFIED COPY OF SOLID WASTE PERMIT

I do hereby certify that the attached permit is an exact and true copy of Permit Number 34-12.

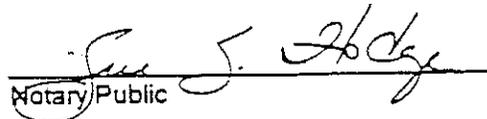

James C. Coffey, Supervisor
Permitting Branch
Solid Waste Section

North Carolina

Wake County

I, Sue S. Hodge, a Notary Public for said County and State, do hereby certify that James C. Coffey, Supervisor, Permitting Branch, personally appeared before me this day and acknowledged the due execution of the foregoing instrument.

Witness my hand and seal, this the 7 day of November, 1995.


Notary Public

My commission expires October 21, ~~19~~ ²⁰⁰⁰.

131

4-1-94 10:2071
PRESENTED FOR
REGISTRATION
APR 1 1994

'94 APR -1 P3:59

L.E. SPEAS
REGISTER OF DEEDS
FORSYTH CO. N.C.

\$1200.00
Owies



\$140.00
Real Estate
Excise Tax

Excise Tax \$140.00

Recording Time, Book and Page

Tax lot No. 1-7, Block 3872 Parcel Identifier No.
Verified by County on the day of 19
by

Mail after recording to Drawer of Leslie E. Browder

This instrument was prepared by PARKS ROBERTS, ATTORNEY AT LAW

Brief description for the Index

NORTH CAROLINA GENERAL WARRANTY DEED

THIS DEED made this 29th day of MARCH 19 94 by and between

GRANTOR

GRANTEE

GARRIS E. EDWARDS
and wife.
JUDITH B. EDWARDS

NORTH CAROLINA MUNICIPAL LEASING CORPORAT

Enter in appropriate block for each party: name, address, and, if appropriate, character of entity, e.g. corporation or partnership.

The designation Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns and shall include singular, plural, masculine, feminine or neuter as required by context.

WITNESSETH, that the Grantor, for a valuable consideration paid by the Grantee, the receipt of which is hereby acknowledged, has and by these presents does grant, bargain, sell and convey unto the Grantee in fee simple, all that certain lot or parcel of land situated in the City of South Fork Township, Forsyth County, North Carolina and more particularly described as follows:

SEE ATTACHED SHEET MARKED EXHIBIT "A" FOR COMPLETE DESCRIPTION AND INCORPORATED HEREIN BY REFERENCE.

The property hereinabove described was acquired by Grantor by instrument recorded in

A map showing the above described property is recorded in Plat Book 10 page 43

TO HAVE AND TO HOLD the aforesaid lot or parcel of land and all privileges and appurtenances thereto belonging to the Grantee in fee simple.

And the Grantor covenants with the Grantee, that Grantor is seized of the premises in fee simple, has the right to convey the same in fee simple, that title is marketable and free and clear of all encumbrances, and that Grantor will warrant and defend the title against the lawful claims of all persons whomsoever except for the exceptions hereinafter stated. Title to the property hereinabove described is subject to the following exceptions:

Easements and restrictive covenants of record, if any. 1994 ad valorem taxes to be prorated.

IN WITNESS WHEREOF, the Grantor has hereunto set his hand and seal, or if corporate, has caused this instrument to be signed in its corporate name by its duly authorized officers and its seal to be hereunto affixed by authority of its Board of Directors, the day and year first above written.

.....
(Corporate Name)

BY:

..... President

ATTEST:

..... Secretary (Corporate Seal)

USE BLACK INK ONLY

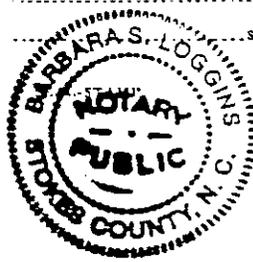
Garris E. Edwards (SEAL)
GARRIS E. EDWARDS

Judith B. Edwards (SEAL)
JUDITH B. EDWARDS

..... (SEAL)

..... (SEAL)

..... (SEAL)



NORTH CAROLINA, Forsyth County.

I, a Notary Public of the County and State aforesaid, certify that
GARRIS E. EDWARDS and wife, JUDITH B. EDWARDS Grantor,

personally appeared before me this day and acknowledged the execution of the foregoing instrument. Witness my hand and official stamp or seal, this 29th day of MARCH 1984.

My commission expires: 5/6/96 *Barbara S. Loggins* Notary Public

SEAL-STAMP

NORTH CAROLINA, County.

I, a Notary Public of the County and State aforesaid, certify that

personally came before me this day and acknowledged that he is Secretary of
..... a North Carolina corporation, and that by authority duly
given and as the act of the corporation, the foregoing instrument was signed in its name by its
President, seated with its corporate seal and attested by as its Secretary.

Witness my hand and official stamp or seal, this day of, 19.....

My commission expires: Notary Public

The foregoing Certificate(s) of BARBARA S. LOGGINS, NOTARY PUBLIC, STOKES COUNTY, NORTH CAROLINA.

is certified to be correct. This instrument and this certificate are duly registered at the date and time and in the Book and Page shown on the first page hereof.

L.E. SPEAS, REGISTER OF DEEDS REGISTER OF DEEDS FOR FORSYTH COUNTY

By *Crystal R. Lee* Deputy/Assistant Register of Deeds

EXHIBIT "A"

BEGINNING at an iron located in the West right of way line of Old Salisbury Road, said iron being located at the Northeast corner of James Albert Cox's property; running thence with said Cox property, North 89 degrees 28 minutes 24 seconds West 110.20 feet to an iron located at the Northeast corner of Donald R. Hege's property, North 87 degrees 58 minutes 09 seconds West 236.69 feet to an iron; running thence with the property of Ruby N. Tesh, et al, North 02 degrees 15 minutes 21 seconds East 350.01 feet to an iron located at the Southwest corner of Lot 8, as shown on the plat of C.A. Mendenhall Estate recorded in Plat Book 10, page 43, Forsyth County Registry; running thence with said Lot 8, South 88 degrees 14 minutes 11 seconds East 283.79 feet to an iron located in the West right of way line of Old Salisbury Road; running thence with the West right of way line of Old Salisbury Road, on a curve to the left, a chord distance of South 04 degrees 19 minutes 33 seconds East 190.11 feet to an iron and South 13 degrees 11 minutes 44 seconds East 165.28 feet to the POINT AND PLACE OF BEGINNING. Containing 2.45 acres, more or less, as shown on Map of City of Winston-Salem Utilities Division, dated March 15, 1994, and prepared by W. Max Brady, Registered Land Surveyor, dated March 15, 1994.

Being all of Lots 1 through 7, inclusive, as shown on plat of C.A. Mendenhall Estate property, recorded in Plat Book 10, Page 43, Forsyth County Registry, except the portion that lies within the right of way of Old Salisbury Road.

This conveyance is subject to the rights of others, if any, to use the old farm road running along the West side of subject property.

100

W. 1820 #2074
PRESENTED FOR
REGISTRATION
AND RECORDING

'94 APR -7 P3:59

L.E. SPEAS
REGISTER OF DEEDS
FORSYTH CO. N.C.

\$12.00
[Signature]



#1788.00
Real Estate
Excise Tax

Excise Tax

Recording Time, Book and Page

Tax Lot No. Parcel Identifier No.
Verified by County on the day of, 19
by

Mail after recording to Drawer of Leslie E. Browder

This instrument was prepared by Leslie E. Browder

Brief description for the Index

NORTH CAROLINA GENERAL WARRANTY DEED

THIS DEED made this 7th day of April, 19 94, by and between

GRANTOR

GRANTEE

RUBY N. TESH (Widow)

NORTH CAROLINA MUNICIPAL LEASING
CORPORATION, a North Carolina corporation

Enter in appropriate block for each party: name, address, and, if appropriate, character of entity, e.g. corporation or partnership.

The designation Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns, and shall include singular, plural, masculine, feminine or neuter as required by context.

WITNESSETH, that the Grantor, for a valuable consideration paid by the Grantee, the receipt of which is hereby acknowledged, has and by these presents does grant, bargain, sell and convey unto the Grantee in fee simple, all that certain lot or parcel of land situated in the City of South Fork Township, Forsyth County, North Carolina and more particularly described as follows:

SEE EXHIBIT "A" ATTACHED HERETO AND INCORPORATED HEREIN BY REFERENCE.

The property hereinabove described was acquired by Grantor by instrument recorded in

A map showing the above described property is recorded in Plat Book page

TO HAVE AND TO HOLD the aforesaid lot or parcel of land and all privileges and appurtenances thereto belonging to the Grantee in fee simple.

And the Grantor covenants with the Grantee, that Grantor is seized of the premises in fee simple, has the right to convey the same in fee simple, that title is marketable and free and clear of all encumbrances, and that Grantor will warrant and defend the title against the lawful claims of all persons whomsoever except for the exceptions hereinafter stated. Title to the property hereinabove described is subject to the following exceptions:

Easements, rights of way of record and restrictive covenants of record, if any, and 1994 ad valorem taxes which have been prorated to the date of delivery of this deed of conveyance.

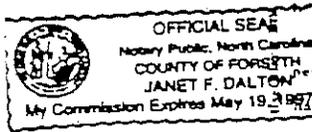
IN WITNESS WHEREOF, the Grantor has hereunto set his hand and seal, or if corporate, has caused this instrument to be signed in its corporate name by its duly authorized officers and its seal to be hereunto affixed by authority of its Board of Directors, the day and year first above written.

.....
(Corporate Name)
By:
..... President
ATTEST:
.....
..... Secretary (Corporate Seal)

USE BLACK INK ONLY

Ruby N. Tesh
Ruby N. Tesh (Widow) (SEAL)

SEAL-STAMP NORTH CAROLINA, Forsyth County.



Notary Public of the County and State aforesaid, certify that Ruby N. Tesh (Widow) Grantor,

personally appeared before me this day and acknowledged the execution of the foregoing instrument. Witness my hand and official stamp or seal, this 7 day of April 1994.

My commission expires: 5/19/97 Janet F. Dalton Notary Public

SEAL-STAMP NORTH CAROLINA, County.

Use Black Ink

I, a Notary Public of the County and State aforesaid, certify that Secretary of
personally came before me this day and acknowledged that he is a North Carolina corporation, and that by authority duly
given and as the act of the corporation, the foregoing instrument was signed in its name by its
President, seated with its corporate seal and attested by as its Secretary.
Witness my hand and official stamp or seal, this day of 19.....

My commission expires: Notary Public

The foregoing Certificate(s) of
.....

is/are certified to be correct. This instrument and this certificate are duly registered at the date and time and in the Book and Page shown first page hereof.

L.E. SPEAS, REGISTER OF DEEDS REGISTER OF DEEDS FOR FORSYTH COUNTY

By *Cynthia Ball* Deputy/Assistant Register of Deeds

EXHIBIT "A"

LYING AND BEING in Southfork Township, Forsyth County, State of North Carolina, and beginning at a monument, said monument being located in the common boundary line between the counties of Forsyth and Davidson, and being the southeast corner of Lot No. 16 as set out upon that plat recorded in Plat Book 23 at Page 113 in the Office of the Register of Deeds of Forsyth County, North Carolina; and running thence from said beginning iron monument North 06° 31' 36" West 1,870.84 feet to a monument in the southern boundary line of Emory R. Snyder and wife, Sarah Bell Snyder (see Deed Book 699 at Page 316); thence along the boundary line of Emory R. Snyder, et ux, the two (2) following courses and distances: North 69° 36' 16" East 620.27 feet to an iron stake; and North 34° 37' 13" West 227.37 feet to an iron stake; thence along the boundary line of Jimmie R. Stewart (see Deed Book 1681 at Page 600) the two (2) following courses and distances: North 77° 55' 07" East 722.66 feet to an iron stake; and North 04° 06' 46" West 301.86 feet to an iron stake; thence South 89° 17' 15" East 961.41 feet to an iron stake in the western boundary line of Aren B. Beshears and wife, Ruby S. Beshears (see Deed Book 1228 at Page 1757); thence along the western boundary line of Beshears South 02° 25' 34" West 431.42 feet to an iron stake; thence along the western boundary line of F.C. Mendenhall and wife, Ersley H. Mendenhall (see Deed Book 616 at Page 309) South 02° 57' 26" West 1,185.35 feet to an iron stake; thence along a new line South 02° 57' 26" West 1,122.56 feet to an iron stake in the mutual boundary line between the counties of Forsyth and Davidson; thence along the mutual boundary line between the counties of Forsyth and Davidson the two (2) following courses and distances: North 88° 29' 39" West 199.66 feet to a monument; and North 88° 57' 18" West 1,549.24 feet to the point and place of beginning, same containing 108.24 acres, more or less, being further known as a part of Tax Lot 1, Tax Block 3881 as set out upon the Tax Maps in the Office of the Forsyth County Tax Supervisor as said maps are presently constituted, and being that same property surveyed and platted by W. Max Brady, Jr., R.L.S. on the 15th day of March, 1994.

APPENDIX B
CALCULATIONS

Site Volume Table: Unadjusted

Site	Stratum	Surf1	Surf2	yards	Cut	yards	Fill	yards	Net	Method
OSR C-D Ph456	Vert	Exp								
	cap comparison	flat to	vert exp	phase 456	flat final	1319	phases 4-5-6	vert exp	1092796 (F)	Composite
							1094115			

APPENDIX C

EROSION CONTROL

North Carolina
Department of Environment and Natural

Michael F. Easley, Governor
William G. Ross Jr., Secretary

James D. Simons, P.G., P.E., Acting Director
and State Geologist

August 22, 2002

RECEIVED
AUG 23 2002
HDR ENGINEERING, INC.
OF THE CAROLINAS



WINSTON-SALEM REGIONAL OFFICE
DIVISION OF LAND RESOURCES
LAND QUALITY SECTION

LETTER OF APPROVAL WITH MODIFICATIONS

City of Winston-Salem
City/County Utilities Commission
P.O. Box 2511
Winston-Salem, NC 27102

Dear Sir or Madam:

This office has reviewed the subject erosion and sedimentation control plan. We find the plan to be acceptable with modifications and hereby issue this Letter of Approval with Modifications. The Modifications Required for Approval are listed on the attached page. This plan approval shall expire three (3) years following the date of approval, if no land-disturbing activity has been undertaken, as is required by Title 15A NCAC 4B .0029.

Please be advised that Title 15 NCAC 4B.0018 (a) requires that a copy of the approved erosion control plan be on file at the job site. Also, you should consider this letter to give the notice required by G.S. 113A-61.1 (a) of our right of periodic inspection to insure compliance with the approved plan.

North Carolina's Sedimentation Pollution Control Program is performance-oriented, requiring protection of existing natural resources and adjoining properties. If, following the commencement of this project, it is determined that the erosion and sedimentation control plan is inadequate to meet the requirements of the Sedimentation and Pollution Control Act of 1973 (North Carolina General Statute 113A-51 through 66), this office may require revisions to the plan and implementation of the revisions to insure compliance with the Act.

Acceptance and approval of this plan is conditioned upon your compliance with Federal and State water quality laws, regulations, and rules. In addition, local city or county ordinances or rules may also apply to this land-disturbing activity. This approval does not supersede any other permit or approval.

585 Waightown Street, Winston-Salem, North Carolina 27107-2241

Phone: 336-771-4600 \ FAX: 336-771-4631 Internet: www.enr.state.nc.us/ENR/

AN EQUAL OPPORTUNITY \ AFFIRMATIVE ACTION EMPLOYER - 50% RECYCLED / 10% POST CONSUMER PAPER

MODIFICATIONS REQUIRED FOR APPROVAL

This plan is approved with the following modification:

1. In the absence of soil tests fertility results lime must be applied at a minimum rate of two (2) tons per acre and a balanced formulation of fertilizer applied at a rate of 1000 pounds per acre.

CERTIFICATE OF PLAN APPROVAL



The posting of this certificate certifies that an erosion and sedimentation control plan has been approved for this project by the North Carolina Department of Environment and Natural Resources in accordance with North Carolina General Statute 113A - 57 (4) and 113A - 54 (d) (4) and North Carolina Administrative Code, Title 15A, Chapter 4B.0007 (c). This certificate must be posted at the primary entrance of the job site before construction begins and until establishment of permanent groundcover as required by North Carolina Administrative Code, Title 15A, Chapter 4B.0027 (b).

Old Salisbury Road Landfill Ph. 9, 576

Project Name and Location

8-22-02

Date of Plan Approval

w/mod.



Assist.

Assist. Regional Engineer
Land Quality Section

Burke Ch

DIVISION OF LAND RESOURCES

EROSION CONTROL PLAN

FOR THE

OLD SALISBURY ROAD C&D LANDFILL
PHASE IV, V, AND VI EXPANSION

WINSTON-SALEM, NORTH CAROLINA



JULY 2002

HDR

HDR Engineering, Inc.
of the Carolinas

July 19, 2002



Mr. Brooks Cole, CPESC
Assistant Regional Engineer
North Carolina Department of Environment
and Natural Resources
Land Quality Section
585 Waughtown Street
Winston-Salem, NC 27107

Re: Old Salisbury Road C&D Landfill Phases IV, V, and VI
Winston-Salem, NC
Erosion and Sediment Control Plan
HDR Project No. 00162-525-018

Dear Mr. Cole:

Enclosed is the Erosion Control Plan submittal for the above referenced project. This plan addresses the proposed disturbance of approximately 29 acres of land located at the northern end of the existing C&D landfill. The City of Winston Salem is planning on developing Phases IV, V and VI of the C&D landfill.

The City of Winston-Salem (City) is submitting a check in the amount of \$1,160 for the 29 acres of disturbance along with an executed Financial Responsibility and Ownership Form under separate cover. In addition, the City is currently pursuing a Mining Permit to allow removal of the excavated material off-site.

If you have any questions regarding this submittal, please do not hesitate to contact me.

Sincerely,

HDR Engineering, Inc. of the Carolinas

A handwritten signature in black ink, appearing to read 'Michael D. Plummer', written over a horizontal line.

Michael D. Plummer, PE
Project Engineer

MDP/mdp

Enclosure

cc: Edward Gibson, w/attachments
Danny Hockett, w/attachments

**HDR Engineering, Inc.
of the Carolinas**

Employee Owned

Suite 1400
128 S. Tryon Street
Charlotte, North Carolina
28202-5001

Telephone
704 338-6700
Fax
704 338-6760

EROSION CONTROL PLAN
FOR THE OLD SALISBURY ROAD C&D LANDFILL
PHASE IV, V, AND VI EXPANSION

WINSTON-SALEM, NORTH CAROLINA

Prepared for:

**City/County Utility Commission
City of Winston-Salem
P.O. Box 2511
Winston-Salem, NC 27102**

Prepared by:

**HDR Engineering, Inc. of the Carolinas
128 S. Tryon Street, Suite 1400
Charlotte, NC 28202-5001**

HDR
HDR Engineering, Inc.
of the Carolinas

JULY 2002

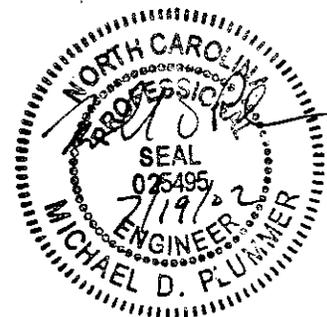


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Appendices

Appendix A – Calculations

Sediment Basins Numbers 6 and 7 (Design)
Sediment Basin Number 5 (Check)
Perimeter Channels
Sideslope Swales
Slope Drain

Appendix B – Technical Specifications

02110 Site Clearing
02220 Earthwork
02270 Soil and Erosion Control
02271 Stone Revetment (Rip Rap)
02485 Seeding
02511 Aggregate Course
02720 Erosion Control Blankets

Appendix C – Drawings

ES-01 Existing Conditions
ES-02 Proposed Excavation Plan
ES-03 Proposed Final Grading Plan
ES-04 Erosion Control Details (1 of 2)
ES-05 Erosion Control Details (2 of 2)

1.0 PURPOSE

The purpose of this Erosion and Sediment Control Plan (Plan) is to obtain a Certificate of Plan Approval from the North Carolina Department of Environment and Natural Resources (NCDENR) to expand the existing soil borrow area at the Old Salisbury Road Landfill (Landfill). This Plan describes the erosion and sedimentation control features for the proposed landfill expansion (Phase IV, V, and VI Expansion), the operational procedures for the area, and potential development of the site as a Construction and Demolition Debris (C&D) landfill. This Plan addresses disturbance for approximately 29 acres and has been prepared in accordance with the *North Carolina Erosion and Sediment Control Planning and Design Manual Guidelines*.

2.0 BACKGROUND

The City of Winston-Salem, North Carolina (City) owns the existing Landfill located west of Old Salisbury Road (SR 3001) and north of Friedberg Road (SR 3132) at the Forsyth/Davidson County Line. The existing landfill is used for the disposal of C&D generated within the City and Forsyth County. The landfill property is comprised of approximately 140 acres, in which three landfill phases have been constructed comprising 31 acres of the property. Phase I was permitted for construction by NCDENR on July 3, 1996; Phase II was permitted October 15, 1999; and Phase III was permitted on August 2, 2000. It is anticipated that landfill activities in the current landfill unit will cease in August 2003.

The City purchased 55 acres adjacent to the northwest boundary of the landfill property. This property is a stockpile area for the excavation from the landfill phases. An erosion and sedimentation control plan was approved for stockpiling the excavation material from Phase III construction. The City is currently pursuing a Mining Permit to handle the excess soil in Phases IV, V, and VI.

3.0 CONTACT INFORMATION

Owner: The owner of the site and the person to contact should sediment control issues arise during the land-disturbing activity is as follows:

City/County Utilities Commission
Attn.: Edward Gibson, P.E., Solid Waste Administrator
City of Winston-Salem
100 East First Street, Suite 131
Winston-Salem, NC 27102
Telephone: (336) 727-8418 Fax: (336) 727-8432

Engineer: For questions regarding this Plan, please contact the following:

HDR Engineering, Inc. of the Carolinas
Attn.: Michael D. Plummer, P.E.
128 South Tryon Street, Suite 1400
Charlotte, NC 28202-5001
Telephone: (704) 338-6700 Fax: (704) 338-6760

4.0 PROJECT DESCRIPTION

The City plans to expand its current landfill into Phases IV, V, and VI. The City will use soil from the landfill excavation for on-site operations; however there will be more excavated material than can be used. Therefore, the City is applying for a Mining Permit to allow removal of excess material from the property. In addition to the landfill, there will be an access road constructed around the landfill perimeter. The total disturbed area within the clearing limits is 29 acres. The work consists of clearing and grubbing, installing erosion and sediment control features, construction of the access road, and excavation of soils.

5.0 EXISTING CONDITIONS

The Phase IV, V, and VI Expansion area expands the existing landfill north and northeast and will expand the landfill footprint by approximately 25 acres. The expansion area is comprised of heavily, wooded forest. Existing ground surface elevations vary from Elevation 824 (feet) at the top of the hill to Elevation 728 (feet) along the drainage feature on the eastern side of the landfill. The borrow material will be used as weekly, intermediate, and final cover for the active Landfill.

6.0 DESIGN GUIDELINES AND PROCEDURES

This Plan for the Phase IV, V, and VI Expansion was conducted based on guidelines and procedures as set forth in the *North Carolina Erosion and Sediment Control Planning and Design Manual* and *Elements of Urban Stormwater Design* by H. Rooney Malcom, P.E. Design calculations are provided as an attachment to this Plan.

Stormwater runoff flows were calculated using the Rational Method based on the maximum rate of runoff from a 25-year storm event for the sediment basins and drainage channels. Runoff coefficients for various groundcover conditions are referenced in the above-mentioned documents. Rainfall intensities used in the concentration were calculated with the Kirpirch Equation. Drainage areas were determined using a planimeter and/or AutoCAD on topographic sheets of the project area.

7.0 EROSION AND SEDIMENTATION CONTROL MEASURES

The following erosion and sedimentation control measures are to be used in construction of the Phase IV, V, and VI Expansion: Sediment Basins, Drainage Channels, Diversion Berms, Silt Fence, and Seeding. Attachments A, B, and C to this Plan include technical specifications, calculations, plans, and details for each of these measures.

8.0 SEDIMENT BASINS

There are two proposed permanent sediment basins (Sediment Basins numbers 6 and 7), which will serve the Phase IV, V, and VI Expansion. Sediment basin design is subject to several requirements. The sediment basin must provide a basin volume of 1,800 ft³/acre of disturbed area and a minimum surface area of 1 percent of the peak flow runoff. The crest of the emergency spillway is set one foot above the invert of the riser and must pass the peak runoff from the ten-year storm event with one foot of freeboard to crest of berm. The principal and emergency spillways were designed using a spreadsheet based on methods provided in *Elements of Urban Stormwater Design*. These methods provide a more detailed design than provided in the *North Carolina Design Manual* while meeting the above requirements. The riser/barrel assembly must be provided with an anchor displacing a buoyant weight of at least 1.1 times the weight of water displaced by the riser. The riser must also be provided with a method of dewatering the basin. This design was performed in accordance with criteria from the *North Carolina Design Manual*.

9.0 DRAINAGE CHANNELS

Drainage channel calculations were conducted using a reformulation of Manning's Equation to calculate normal depth of flow, as set forth in *Elements of Urban Stormwater Design*, for given conditions to establish ditch capacity and flow velocity. For conservatism, the channel calculations assume peak flow over maximum slope of channel reach in determining velocity. Channels were first checked assuming bare earth as the initial condition. The maximum allowable velocity for bare earth was assumed to be 2.5 feet per second (*North Carolina Design Manual*, Table 8.05d). If the velocity exceeded this value, a temporary liner was chosen if appropriate. Normal depth and velocity was then calculated assuming grass lining as a minimum constructed condition. The allowable velocity for grass lining was assumed to be 4.5 feet per second (*North Carolina Design Manual*, Table 8.05a). If velocity exceeded 4.5 feet, a permanent liner was designed.

10.0 TEMPORARY DIVERSION BERMS

Temporary diversion berms are to be installed on disturbed slopes and above cut slopes to prevent runoff from flowing over the slope. The temporary diversion berms will divert stormwater runoff into the appropriate sediment basins. No more than half (14.5 acres) of the disturbed area may be diverted to Sediment Basin No. 7. Temporary diversion berm slopes are designed to minimize the erosive velocity of the stormwater within the diversion channel. Drainage areas will be minimized as necessary. Diversion berm capacity, velocity, and ridge design were designed in accordance the *North Carolina Design Manual*, Section 6.20.

11.0 SLOPE DRAINS

Slope drains are to be installed on the disturbed slopes of the landfill cap to collect runoff from the sideslope channels and direct it into either a perimeter channel or sediment basin. The pipes were sized to handle the amount of drainage area directed to them and in accordance with the *North Carolina Design Manual*, Section 6.20.

12.0 VEGETATIVE STABILIZATION

Vegetative stabilization will be in accordance with the seeding schedule in the project specifications and on the plans. The seeding schedule was prepared with reference to the *North Carolina Design Manual*, Sections 6.10 and 6.11, and seeding regimes used in the geographic location.

13.0 SILT FENCE

Silt fence will be installed at or outside the clearing limits as shown on the plans prior to land-disturbing activity. Silt fence is an adequate runoff control measure provided that less than one-fourth an acre per 100 linear feet drains to it according to the *North Carolina Design Manual* Section 6.62.1.

14.0 MAINTENANCE AND SEDIMENT DISPOSAL

All erosion and sedimentation control devices will be inspected at regular intervals and immediately following any major storm event. Repairs will be made as needed and accumulated sediment removed when one half of the holding capacity is depleted.

All sediments which are removed from erosion and sedimentation control measures will be disposed of in a manner such that further erosion and sedimentation will not occur.

15.0 CONSTRUCTION SEQUENCE

Prior to any land disturbing activity, silt fence will be installed outside the construction limits. Clearing and grubbing will initially begin in the areas of the proposed Sediment Basins 6 and 7. After the basins are constructed and operational, clearing and grubbing of the areas within the construction limits will continue. Drainage channels and diversion berms will be constructed to promote drainage to either sediment basin. The locations of these drainage channels and diversion berms will change throughout development of the landfill.

The clearing and grubbing debris will be stockpiled within the disturbed area limits and hauled to an appropriate disposal site. After clearing and grubbing is complete, all disturbed areas are to be seeded and mulched as per the specifications.

Excavation is anticipated to occur in phases and will initially begin in Phase IV. After excavation reaches the proposed grades as shown on the plans, excavation will proceed to the east to Phase V and VI.

16.0 PHASE DEVELOPMENT

Initially, a 50-foot section along the tree line between Phase IV and V will be cleared and grubbed so soil may be borrowed for on-site operations. This area will be excavated in a manner to maintain drainage to Sediment Basin No. 5. Calculations are attached showing that this basin can handle the additional drainage area. Borrow activities will continue in Phase IV until the proposed grades are reached. Excavation will then continue eastward into Phase V and VI.

Appendix A

CALCULATIONS

Project: Old Salisbury Road Landfill	Computed: PAW	Date: 7-17-02
Subject: Drainage	Checked MDP	Date 7-17-02
ask: Sediment Basins	Sheet 1	Of 1

Objective: Design the sediment basins based on the largest drainage area to each feature during each phase of site development.

Total Disturbed Area (ac): 29

References:

1. NC Erosion and Sediment Control Planning and Design Manual
2. Elements of Urban Stormwater Design, H. Rooney Malcom, P.E.
3. VA Erosion and Sediment Control Handbook

Given:

Calculate Time of Concentration (t_c)

$$t_c = [L^3/H]^{0.385}/128 \quad \text{Ref 2}$$

SB #6

Development Phase	Pre	During	Post
Drainage Area (ac) =	10.2	17.4	9.9
Hydraulic length of watershed L (ft) =	1,100	1,238	900
Elevation change along length H (ft) =	90	44	144
t_c (min) =	4.5	6.8	3.0

use t_c (min) = 7.0
Drainage Area (ac) = 17.4

SB #7

Development Phase	Pre	During	Post
Drainage Area (ac) =	8.5	9.5	13.3
Hydraulic length of watershed L (ft) =	550	1050	1,180
Elevation change along length H (ft) =	58	58	136
t_c (min) =	2.4	5.1	4.2

Assume that no more than 1/2 of the total disturbed area will be diverted to SB #7.

Drainage Area (ac) = 14.5
 t_c (min) = 5

Project:	Old Salisbury Road Landfill	Computed:	PMW	Date:	7-17-02
Subject:	Drainage	Checked:	MDP	Date:	7-17-02
Task:	Sediment Basin 6	Sheet:	1	Of:	8

Objective: Design sediment basins for 25-Year Storm per C&D Solid Waste Regulations

Drainage Area

Area Type = Newly Graded Area
 Drainage Area (ac) = 17.4
 CN = 93 Newly Graded Area Ref 1, Table 8.03b
 Runoff Coeff = 0.4 Ag land, smooth Ref 3
 Soil Group = C Class C Soils having a moderately high runoff potential due to slow infiltration rates. These soils consist primarily of soils in which a layer exists near the surface that impede the downward movement of water or soils with moderately fine to fine texture.

Inflow Data

Calculate Peak Flow using the Rational Method (Q_p):

25-yr, 5-min Design Storm

Rainfall, P (inches) = 5.5 Ref 1, Figure 8.03k
 I (in/hr) = 7.0
 Q_p (cfs) = CIA = 48.7

Estimate Depth of Runoff for design storm @ location:

Ref 2, page III-4

Determine Ultimate Storage Capacity (S):

$$S = (1000/CN) - 10 = 0.75$$

Determine Runoff Depth (Q^*):

$$Q^* \text{ (inches)} = (P - 0.2S)^2 / (P + 0.8S) = 4.69$$

Determine Time to Peak (T_p):

$$T_p \text{ (min)} = 60.5(Q^*)A/Q_p/1.39 = 73 \text{ minutes} \quad \text{Ref 2, page III-4}$$

Determine Shape of Basin:

Find the area of the Basin using AutoCADD.

Calculate Volume of the Basin using Truncated Pyramid Method.

Elevation (ft)	Depth (ft)	Area (sf)	Volume (cf)	Cumulative Vol (cf)
735	0	0	0	0
736	1	5,069	1,690	1,690
738	3	16,988	20,891	22,581
740	5	20,314	37,252	59,833
742	7	24,034	44,296	104,129
743	8	26,043	25,032	129,161

Calculate the Sediment Storage Volume (V_c):

Clean Out Interval (T), days = 180 or as needed Ref 1 pg 8.07.17
 $V_c \text{ (cf)} = 18 * T * A^{0.84} = 35,695$

Project:	Old Salisbury Road Landfill	Computed:	PAW	Date:	7-17-02
Subject:	Drainage	Checked:	MDP	Date:	7-17-02
Task:	Sediment Basin 6	Sheet:	2	Of:	8

Determine Sediment Storage Elevation (Z_{sed}):

$$Z_{sed} (ft) = (V_C/K_S)^{1/b}$$

Ref 2 pg III-8

Pick one point near max expected water surface and the other at the mid depth.

$$Z_1 (ft) = 5 \quad S_1 (cf) = 59,833$$

$$Z_2 (ft) = 8 \quad S_2 (cf) = 129,161$$

$$b = \ln(S_2/S_1)/\ln(Z_2/Z_1) = 1.6$$

$$K_S = S_2/Z_2^b = 4,291$$

$Z_{sed} (ft) = 3.6$ set riser a minimum of this height measured from bottom of pond

Determine the remaining volume for wet Storage (V_{rem}):

$$V_{rem} (cf) = S_2 - V_C = 93,466$$

Route the Storm through the Basin using the Hydrograph Model

see attached calculations

Set Height of Emergency Spillway at (ft) = 8

Set Top of Dam at (ft) = 9

Emergency Spillway

$$Q_E (cfs) = 9.87 \quad \text{Peak "Weir Flow" from Hydrograph}$$

Use Normal Depth Procedure (Manning's Eqn.)

$$A * R^{2/3} = Q * n / 1.49 s^{0.5}$$

$$\text{Area (A)} = bd + z(d^2)$$

$$Z_{req} = Q * n / 1.49 s^{0.5}$$

$$R = \text{Area} / (b + 2d((z^2 + 1)^{0.5}))$$

$$Z_{av} = A * R^{2/3}$$

n =	0.048	Class B Phase 3 (Fully vegetated) TRM (NAG C350)
Vp (ft/sec) =	18.0	Class B Phase 3 (Fully vegetated) TRM (NAG C350)
z (enter X for X:1) =	5	Side Slope of channel
s (ft/ft) =	2	Slope down the dam
Bottom Width (ft) =	25	Length of Emergency Spillway (from Hydrograph)

Flow Depth d

Z_{req}	(ft)	A (sf)	R (ft)	Z_{av}	V (ft/sec)
0.22	0.06	1.5	0.06	0.22	6.7

Project:	Old Salisbury Road Landfill	Computed: PAN	Date: 7-17-02
Subject:	Drainage	Checked MSP	Date 7-17-02
Task:	Sediment Basin 6	Sheet 3	Of 8

Anti-Seep Collar:

Anti-Seep Collar Size = 2 * Barrel Dia
 Anti-Seep Collar Size (ft) = 3.0
 Use Anti-Seep Collar Size (ft) = 3 x 3
 Width of access road (ft) = 15
 Length of base of dam (ft) = 51 Toe to toe
 Locations for Collars:
 Space collars at 15 intervals.

Minimum Concrete Base for Riser:

Diameter of Riser (in) = 24 From Hydrograph
 Avg Density of Concrete (lbs/cf) = 87.6
 Density of Water (cf/lb) = 62.4
 Riser Displacement (cf) = 18.85 $\text{Pi} * D_R/24 * \text{Total Ht of Riser}$
 Convert cf to cy = 27^{-1}
 Min Concrete Needed (cy) = 0.50

Anti-Vortex Device:

Ref 3, Table 3.14-D

Diameter of Riser (in) = 24
 Cylinder Diameter (in) = 36
 Cylinder Thickness (gage) = 16
 Cylinder Height (in) = 13
 Support Bars = #6 Rebar
 Top Thickness = 16 gage corrugated , 14 gage flat
 Stiffener = none required

Project:	Old Salisbury Road Landfill	Computed:	PMW	Date:	7-17-02
Subject:	Drainage	Checked:	MDP	Date:	7-17-02
Task:	Sediment Basin 6	Sheet:	4	Of:	8

Outlet Apron

Determine Tailwater conditions to size apron
Use Normal Depth Procedure (Manning's Eqn.)

$$A \cdot R^{2/3} = Q \cdot n / 1.49 s^{0.5}$$

$$Z_{req} = Q \cdot n / 1.49 s^{0.5}$$

$$\text{Area (A)} = bd + z(d^2)$$

$$R = \text{Area} / (b + 2d((z^2 + 1)^{0.5}))$$

$$Z_{av} = A \cdot R^{2/3}$$

- n = 0.032 9" Rip Rap Lined Channel Ref 2
- Vp (ft/sec) = 10.8 Permissible Velocity for 9" Rip Rap @ 12:1 Ref 2
- Side Slope (z) = 5 enter X for X:1
- s (ft/ft) = 0.05 Outlet Slope (assumed)
- Bottom Width (ft) = 4.5 3 * Barrel Diameter

Q _B (cfs)	Z _{req}	Depth d (ft)	A (sf)	R (ft)	Z _{av}	V (ft/sec)
32	3.09	0.66	5.2	0.46	3.09	6.2

Flow Depth = Tailwater (d) = 0.66 0.5 * Barrel Diameter = 0.75

Minimum Tailwater Conditions: d < 0.5 * Diameter of Outlet Pipe

Maximum Tailwater Conditions: d > 0.5 * Diameter of Outlet Pipe

Since the Tailwater is less than half of the diameter of the outlet, use Minimum Tailwater conditions.

Barrel Diameter (ft)	Entrance (ft)	Length (ft)	Outlet Width (ft)	Median Rip Rap Size d ₅₀	Selected Rip Rap Size (in)	Ref 3 p. 8.06.4
1.5	4.5	22	27	1	Class B	

Old Salisbury Road C&D Landfill

Sediment Basin #6

25-Year Storm

HDR Project No. 162-525-018

Qp = 48.72 cfs
 Tp = 73 min.
 dT = 2

			Bottom	at 5' deep
Diameter of Barrel =	18 (in)	Length of Basin (ft) =	25	110
Height of Riser =	6.0 (ft)	Width of Basin (ft) =	180	260
Emergency Spillway =	8 (ft)	Slope of side & front walls =	2	(enter "X" for X:1)
Total Height of Dam =	9 (ft)	Slope of back wall =	7.50	(enter "X" for X:1)
Length of Emergency Spillway =	25 (ft)	b =	1.64	
Diameter of Riser =	24 (in)	Ks =	4,291	

Notes:

- Length of emergency spillway is the bottom width of the emergency spillway.

TIME	INFLOW	STORAGE	STAGE	RISER	WEIR	BARREL	TOTAL	BOUND	SETTLING
[min]	[cfs]	[cu ft]	[ft]	CAPACITY	FLOW	CAPACITY	OUTFLOW	DISCHG	EFF.
				[cfs]	[cfs]	[cfs]	[cfs]	[cfs]	[%]
0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A
2	0.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A
4	0.4	11	0.03	0.00	0.00	0.00	0.00	1.51	N/A
6	0.8	54	0.07	0.00	0.00	0.00	0.00	2.82	N/A
8	1.4	151	0.13	0.00	0.00	0.00	0.00	4.20	N/A
10	2.2	323	0.21	0.00	0.00	0.00	0.00	5.65	N/A
12	3.2	591	0.30	0.00	0.00	0.00	0.00	7.14	N/A
14	4.3	973	0.40	0.00	0.00	0.00	0.00	8.67	N/A
16	5.6	1,489	0.52	0.00	0.00	0.00	0.00	10.24	N/A
18	7.0	2,157	0.66	0.00	0.00	0.00	0.00	11.83	N/A
20	8.5	2,993	0.80	0.00	0.00	0.00	0.00	13.43	N/A
22	10.2	4,013	0.96	0.00	0.00	0.00	0.00	15.06	N/A
24	11.9	5,232	1.13	0.00	0.00	0.00	0.00	16.70	N/A
26	13.8	6,661	1.31	0.00	0.00	0.00	0.00	18.34	N/A
28	15.7	8,312	1.50	0.00	0.00	0.00	0.00	19.99	N/A
30	17.7	10,194	1.70	0.00	0.00	0.00	0.00	21.64	N/A
32	19.7	12,315	1.90	0.00	0.00	0.00	0.00	23.30	N/A
34	21.8	14,681	2.12	0.00	0.00	0.00	0.00	24.95	N/A
36	23.9	17,296	2.34	0.00	0.00	0.00	0.00	26.59	N/A
38	26.0	20,163	2.57	0.00	0.00	0.00	0.00	28.23	N/A
40	28.1	23,281	2.81	0.00	0.00	0.00	0.00	29.85	N/A
42	30.1	26,650	3.05	0.00	0.00	0.00	0.00	31.46	N/A
44	32.1	30,266	3.30	0.00	0.00	0.00	0.00	33.06	N/A
46	34.1	34,123	3.55	0.00	0.00	0.00	0.00	34.64	N/A
48	36.0	38,216	3.80	0.00	0.00	0.00	0.00	36.20	N/A
50	37.8	42,535	4.06	0.00	0.00	0.00	0.00	37.74	N/A
52	39.5	47,070	4.32	0.00	0.00	0.00	0.00	39.26	N/A
54	41.1	51,809	4.58	0.00	0.00	0.00	0.00	40.75	N/A
56	42.5	56,738	4.84	0.00	0.00	0.00	0.00	42.22	N/A
58	43.9	61,843	5.10	0.00	0.00	0.00	0.00	43.66	N/A
60	45.1	67,107	5.36	0.00	0.00	0.00	0.00	45.07	N/A
62	46.1	72,513	5.62	0.00	0.00	0.00	0.00	46.45	N/A
64	47.0	78,043	5.88	0.00	0.00	0.00	0.00	47.80	N/A

Computed By: PKA Date: 7-17-02

Checked By: MDP Date: 7-17-02

Sheet: 6 of 8

66	47.7	83,677	6.14	1.05	0.00	19.72	1.05	49.11	100.0
68	48.2	89,270	6.38	4.94	0.00	20.16	4.94	50.37	99.7
70	48.5	94,459	6.61	9.84	0.00	20.56	9.84	51.49	99.0
72	48.7	99,102	6.80	14.97	0.00	20.90	14.97	52.46	98.0
74	48.7	103,150	6.97	19.91	0.00	21.19	19.91	53.28	96.8
76	48.5	106,604	7.11	24.41	0.00	21.43	21.43	53.97	96.4
78	48.1	109,852	7.25	28.86	0.00	21.65	21.65	54.60	96.4
80	47.6	113,030	7.37	33.39	0.00	21.86	21.86	55.21	96.4
82	46.9	116,116	7.50	37.95	0.00	22.07	22.07	55.79	96.4
84	46.0	119,093	7.61	42.48	0.00	22.26	22.26	56.34	96.4
86	44.9	121,941	7.72	46.93	0.00	22.43	22.43	56.87	96.4
88	43.7	124,641	7.83	51.24	0.00	22.60	22.60	57.35	96.4
90	42.4	127,178	7.92	55.37	0.00	22.76	22.76	57.80	96.4
92	41.0	129,535	8.01	59.27	0.13	22.90	23.02	58.22	96.4
94	39.6	131,691	8.10	62.89	2.21	23.02	25.23	58.59	95.8
96	38.2	133,410	8.16	65.81	4.79	23.12	27.91	58.89	95.1
98	36.8	134,640	8.21	67.92	6.99	23.20	30.19	59.10	94.5
100	35.5	135,437	8.24	69.29	8.56	23.24	31.80	59.24	94.1
102	34.3	135,886	8.25	70.07	9.48	23.27	32.75	59.31	93.9
104	33.1	136,072	8.26	70.39	9.87	23.28	33.15	59.34	93.7
106	31.9	136,064	8.26	70.38	9.86	23.28	33.14	59.34	93.7
108	30.8	135,920	8.25	70.13	9.55	23.27	32.82	59.32	93.8
110	29.7	135,679	8.24	69.71	9.05	23.26	32.31	59.28	94.0
112	28.7	135,370	8.23	69.18	8.42	23.24	31.66	59.23	94.1
114	27.7	135,014	8.22	68.56	7.71	23.22	30.93	59.16	94.3
116	26.7	134,625	8.21	67.89	6.96	23.20	30.16	59.10	94.6
118	25.8	134,212	8.19	67.18	6.19	23.17	29.37	59.03	94.8
120	24.9	133,782	8.17	66.45	5.43	23.15	28.57	58.95	95.0
122	24.0	133,339	8.16	65.69	4.67	23.12	27.79	58.88	95.2
124	23.2	132,885	8.14	64.91	3.93	23.09	27.03	58.80	95.4
126	22.4	132,421	8.12	64.13	3.23	23.07	26.29	58.72	95.6
128	21.6	131,949	8.11	63.33	2.55	23.04	25.59	58.64	95.7
130	20.8	131,466	8.09	62.51	1.92	23.01	24.93	58.55	95.9
132	20.1	130,972	8.07	61.68	1.34	22.98	24.32	58.47	96.1
134	19.4	130,464	8.05	60.82	0.82	22.95	23.77	58.38	96.2
136	18.7	129,937	8.03	59.94	0.38	22.92	23.30	58.29	96.3
138	18.0	129,386	8.01	59.02	0.06	22.89	22.95	58.19	96.4
140	17.4	128,798	7.99	58.04	0.00	22.85	22.85	58.09	96.4
142	16.8	128,146	7.96	56.96	0.00	22.81	22.81	57.97	96.4
144	16.2	127,425	7.93	55.77	0.00	22.77	22.77	57.85	96.4
146	15.6	126,638	7.90	54.48	0.00	22.72	22.72	57.71	96.4
148	15.1	125,789	7.87	53.10	0.00	22.67	22.67	57.56	96.4
150	14.6	124,881	7.84	51.63	0.00	22.62	22.62	57.39	96.4
152	14.1	123,915	7.80	50.07	0.00	22.56	22.56	57.22	96.4
154	13.6	122,896	7.76	48.44	0.00	22.49	22.49	57.04	96.4
156	13.1	121,825	7.72	46.74	0.00	22.43	22.43	56.84	96.4
158	12.6	120,704	7.68	44.98	0.00	22.36	22.36	56.64	96.4
160	12.2	119,538	7.63	43.17	0.00	22.28	22.28	56.43	96.4
162	11.8	118,327	7.58	41.30	0.00	22.21	22.21	56.20	96.4
164	11.4	117,073	7.53	39.39	0.00	22.13	22.13	55.97	96.4
166	11.0	115,780	7.48	37.45	0.00	22.04	22.04	55.73	96.4
168	10.6	114,450	7.43	35.47	0.00	21.96	21.96	55.48	96.4

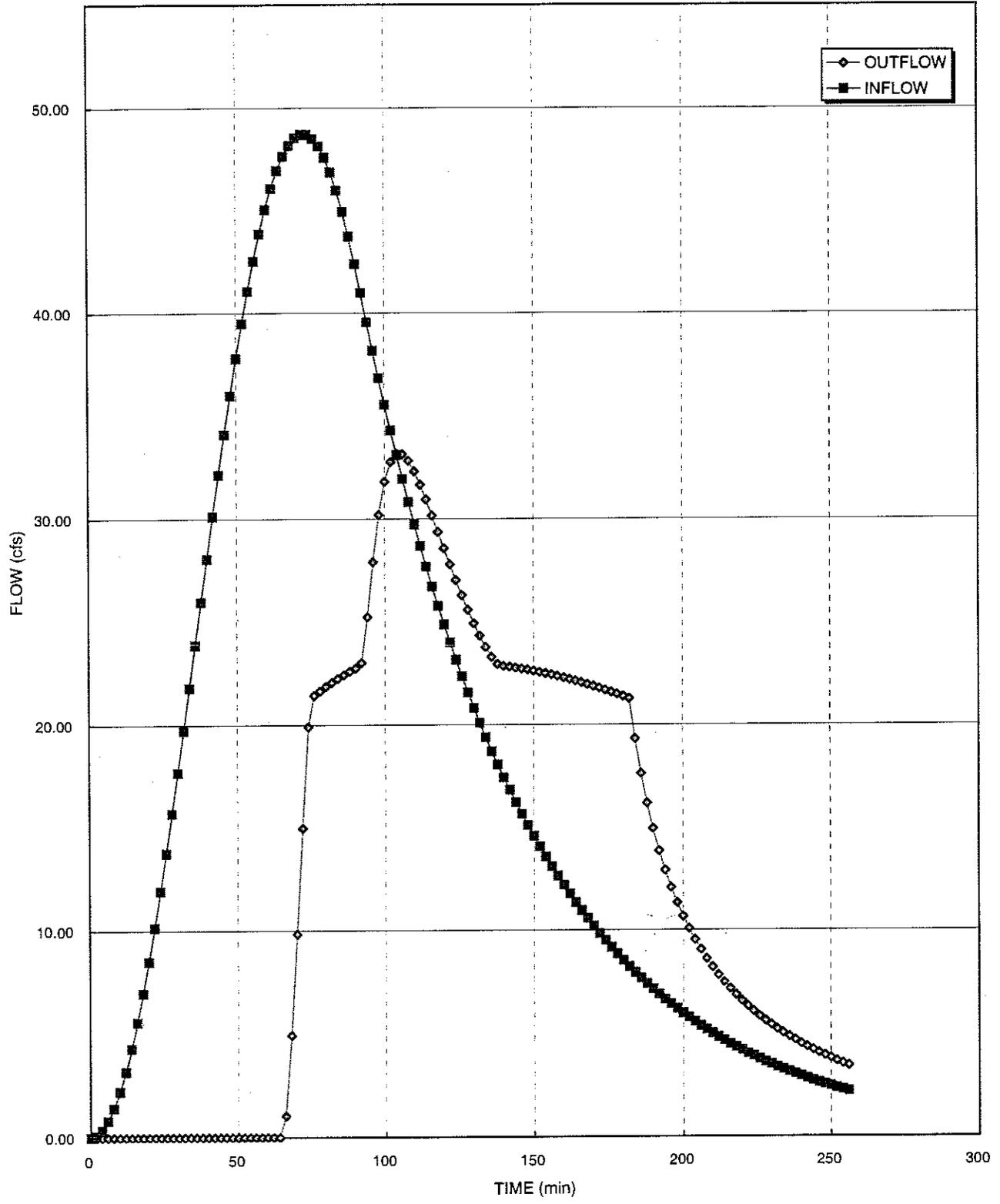
Computed By: PMW Date: 7-17-02

Checked By: MDP Date: 7-17-02

Sheet: 7 of 8

170	10.2	113,083	7.38	33.47	0.00	21.87	21.87	55.22	96.4
172	9.8	111,683	7.32	31.45	0.00	21.78	21.78	54.95	96.4
174	9.5	110,251	7.26	29.42	0.00	21.68	21.68	54.68	96.4
176	9.2	108,789	7.20	27.38	0.00	21.58	21.58	54.39	96.4
178	8.8	107,299	7.14	25.35	0.00	21.48	21.48	54.10	96.4
180	8.5	105,783	7.08	23.32	0.00	21.38	21.38	53.80	96.4
182	8.2	104,242	7.02	21.31	0.00	21.27	21.27	53.50	96.4
184	7.9	102,677	6.95	19.31	0.00	21.16	19.31	53.18	96.9
186	7.7	101,313	6.90	17.62	0.00	21.06	17.62	52.91	97.4
188	7.4	100,119	6.85	16.17	0.00	20.98	16.17	52.66	97.7
190	7.1	99,066	6.80	14.93	0.00	20.90	14.93	52.45	98.0
192	6.9	98,131	6.76	13.85	0.00	20.83	13.85	52.26	98.2
194	6.6	97,296	6.73	12.90	0.00	20.77	12.90	52.08	98.4
196	6.4	96,546	6.70	12.07	0.00	20.72	12.07	51.92	98.6
198	6.2	95,867	6.67	11.33	0.00	20.67	11.33	51.78	98.7
200	6.0	95,251	6.64	10.67	0.00	20.62	10.67	51.65	98.9
202	5.8	94,687	6.62	10.08	0.00	20.58	10.08	51.53	99.0
204	5.6	94,170	6.60	9.54	0.00	20.54	9.54	51.42	99.1
206	5.4	93,693	6.58	9.05	0.00	20.50	9.05	51.32	99.1
208	5.2	93,251	6.56	8.61	0.00	20.47	8.61	51.23	99.2
210	5.0	92,839	6.54	8.20	0.00	20.44	8.20	51.14	99.3
212	4.8	92,455	6.52	7.83	0.00	20.41	7.83	51.06	99.3
214	4.7	92,094	6.51	7.48	0.00	20.38	7.48	50.98	99.4
216	4.5	91,755	6.49	7.16	0.00	20.36	7.16	50.91	99.4
218	4.3	91,435	6.48	6.86	0.00	20.33	6.86	50.84	99.5
220	4.2	91,132	6.47	6.58	0.00	20.31	6.58	50.77	99.5
222	4.0	90,844	6.45	6.32	0.00	20.29	6.32	50.71	99.6
224	3.9	90,571	6.44	6.07	0.00	20.27	6.07	50.65	99.6
226	3.8	90,310	6.43	5.84	0.00	20.25	5.84	50.59	99.6
228	3.6	90,060	6.42	5.62	0.00	20.23	5.62	50.54	99.6
230	3.5	89,822	6.41	5.41	0.00	20.21	5.41	50.49	99.7
232	3.4	89,593	6.40	5.21	0.00	20.19	5.21	50.44	99.7
234	3.3	89,372	6.39	5.02	0.00	20.17	5.02	50.39	99.7
236	3.1	89,161	6.38	4.84	0.00	20.16	4.84	50.34	99.7
238	3.0	88,956	6.37	4.67	0.00	20.14	4.67	50.30	99.7
240	2.9	88,759	6.36	4.51	0.00	20.12	4.51	50.25	99.8
242	2.8	88,569	6.35	4.36	0.00	20.11	4.36	50.21	99.8
244	2.7	88,385	6.35	4.21	0.00	20.10	4.21	50.17	99.8
246	2.6	88,207	6.34	4.07	0.00	20.08	4.07	50.13	99.8
248	2.5	88,035	6.33	3.93	0.00	20.07	3.93	50.09	99.8
250	2.4	87,867	6.32	3.80	0.00	20.05	3.80	50.06	99.8
252	2.4	87,705	6.32	3.68	0.00	20.04	3.68	50.02	99.8
254	2.3	87,548	6.31	3.56	0.00	20.03	3.56	49.98	99.8
256	2.2	87,395	6.30	3.44	0.00	20.02	3.44	49.95	99.9

**Sediment Basin #6 Hydrograph
25-Yr Storm**



Conclusion: The basin can pass the design storm without overtopping the dam and provide a settling efficiency greater than 75%.

Project:	Old Salisbury Road Landfill	Computed:	PAW	Date:	7-17-02
Subject:	Drainage	Checked:	MBP	Date:	7-17-02
Task:	Sediment Basin 7	Sheet:	1	Of:	8

Objective: Design sediment basins for 25-Year Storm per C&D Solid Waste Regulations

Drainage Area

Area Type = Newly Graded Area
 Drainage Area (ac) = 14.5
 CN = 93 Newly Graded Area Ref 1, Table 8.03b
 Runoff Coeff = 0.4 Ag land, smooth Ref 3
 Soil Group = C Class C Soils having a moderately high runoff potential due to slow infiltration rates. These soils consist primarily of soils in which a layer exists near the surface that impede the downward movement of water or soils with moderately fine to fine texture.

Inflow Data

Calculate Peak Flow using the Rational Method (Q_p):

25-yr, 5-min Design Storm

Rainfall, P (inches) = 5.5 Ref 1, Figure 8.03k
 I (in/hr) = 7.2
 Q_p (cfs) = CIA = 41.8

Estimate Depth of Runoff for design storm @ location:

Ref 2, page III-4

Determine Ultimate Storage Capacity (S):
 $S = (1000/CN) - 10 = 0.75$
 Determine Runoff Depth (Q^*):
 $Q^* \text{ (inches)} = (P - 0.2S)^2 / (P + 0.8S) = 4.69$

Determine Time to Peak (T_p):

$T_p \text{ (min)} = 60.5(Q^*)A/Q_p / 1.39 = 71 \text{ minutes}$ Ref 2, page III-4

Determine Shape of Basin:

Find the area of the Basin using AutoCADD.
 Calculate Volume of the Basin using Truncated Pyramid Method

Elevation (ft)	Depth (ft)	Area (sf)	Volume (cf)	Cumulative Vol (cf)
737	0	0	0	0
738	1	6,284	2,095	2,095
740	3	13,108	18,979	21,073
742	5	16,908	29,935	51,009
743	6	19,247	18,065	69,074

Calculate the Sediment Storage Volume (V_c):

Clean Out Interval (T), days = 150 or as needed Ref 1 pg 8.07.17
 $V_c \text{ (cf)} = 18 * T * A^{0.84} = 25,522$

Project: Old Salisbury Road Landfill	Computed: <i>PAW</i>	Date: <i>7-17-02</i>
Subject: Drainage	Checked <i>MDP</i>	Date <i>7-17-02</i>
Task: Sediment Basin 7	Sheet <i>2</i>	Of <i>8</i>

Determine Sediment Storage Elevation (Z_{sed}):

$$Z_{sed} (ft) = (V_C/K_S)^{1/b}$$

Ref 2 pg III-8

Pick one point near max expected water surface and the other at the mid depth.

$$Z_1 (ft) = 3 \quad S_1 (cf) = 21,073$$

$$Z_2 (ft) = 6 \quad S_2 (cf) = 69,074$$

$$b = \ln(S_2/S_1) / \ln(Z_2/Z_1) = 1.7$$

$$K_S = S_2/Z_2^b = 3,210$$

$Z_{sed} (ft) = 3.4$ set riser a minimum of this height measured from bottom of pond

Determine the remaining volume for wet Storage (V_{rem}):

$$V_{rem} (cf) = S_2 - V_C = 43,552$$

Route the Storm through the Basin using the Hydrograph Model

see attached calculations

Set Height of Emergency Spillway at (ft) = 6

Set Top of Dam at (ft) = 7

Emergency Spillway

$$Q_E (cfs) = 20.91 \quad \text{Peak "Weir Flow" from Hydrograph}$$

Use Normal Depth Procedure (Manning's Eqn.)

$$A * R^{2/3} = Q * n / 1.49 s^{0.5}$$

$$\text{Area (A)} = bd + z(d^2)$$

$$Z_{req} = Q * n / 1.49 s^{0.5}$$

$$R = \text{Area} / (b + 2d((z^2) + 1)^{.5})$$

$$Z_{av} = A * R^{2/3}$$

n =	0.048	Class B Phase 3 (Fully vegetated) TRM (NAG C350)
Vp (ft/sec) =	18.0	Class B Phase 3 (Fully vegetated) TRM (NAG C350)
Side Slope (z) =	5	enter X for X:1
s (ft/ft) =	2	Slope down the dam
Bottom Width (ft) =	25.0	Length of Emergency Spillway (from Hydrograph)

Flow Depth d

Z_{req}	(ft)	A (sf)	R (ft)	Z_{av}	V (ft/sec)
0.48	0.09	2.4	0.09	0.48	8.8

Project:	Old Salisbury Road Landfill	Computed:	PHW	Date:	7-17-02
Subject:	Drainage	Checked:	MVP	Date:	7-17-02
Task:	Sediment Basin 7	Sheet:	3	Of:	8

Anti-Seep Collar:

Anti-Seep Collar Size = 2 * Barrel Dia
 Anti-Seep Collar Size (ft) = 3.0
 Use Anti-Seep Collar Size (ft) = 3 x 3
 Width of access road (ft) = 15
 Length of base of dam (ft) = 43 Toe to toe
 Locations for Collars:
 Space collars at 15 intervals.

Minimum Concrete Base for Riser:

Diameter of Riser (in) = 24 From Hydrograph
 Avg Density of Concrete (lbs/cf) = 87.6
 Density of Water (cf/lb) = 62.4
 Riser Displacement (cf) = 0.65 $\text{Pi} * D_R/24 * \text{Total Ht of Riser}$
 Convert cf to cy = 27^{-1}
 Min Concrete Needed (cy) = 0.02

Anti-Vortex Device:

Ref 3, Table 3.14-D

Diameter of Riser (in) = 24
 Cylinder Diameter (in) = 36
 Cylinder Thickness (gage) = 16
 Cylinder Height (in) = 13
 Support Bars = #6 Rebar
 Top Thickness = 16 gage corrugated , 14 gage flat
 Stiffener = none required

Project:	Old Salisbury Road Landfill	Computed:	PMW	Date:	7-17-02
Subject:	Drainage	Checked:	MDP	Date:	7-17-02
Task:	Sediment Basin 7	Sheet:	4	Of:	8

Outlet Apron

Determine Tailwater conditions to size apron
Use Normal Depth Procedure (Manning's Eqn.)

$$A \cdot R^{2/3} = Q \cdot n / 1.49 s^{0.5}$$

$$\text{Area (A)} = bd + z(d^2)$$

$$Z_{req} = Q \cdot n / 1.49 s^{0.5}$$

$$R = \text{Area} / (b + 2d((z^2 + 1)^{0.5}))$$

$$Z_{av} = A \cdot R^{2/3}$$

- n = 0.032 9" Rip Rap Lined Channel Ref 2
- Vp (ft/sec) = 10.8 Permissible Velocity for 9" Rip Rap @ 12:1 Ref 2
- Side Slope (z) = 5 enter X for X:1
- s (ft/ft) = 0.05 Outlet Slope (assumed)
- Bottom Width (ft) = 4.5 3 * Barrel Diameter

Q _B (cfs)	Z _{req}	Depth d (ft)	A (sf)	R (ft)	Z _{av}	V (ft/sec)
40	3.88	0.74	6.1	0.51	3.88	6.6

Flow Depth = Tailwater (d) = 0.74 0.5 * Barrel Diameter = 0.75

Minimum Tailwater Conditions: d < 0.5 * Diameter of Outlet Pipe

Maximum Tailwater Conditions: d > 0.5 * Diameter of Outlet Pipe

Since the Tailwater is less than half of the diameter of the outlet, use Minimum Tailwater conditions.

Barrel Diameter (ft)	Entrance (ft)	Length (ft)	Outlet Width (ft)	Median Rip Rap Size d ₅₀	Selected Rip Rap Size (in)	Ref 3 p. 8.06.4
1.5	4.5	24	26	1.1	Class 1	

Old Salisbury Road C&D Landfill

Sediment Basin #7

25-Year Storm

HDR Project No. 162-525-018

Qp = 41.76 cfs
 Tp = 71 min.
 dT = 4

			Bottom	at 4' deep
Diameter of Barrel =	18 (in)	Length of Basin (ft) =	40	60
Height of Riser =	5.00 (ft)	Width of Basin (ft) =	290	360
Emergency Spillway =	6 (ft)	Slope of side & front walls =	2	(enter "X" for X:1)
Total Height of Dam =	7 (ft)	Slope of back wall =	2.00	(enter "X" for X:1)
Length of Overflow Weir =	25 (ft)	b =	1.71	
Diameter of Riser =	24 (in)	Ks =	3,210	

Notes:

1. Length of overflow weir is the width of the dam.

TIME	INFLOW	STORAGE	STAGE	RISER	WEIR	BARREL	TOTAL	BOUND	SETTLING
[min]	[cfs]	[cu ft]	[ft]	CAPACITY	FLOW	CAPACITY	OUTFLOW	DISCHG	EFF.
				[cfs]	[cfs]	[cfs]	[cfs]	[cfs]	[%]
0	0.0	0.00	0.00	0.0	0.00	0.00	0.00	0.0	N/A
4	0.3	0.00	0.00	0.0	0.00	0.00	0.00	0.0	N/A
8	1.3	79	0.11	0.0	0.00	0.00	0.00	2.6	N/A
12	2.9	390	0.29	0.0	0.00	0.00	0.00	5.0	N/A
16	5.0	1,083	0.53	0.0	0.00	0.00	0.00	7.7	N/A
20	7.7	2,291	0.82	0.0	0.00	0.00	0.00	10.5	N/A
24	10.7	4,135	1.16	0.0	0.00	0.00	0.00	13.4	N/A
28	14.1	6,713	1.54	0.0	0.00	0.00	0.00	16.4	N/A
32	17.7	10,102	1.95	0.0	0.00	0.00	0.00	19.5	N/A
36	21.4	14,353	2.40	0.0	0.00	0.00	0.00	22.6	N/A
40	25.1	19,489	2.87	0.0	0.00	0.00	0.00	25.6	N/A
44	28.6	25,507	3.35	0.0	0.00	0.00	0.00	28.7	N/A
48	31.9	32,375	3.85	0.0	0.00	0.00	0.00	31.6	N/A
52	34.9	40,035	4.36	0.0	0.00	0.00	0.00	34.6	N/A
56	37.4	48,403	4.88	0.0	0.00	0.00	0.00	37.4	N/A
60	39.4	57,375	5.38	4.9	0.00	18.29	4.93	40.2	99.3
64	40.8	65,643	5.82	15.5	0.00	19.14	15.51	42.5	95.5
68	41.6	71,711	6.13	25.0	3.63	19.71	23.34	44.1	91.9
72	41.7	76,092	6.35	32.5	15.45	20.10	35.55	45.2	85.9
76	41.2	77,576	6.42	35.1	20.47	20.23	40.70	45.5	83.5
80	40.1	77,702	6.43	35.3	20.91	20.24	41.16	45.6	83.3
84	38.3	77,442	6.41	34.9	20.00	20.22	40.22	45.5	83.7
88	36.0	76,987	6.39	34.1	18.43	20.18	38.61	45.4	84.5
92	33.5	76,368	6.36	33.0	16.35	20.13	36.48	45.2	85.5
96	31.2	75,660	6.33	31.7	14.07	20.06	34.13	45.1	86.6
100	28.9	74,945	6.29	30.5	11.88	20.00	31.88	44.9	87.7
104	26.9	74,242	6.26	29.3	9.84	19.94	29.78	44.7	88.7
108	25.0	73,552	6.22	28.1	7.96	19.88	27.84	44.5	89.7
112	23.2	72,871	6.19	26.9	6.23	19.82	26.05	44.4	90.6
116	21.6	72,195	6.16	25.8	4.66	19.75	24.41	44.2	91.3
120	20.1	71,517	6.12	24.7	3.24	19.69	22.93	44.0	92.1
124	18.6	70,828	6.09	23.5	1.98	19.63	21.60	43.8	92.7
128	17.3	70,117	6.05	22.4	0.91	19.56	20.47	43.6	93.2

Computed By: DIAW Date: 7-17-02

Checked By: MJP Date: 7-17-02

Sheet: 6 of 8

132	16.1	69,361	6.01	21.2	0.13	19.49	19.62	43.5	93.6
136	15.0	68,515	5.97	19.9	0.00	19.41	19.41	43.2	93.7
140	13.9	67,446	5.92	18.2	0.00	19.31	18.21	42.9	94.3
144	12.9	66,412	5.86	16.6	0.00	19.21	16.65	42.7	95.0
148	12.0	65,516	5.82	15.3	0.00	19.12	15.33	42.4	95.6
152	11.2	64,718	5.78	14.2	0.00	19.05	14.18	42.2	96.1
156	10.4	63,992	5.74	13.2	0.00	18.97	13.15	42.0	96.5
160	9.6	63,323	5.70	12.2	0.00	18.91	12.22	41.8	96.9
164	8.9	62,701	5.67	11.4	0.00	18.84	11.38	41.7	97.2
168	8.3	62,118	5.64	10.6	0.00	18.78	10.60	41.5	97.5
172	7.7	61,569	5.61	9.9	0.00	18.73	9.89	41.4	97.8
176	7.2	61,051	5.58	9.2	0.00	18.68	9.22	41.2	98.0
180	6.7	60,561	5.56	8.6	0.00	18.62	8.61	41.1	98.3
184	6.2	60,097	5.53	8.0	0.00	18.58	8.04	40.9	98.4
188	5.8	59,657	5.51	7.5	0.00	18.53	7.51	40.8	98.6
192	5.4	59,238	5.49	7.0	0.00	18.49	7.01	40.7	98.8
196	5.0	58,841	5.46	6.5	0.00	18.44	6.55	40.6	98.9
200	4.6	58,464	5.44	6.1	0.00	18.40	6.12	40.5	99.0
204	4.3	58,105	5.42	5.7	0.00	18.37	5.72	40.4	99.1
208	4.0	57,763	5.41	5.3	0.00	18.33	5.35	40.3	99.2
212	3.7	57,438	5.39	5.0	0.00	18.29	5.00	40.2	99.3
216	3.4	57,129	5.37	4.7	0.00	18.26	4.67	40.1	99.4
220	3.2	56,835	5.35	4.4	0.00	18.23	4.37	40.0	99.5
224	3.0	56,554	5.34	4.1	0.00	18.20	4.09	39.9	99.5
228	2.8	56,288	5.32	3.8	0.00	18.17	3.83	39.8	99.6
232	2.6	56,034	5.31	3.6	0.00	18.14	3.58	39.8	99.6
236	2.4	55,791	5.30	3.4	0.00	18.11	3.35	39.7	99.7
240	2.2	55,561	5.28	3.1	0.00	18.09	3.14	39.6	99.7
244	2.1	55,341	5.27	2.9	0.00	18.06	2.94	39.6	99.7
248	1.9	55,132	5.26	2.7	0.00	18.04	2.75	39.5	99.8
252	1.8	54,932	5.25	2.6	0.00	18.02	2.57	39.4	99.8
256	1.7	54,742	5.24	2.4	0.00	18.00	2.41	39.4	99.8
260	1.5	54,561	5.23	2.3	0.00	17.98	2.26	39.3	99.8
264	1.4	54,388	5.22	2.1	0.00	17.96	2.12	39.3	99.9
268	1.3	54,223	5.21	2.0	0.00	17.94	1.98	39.2	99.9
272	1.2	54,066	5.20	1.9	0.00	17.92	1.86	39.2	99.9
276	1.1	53,916	5.19	1.7	0.00	17.90	1.74	39.1	99.9
280	1.1	53,772	5.18	1.6	0.00	17.89	1.63	39.1	99.9
284	1.0	53,636	5.18	1.5	0.00	17.87	1.53	39.0	99.9
288	0.9	53,506	5.17	1.4	0.00	17.86	1.44	39.0	99.9
292	0.9	53,381	5.16	1.3	0.00	17.84	1.35	39.0	99.9
296	0.8	53,263	5.16	1.3	0.00	17.83	1.27	38.9	99.9
300	0.7	53,149	5.15	1.2	0.00	17.82	1.19	38.9	100.0
304	0.7	53,041	5.14	1.1	0.00	17.80	1.12	38.9	100.0
308	0.6	52,938	5.14	1.0	0.00	17.79	1.05	38.8	100.0
312	0.6	52,839	5.13	1.0	0.00	17.78	0.99	38.8	100.0
316	0.6	52,745	5.13	0.9	0.00	17.77	0.93	38.8	100.0
320	0.5	52,655	5.12	0.9	0.00	17.76	0.87	38.7	100.0
324	0.5	52,569	5.12	0.8	0.00	17.75	0.82	38.7	100.0
328	0.4	52,487	5.11	0.8	0.00	17.74	0.77	38.7	100.0
332	0.4	52,409	5.11	0.7	0.00	17.73	0.72	38.7	100.0
336	0.4	52,334	5.10	0.7	0.00	17.72	0.68	38.6	100.0

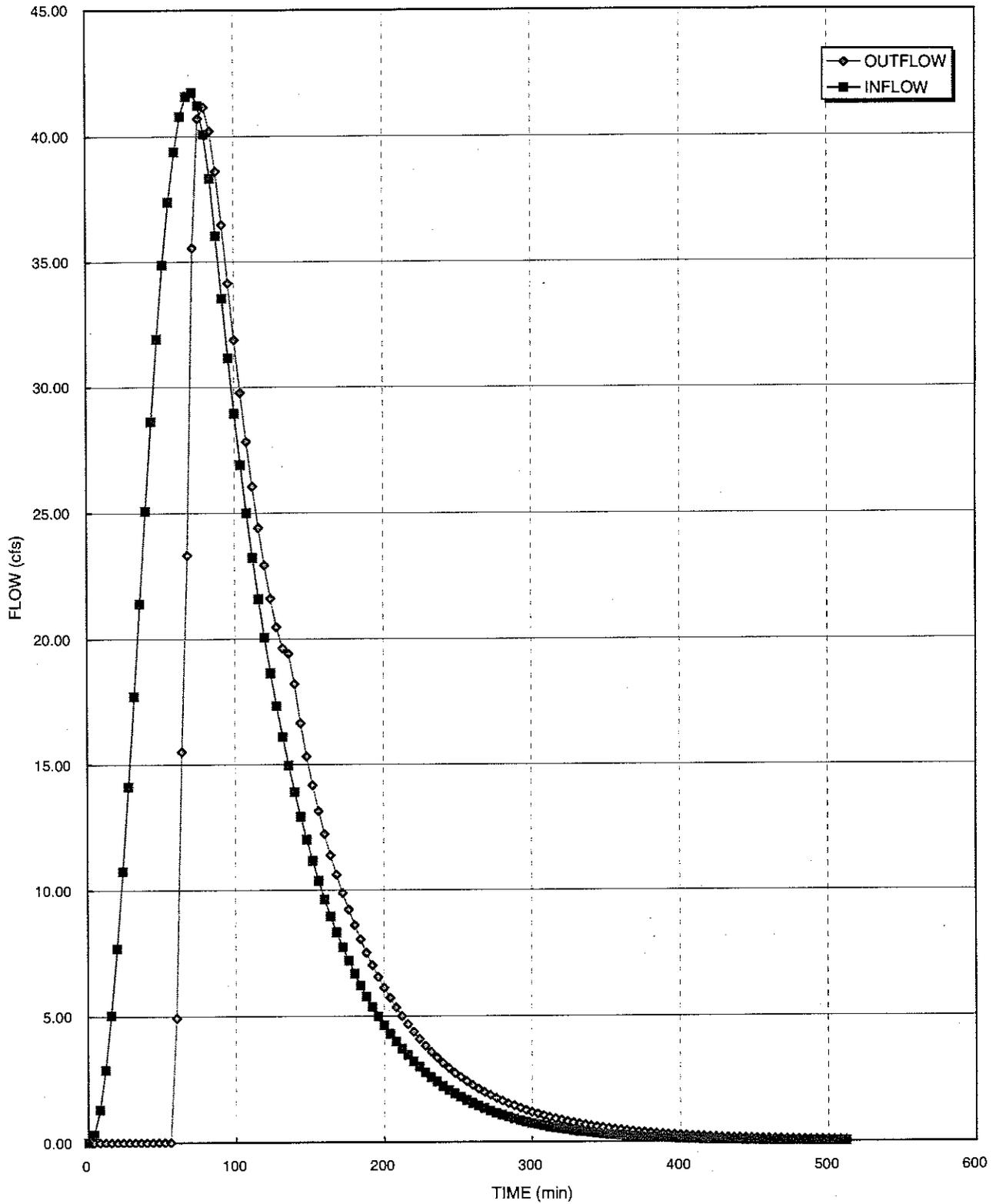
Computed By: PAW Date: 7-17-02

Checked By: MOP Date: 7-17-02

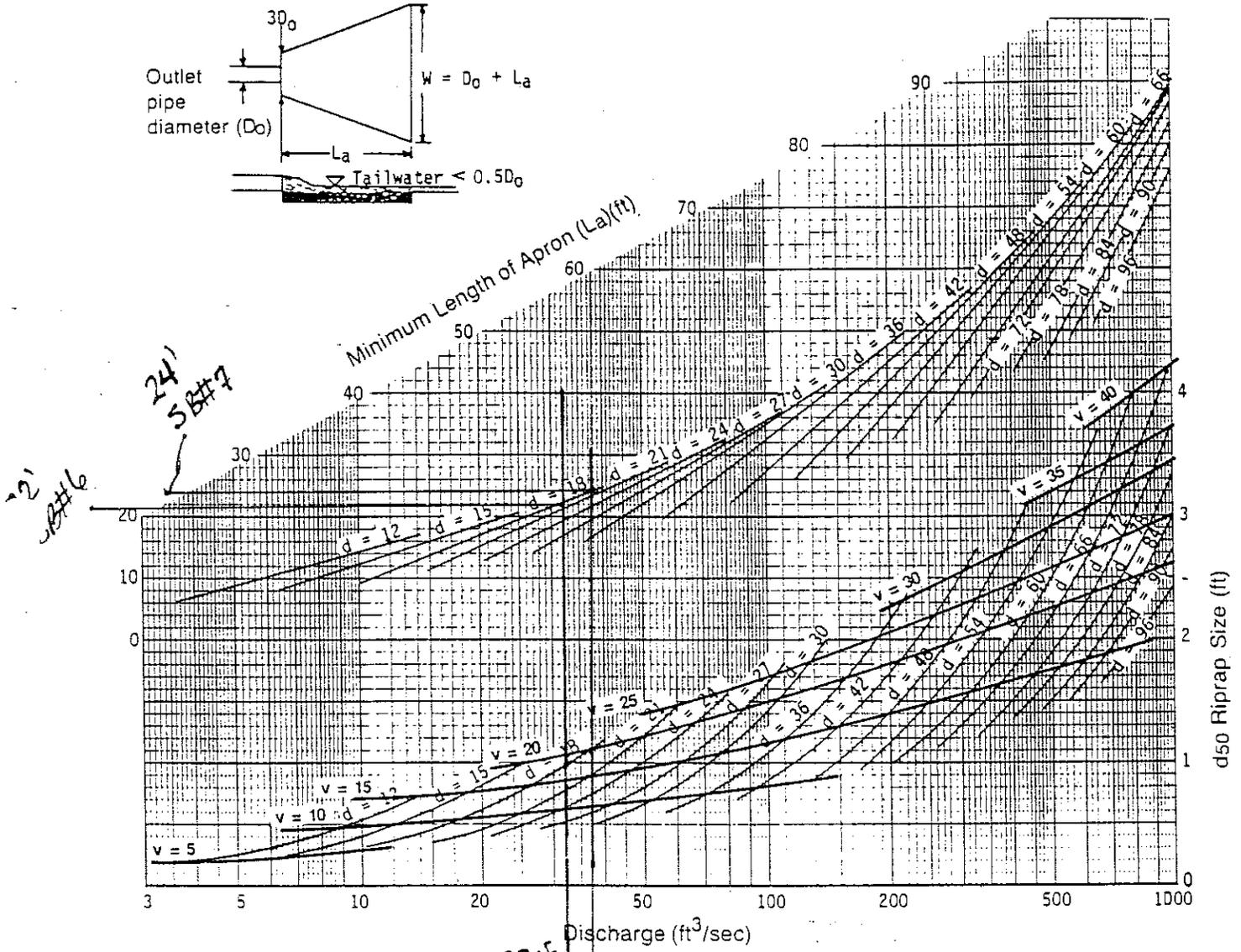
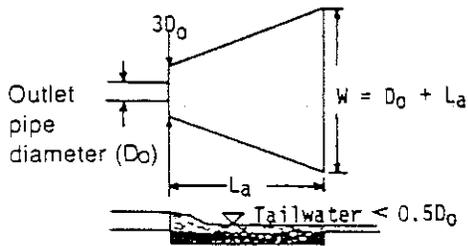
Sheet: 7 of 8

340	0.4	52,262	5.10	0.6	0.00	17.72	0.64	38.6	100.0
344	0.3	52,194	5.09	0.6	0.00	17.71	0.60	38.6	100.0
348	0.3	52,129	5.09	0.6	0.00	17.70	0.57	38.6	100.0
352	0.3	52,066	5.09	0.5	0.00	17.69	0.53	38.6	100.0
356	0.3	52,006	5.08	0.5	0.00	17.69	0.50	38.5	100.0
360	0.2	51,949	5.08	0.5	0.00	17.68	0.47	38.5	100.0
364	0.2	51,894	5.08	0.4	0.00	17.67	0.45	38.5	100.0
368	0.2	51,842	5.07	0.4	0.00	17.67	0.42	38.5	100.0
372	0.2	51,792	5.07	0.4	0.00	17.66	0.40	38.5	100.0
376	0.2	51,744	5.07	0.4	0.00	17.65	0.37	38.5	100.0
380	0.2	51,698	5.07	0.4	0.00	17.65	0.35	38.5	100.0
384	0.2	51,654	5.06	0.3	0.00	17.64	0.33	38.4	100.0
388	0.1	51,613	5.06	0.3	0.00	17.64	0.31	38.4	100.0
392	0.1	51,572	5.06	0.3	0.00	17.63	0.30	38.4	100.0
396	0.1	51,534	5.06	0.3	0.00	17.63	0.28	38.4	100.0
400	0.1	51,497	5.05	0.3	0.00	17.63	0.26	38.4	100.0
404	0.1	51,462	5.05	0.3	0.00	17.62	0.25	38.4	100.0
408	0.1	51,428	5.05	0.2	0.00	17.62	0.24	38.4	100.0
412	0.1	51,396	5.05	0.2	0.00	17.61	0.22	38.4	100.0
416	0.1	51,365	5.05	0.2	0.00	17.61	0.21	38.3	100.0
420	0.1	51,335	5.05	0.2	0.00	17.61	0.20	38.3	100.0
424	0.1	51,307	5.04	0.2	0.00	17.60	0.19	38.3	100.0
428	0.1	51,279	5.04	0.2	0.00	17.60	0.18	38.3	100.0
432	0.1	51,253	5.04	0.2	0.00	17.60	0.17	38.3	100.0
436	0.1	51,228	5.04	0.2	0.00	17.59	0.16	38.3	100.0
440	0.1	51,204	5.04	0.2	0.00	17.59	0.15	38.3	100.0
444	0.1	51,181	5.04	0.1	0.00	17.59	0.14	38.3	100.0
448	0.0	51,159	5.04	0.1	0.00	17.59	0.14	38.3	100.0
452	0.0	51,138	5.03	0.1	0.00	17.58	0.13	38.3	100.0
456	0.0	51,117	5.03	0.1	0.00	17.58	0.12	38.3	100.0
460	0.0	51,098	5.03	0.1	0.00	17.58	0.12	38.3	100.0
464	0.0	51,079	5.03	0.1	0.00	17.58	0.11	38.3	100.0
468	0.0	51,061	5.03	0.1	0.00	17.57	0.11	38.3	100.0
472	0.0	51,044	5.03	0.1	0.00	17.57	0.10	38.2	100.0
476	0.0	51,027	5.03	0.1	0.00	17.57	0.10	38.2	100.0
480	0.0	51,012	5.03	0.1	0.00	17.57	0.09	38.2	100.0
484	0.0	50,996	5.03	0.1	0.00	17.57	0.09	38.2	100.0
488	0.0	50,982	5.03	0.1	0.00	17.57	0.08	38.2	100.0
492	0.0	50,968	5.02	0.1	0.00	17.56	0.08	38.2	100.0
496	0.0	50,954	5.02	0.1	0.00	17.56	0.07	38.2	100.0
500	0.0	50,941	5.02	0.1	0.00	17.56	0.07	38.2	100.0
504	0.0	50,928	5.02	0.1	0.00	17.56	0.07	38.2	100.0
508	0.0	50,916	5.02	0.1	0.00	17.56	0.06	38.2	100.0
512	0.0	50,905	5.02	0.1	0.00	17.56	0.06	38.2	100.0

**Sediment Basin #7 Hydrograph
25-Yr Storm**



Conclusion: The basin can pass the design storm without overtopping the dam and provide a settling efficiency greater than 75%.



Curves may not be extrapolated.

Figure 8.06a Design of outlet protection protection from a round pipe flowing full, minimum tailwater condition ($T_w < 0.5$ diameter).

TABLE 3.14-D

CONCENTRIC TRASH RACK AND ANTI-VORTEX DEVICE DESIGN TABLE

Riser Diam., in.	Cylinder		Height, inches	Minimum Size Support Bar	Minimum Top	
	Diameter, inches	Thickness, gage			Thickness	Stiffener
12	18	16	6	#6 Rebar or 1½ x 1½ x 3/16 angle	16 ga. (F&C)	-
15	21	16	7	" "	" "	-
18	27	16	8	" "	" "	-
21	30	16	11	" "	16 ga.(C), 14 ga.(F)	-
24	36	16	13	" "	" "	-
27	42	16	15	" "	" "	-
36	54	14	17	#8 Rebar	14 ga.(C), 12 ga.(F)	-
42	60	16	19	" "	" "	-
48	72	16	21	1¼" pipe or 1¼ x 1¼ x ¼ angle	14 ga.(C), 10 ga.(F)	-
54	78	16	25	" "	" "	-
60	90	14	29	1½" pipe or 1½ x 1½ x ¼ angle	12 ga.(C), 8 ga.(F)	-
66	96	14	33	2" pipe or 2 x 2 x 3/16 angle	12 ga.(C), 8 ga.(F) w/stiffener	2 x 2 x ¼ angle
72	102	14	36	" "	" "	2½ x 2½ x ¼ angle
78	114	14	39	2½" pipe or 2 x 2 x ¼ angle	" "	" "
84	120	12	42	2½" pipe or 2½ x 2½ x ¼ angle	" "	2½ x 2½ x 5/16 angle

Note₁: The criterion for sizing the cylinder is that the area between the inside of the cylinder and the outside of the riser is equal to or greater than the area inside the riser. Therefore, the above table is invalid for use with concrete pipe risers.

Note₂: Corrugation for 12"-36" pipe measures 2¾" x ½"; for 42" -84" the corrugation measures 5" x 1" or 8" x 1".

Note₃: C = corrugated; F = flat.

Source: Adapted from USDA-SCS and Carl M. Henshaw Drainage Products Information.

Project: Old Salisbury Road Landfill	Computed: <i>PAW</i>	Date: <i>7-17-02</i>
Subject: Drainage	Checked: <i>MDP</i>	Date: <i>7-17-02</i>
Task: Sediment Basin #5 Check	Sheet 1	Of 7

Objective: Verify the construction of SB #5 with the design.

Drainage Area

Area Type = Newly Graded Area
 Drainage Area (ac) = 20
 CN = 90
 Runoff Coeff = 0.45 Ag land, smooth Ref 3
 Soil Group = C Class C Soils having a moderately high runoff potential due to slow infiltration rates. These soils consist primarily of soils in which a layer exists near the surface that impede the downward movement of water or soils with moderately fine to fine texture

Inflow Data

Calculate Peak Flow using the Rational Method (Q_p):

25-yr, 5-min Design Storm

Rainfall, P (inches) = 5.5 Ref 1, Figure 8.03k
 I (in/hr) = 7.6 *Design Intensity*
 Q_p (cfs) = CIA = 68.40

Estimate Depth of Runoff for design storm @ location:

Ref 2, page III-4

Determine Ultimate Storage Capacity (S):

$$S = (1000/CN) - 10 = 1.11$$

Determine Runoff Depth (Q^*):

$$Q^* \text{ (inches)} = (P - 0.2S)^2 / (P + 0.8S) = 4.36$$

Determine Time to Peak (T_p):

$$T_p \text{ (min)} = 60.5(Q^*)A/Q_p/1.39 = 55 \text{ minutes} \quad \text{Ref 2, page III-4}$$

Determine Shape of Basin:

Find the area of the Basin using AutoCADD.

Calculate Volume of the Basin using Truncated Pyramid Method

Elevation (ft)	Area (sf)	Volume (cf)	Cumulative Vol (cf)
0	0	0	0
2	31,913	21,275	21,275
4	38,643	70,449	91,724

Calculate the Sediment Storage Volume (V_c):

lean Out Internal (T), days = 180 or as needed Ref 1 pg 8.07.17

$$V_c \text{ (cf)} = 18 * T(A)^{0.84} = 40,125$$

Project: Old Salisbury Road Landfill	Computed: <i>PMO</i>	Date: <i>7-17-02</i>
Subject: Drainage	Checked: <i>MDP</i>	Date: <i>7-17-02</i>
Task: Sediment Basin #5 Check	Sheet <i>2</i>	Of <i>7</i>

Determine Sediment Storage Elevation (Z_{sed}):

$$Z_{sed} (ft) = (V_C/K_S)^{1/b}$$

Ref 2 pg III-8

Pick one point near max expected water surface and the other at the mid depth.

$$Z_1 (ft) = 2 \quad S_1 (cf) = 21,275$$

$$Z_2 (ft) = 4 \quad S_2 (cf) = 91,724$$

$$b = \ln(S_2/S_1)/\ln(Z_2/Z_1) = 2.1$$

$$K_S = S_2/Z_2^b = 4,935$$

$$Z_{sed} (ft) = 2.7 \quad \text{set riser a minimum of this height measured from bottom of pond}$$

Determine the remaining volume for wet Storage (V_{rem}):

$$V_{rem} (cf) = S_2 - V_C = 51,600$$

Route the Storm through the Basin using the Hydrograph Model

see attached calculations

Height of Emergency Spillway at (ft) = 4

Top of Dam at (ft) = 5

Determine Emergency Spillway Shape:

Required Capacity of Emergency Spillway (Q_E):

$$Q_E (cfs) = 3.49 \quad \text{Peak "Weir Flow" from Hydrograph}$$

Determine Tailwater conditions to size spillway

Use Normal Depth Procedure (Manning's Eqn.)

$$A * R^{2/3} = Q * n / 1.49 s^{0.5}$$

$$\text{Area (A)} = bd + z(d^2)$$

$$Z_{req} = Q * n / 1.49 s^{0.5}$$

$$R = \text{Area} / (b + 2d((z^2) + 1)^{.5})$$

$$Z_{av} = A * R^{2/3}$$

- n = 0.030 6" Rip Rap
- Q_B (cfs) = - Peak Outflow of Barrel from Hydrograph Model.
- V_p (ft/sec) = 8.4 Permissible 6" Rip Rap at 4:1
- Side Slope (z) = 3 enter X for X:1
- s (ft/ft) = 0.150 Slope down the dam (estimated from as built survey)
- Bottom Width (ft) = 10 estimated from as built survey

Flow Depth d

Z_{req}	(ft)	A (sf)	R (ft)	Z_{av}	V (ft/sec)
0.18	0.09	0.9	0.09	0.18	3.8

HDR Computation

Project: Old Salisbury Road Landfill	Computed: <i>PAW</i>	Date: <i>7-17-02</i>
Subject: Drainage	Checked: <i>MJP</i>	Date: <i>7-17-02</i>
Task: Sediment Basin #5 Check	Sheet <i>3</i>	Of <i>7</i>

Anti-Vortex Device:

Installed per design

Outlet Apron

Determine Tailwater conditions to size apron
Use Normal Depth Procedure (Manning's Eqn.)

$$A \cdot R^{2/3} = Q \cdot n / 1.49 s^{0.5}$$

$$Z_{req} = Q \cdot n / 1.49 s^{0.5}$$

$$\text{Area (A)} = bd + z(d^2)$$

$$R = \text{Area} / (b + 2d((z^2) + 1)^{0.5})$$

$$Z_{av} = A \cdot R^{2/3}$$

- n = 0.030 6" Rip Rap Lined Channel
- Q_B (cfs) = - Peak Outflow of Barrel from Hydrograph Model.
- V_p (ft/sec) = 8.4 Permissible Velocity for 6" Rip Rap
- Side Slope (z) = 3 enter X for X:1
- s (ft/ft) = 0.10 Outlet Slope (assumed)
- Bottom Width (ft) = 6.0 3 * Barrel Diameter

Q _B (cfs)	Z _{req}	Depth d (ft)	A (sf)	R (ft)	Z _{av}	V (ft/sec)
34.3	2.18	0.52	3.9	0.42	2.18	8.8

Flow Depth = Tailwater (d) = 0.52 0.5* Barrel Diameter = 1.00

Minimum Tailwater Conditions: d < 0.5 * Diameter of Outlet Pipe

Maximum Tailwater Conditions: d > 0.5 * Diameter of Outlet Pipe

Since the Tailwater is less than half of the diameter of the outlet, use Minimum Tailwater conditions.

	Barrel Diameter (ft)	Entrance (ft)	Length (ft)	Outlet Width (ft)	Rip Rap Size d ₅₀	Selected Rip Rap Size (in)	Ref 3 p. 8.06.4
Design	2	6	10	12	0.3	Class B	
As-Built	2	6	20	22	0.7	Class B	

Conclusion The Apron Outlet is adequate.

Old Salisbury Road C&D Landfill

Sediment Basin #5

25-Year Storm

HDR Project No. 162-525-018

Qp = 68.40 cfs
 Tp = 55 min.
 dT = 2

				Bottom	at 4' deep
Diameter of Barrel =	24	(in)	Length of Basin (ft) =	234	270
Height of Riser =	3.50	(ft)	Width of Basin (ft) =	142	164
Emergency Spillway =	5.0	(ft)	Slope of side & front walls =	3	(enter "X" for X:1)
Total Height of Dam =	6	(ft)	Slope of back wall =	3	(enter "X" for X:1)
Length of Overflow Weir =	20	(ft)	b =	2.11	
Diameter of Riser =	48	(in)	Ks =	4,935	

Notes:

1. Length of overflow weir is the width of the dam.
2. Datum is measured from the bottom of the barrel.

TIME	INFLOW	STORAGE	STAGE	RISER CAPACITY	WEIR FLOW	BARREL CAPACITY	TOTAL OUTFLOW	BOUND DISCHG	SETTLING EFF.
[min]	[cfs]	[cu ft]	[ft]	[cfs]	[cfs]	[cfs]	[cfs]	[cfs]	[%]
0	0.0	0.00	0.00	0.0	0.00	0.00	0.00	0.0	N/A
3	0.5	0.00	0.00	0.0	0.00	0.00	0.00	0.0	N/A
4	0.9	30	0.09	0.0	0.00	0.00	0.00	1.6	N/A
5	1.4	82	0.14	0.0	0.00	0.00	0.00	2.7	N/A
6	2.0	164	0.20	0.0	0.00	0.00	0.00	3.8	N/A
7	2.7	281	0.26	0.0	0.00	0.00	0.00	5.1	N/A
8	3.4	440	0.32	0.0	0.00	0.00	0.00	6.4	N/A
9	4.3	647	0.38	0.0	0.00	0.00	0.00	7.9	N/A
10	5.3	908	0.45	0.0	0.00	0.00	0.00	9.4	N/A
11	6.4	1,228	0.52	0.0	0.00	0.00	0.00	11.0	N/A
12	7.6	1,613	0.59	0.0	0.00	0.00	0.00	12.7	N/A
13	8.9	2,069	0.66	0.0	0.00	0.00	0.00	14.5	N/A
14	10.2	2,600	0.74	0.0	0.00	0.00	0.00	16.3	N/A
15	11.6	3,211	0.82	0.0	0.00	0.00	0.00	18.3	N/A
16	13.1	3,908	0.90	0.0	0.00	0.00	0.00	20.2	N/A
17	14.7	4,694	0.98	0.0	0.00	0.00	0.00	22.3	N/A
18	16.3	5,573	1.06	0.0	0.00	0.00	0.00	24.4	N/A
19	18.0	6,550	1.14	0.0	0.00	0.00	0.00	26.6	N/A
20	19.7	7,627	1.23	0.0	0.00	0.00	0.00	28.8	N/A
21	21.5	8,808	1.32	0.0	0.00	0.00	0.00	31.0	N/A
22	23.3	10,095	1.40	0.0	0.00	0.00	0.00	33.3	N/A
23	25.1	11,492	1.49	0.0	0.00	0.00	0.00	35.7	N/A
24	27.0	12,999	1.58	0.0	0.00	0.00	0.00	38.1	N/A
25	28.9	14,620	1.67	0.0	0.00	0.00	0.00	40.5	N/A
26	30.8	16,354	1.77	0.0	0.00	0.00	0.00	43.0	N/A
27	32.8	18,204	1.86	0.0	0.00	0.00	0.00	45.5	N/A
28	34.7	20,170	1.95	0.0	0.00	0.00	0.00	48.0	N/A
29	36.6	22,251	2.04	0.0	0.00	0.00	0.00	50.5	N/A
30	38.6	24,449	2.14	0.0	0.00	0.00	0.00	53.1	N/A
31	40.5	26,763	2.23	0.0	0.00	0.00	0.00	55.7	N/A
32	42.4	29,191	2.32	0.0	0.00	0.00	0.00	58.3	N/A
33	44.2	31,733	2.42	0.0	0.00	0.00	0.00	60.9	N/A
34	46.1	34,386	2.51	0.0	0.00	0.00	0.00	63.5	N/A

Computed By: PAW Date: 7-17-02

Checked By: MDP Date: 7-17-02

Sheet: 5 of 7

35	47.9	37,150	2.61	0.0	0.00	0.00	0.00	66.1	N/A
36	49.6	40,022	2.70	0.0	0.00	0.00	0.00	68.8	N/A
37	51.3	42,998	2.79	0.0	0.00	0.00	0.00	71.4	N/A
38	53.0	46,077	2.89	0.0	0.00	0.00	0.00	74.1	N/A
40	56.1	52,433	3.07	0.0	0.00	0.00	0.00	79.3	N/A
42	58.9	59,162	3.25	0.0	0.00	0.00	0.00	84.5	N/A
44	61.4	66,230	3.43	0.0	0.00	0.00	0.00	89.6	N/A
46	63.6	73,600	3.60	1.4	0.00	24.37	1.38	94.7	100.0
48	65.4	81,065	3.77	5.9	0.00	25.15	5.89	99.7	99.5
50	66.8	88,202	3.93	11.5	0.00	25.84	11.55	104.2	98.3
52	67.7	94,828	4.06	17.5	0.00	26.43	17.55	108.2	96.6
54	68.3	100,851	4.18	23.5	0.00	26.95	23.46	111.8	94.6
56	68.4	106,229	4.29	29.0	0.00	27.39	27.39	114.9	93.3
58	68.1	111,148	4.38	34.3	0.00	27.77	27.77	117.6	93.2
60	67.3	115,982	4.47	39.7	0.00	28.14	28.14	120.3	93.1
62	66.1	120,681	4.56	45.0	0.00	28.48	28.48	122.8	93.1
64	64.5	125,195	4.64	50.2	0.00	28.80	28.80	125.2	93.0
66	62.5	129,480	4.71	55.2	0.00	29.09	29.09	127.5	92.9
68	60.2	133,491	4.78	60.0	0.00	29.36	29.36	129.5	92.9
70	57.6	137,188	4.84	64.4	0.00	29.60	29.60	131.4	92.8
72	54.9	140,546	4.90	68.5	0.00	29.82	29.82	133.1	92.8
74	52.4	143,561	4.95	72.2	0.00	30.00	30.00	134.6	92.8
76	50.0	146,253	4.99	75.5	0.00	30.17	30.17	135.9	92.7
78	47.7	148,636	5.03	78.4	0.30	30.32	30.62	137.1	92.6
80	45.6	150,691	5.06	81.0	0.93	30.44	31.37	138.1	92.3
82	43.5	152,393	5.09	83.1	1.60	30.54	32.14	138.9	92.1
84	41.5	153,753	5.11	84.8	2.21	30.62	32.83	139.5	91.9
86	39.6	154,791	5.13	86.1	2.72	30.68	33.40	140.0	91.7
88	37.8	155,534	5.14	87.0	3.10	30.72	33.82	140.4	91.5
90	36.0	156,007	5.15	87.6	3.35	30.75	34.10	140.6	91.4
92	34.4	156,240	5.15	87.9	3.48	30.77	34.24	140.7	91.4
94	32.8	156,258	5.15	87.9	3.49	30.77	34.25	140.7	91.4
96	31.3	156,086	5.15	87.7	3.39	30.76	34.15	140.6	91.4
98	29.9	155,746	5.14	87.3	3.21	30.74	33.95	140.5	91.5
100	28.5	155,258	5.13	86.6	2.95	30.71	33.66	140.2	91.6
102	27.2	154,640	5.12	85.9	2.64	30.67	33.31	140.0	91.7
104	26.0	153,907	5.11	85.0	2.28	30.63	32.91	139.6	91.8
106	24.8	153,073	5.10	83.9	1.90	30.58	32.48	139.2	92.0
108	23.6	152,149	5.09	82.8	1.49	30.53	32.02	138.8	92.1
110	22.6	151,143	5.07	81.5	1.10	30.47	31.56	138.3	92.3
112	21.5	150,063	5.05	80.2	0.71	30.40	31.12	137.8	92.4
114	20.5	148,912	5.03	78.8	0.37	30.33	30.70	137.2	92.6
116	19.6	147,692	5.01	77.3	0.10	30.26	30.36	136.6	92.7
118	18.7	146,401	4.99	75.7	0.00	30.18	30.18	136.0	92.7
120	17.8	145,024	4.97	74.0	0.00	30.10	30.10	135.3	92.7
122	17.0	143,554	4.95	72.2	0.00	30.00	30.00	134.6	92.8
124	16.2	141,997	4.92	70.3	0.00	29.91	29.91	133.8	92.8
126	15.5	140,358	4.89	68.3	0.00	29.80	29.80	133.0	92.8
128	14.8	138,642	4.87	66.2	0.00	29.69	29.69	132.1	92.8
130	14.1	136,854	4.84	64.0	0.00	29.58	29.58	131.2	92.8
132	13.5	134,999	4.80	61.8	0.00	29.46	29.46	130.3	92.9
134	12.9	133,080	4.77	59.5	0.00	29.33	29.33	129.3	92.9

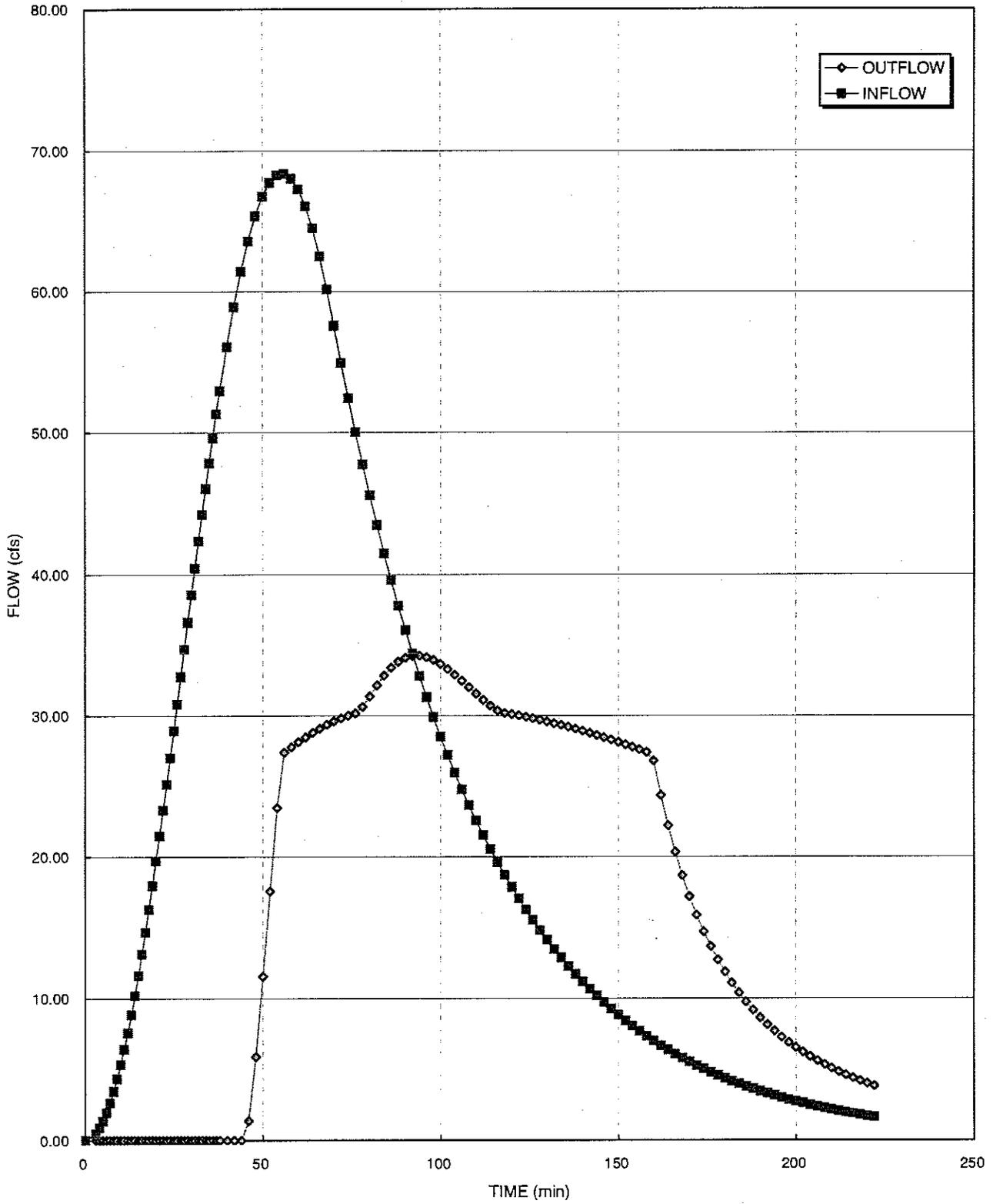
Computed By: PAW Date: 7-17-02

Checked By: MJP Date: 7-17-02

Sheet: 6 of 7

136	12.3	131,103	4.74	57.2	0.00	29.20	29.20	128.3	92.9
138	11.7	129,071	4.70	54.8	0.00	29.06	29.06	127.3	92.9
140	11.2	126,988	4.67	52.3	0.00	28.92	28.92	126.2	93.0
142	10.7	124,857	4.63	49.8	0.00	28.77	28.77	125.1	93.0
144	10.2	122,683	4.59	47.3	0.00	28.62	28.62	123.9	93.0
146	9.7	120,469	4.55	44.8	0.00	28.46	28.46	122.7	93.1
148	9.3	118,218	4.51	42.2	0.00	28.30	28.30	121.5	93.1
150	8.8	115,933	4.47	39.6	0.00	28.13	28.13	120.3	93.1
152	8.4	113,618	4.43	37.0	0.00	27.96	27.96	119.0	93.2
154	8.0	111,274	4.38	34.5	0.00	27.78	27.78	117.7	93.2
156	7.7	108,906	4.34	31.9	0.00	27.60	27.60	116.4	93.3
158	7.3	106,515	4.29	29.3	0.00	27.41	27.41	115.0	93.3
160	7.0	104,105	4.25	26.8	0.00	27.22	26.81	113.7	93.5
162	6.7	101,727	4.20	24.4	0.00	27.02	24.35	112.3	94.3
164	6.4	99,605	4.16	22.2	0.00	26.85	22.21	111.1	95.1
166	6.1	97,704	4.12	20.3	0.00	26.68	20.33	109.9	95.7
168	5.8	95,994	4.09	18.7	0.00	26.54	18.66	108.9	96.2
170	5.5	94,450	4.06	17.2	0.00	26.40	17.19	108.0	96.7
172	5.3	93,051	4.03	15.9	0.00	26.28	15.88	107.2	97.1
174	5.0	91,778	4.00	14.7	0.00	26.16	14.71	106.4	97.4
176	4.8	90,617	3.98	13.7	0.00	26.06	13.66	105.7	97.7
178	4.6	89,555	3.95	12.7	0.00	25.96	12.72	105.0	98.0
180	4.4	88,578	3.93	11.9	0.00	25.87	11.87	104.4	98.2
182	4.2	87,679	3.92	11.1	0.00	25.79	11.10	103.9	98.4
184	4.0	86,848	3.90	10.4	0.00	25.71	10.40	103.3	98.6
186	3.8	86,078	3.88	9.8	0.00	25.64	9.76	102.9	98.7
188	3.6	85,363	3.87	9.2	0.00	25.57	9.18	102.4	98.9
190	3.5	84,697	3.85	8.6	0.00	25.50	8.64	102.0	99.0
192	3.3	84,075	3.84	8.2	0.00	25.44	8.15	101.6	99.1
194	3.2	83,493	3.83	7.7	0.00	25.39	7.70	101.2	99.2
196	3.0	82,947	3.81	7.3	0.00	25.33	7.28	100.9	99.2
198	2.9	82,434	3.80	6.9	0.00	25.28	6.90	100.5	99.3
200	2.7	81,950	3.79	6.5	0.00	25.23	6.54	100.2	99.4
202	2.6	81,495	3.78	6.2	0.00	25.19	6.20	99.9	99.4
204	2.5	81,064	3.77	5.9	0.00	25.15	5.89	99.7	99.5
206	2.4	80,656	3.76	5.6	0.00	25.11	5.60	99.4	99.5
208	2.3	80,269	3.75	5.3	0.00	25.07	5.33	99.1	99.6
210	2.2	79,902	3.75	5.1	0.00	25.03	5.08	98.9	99.6
212	2.1	79,552	3.74	4.8	0.00	24.99	4.84	98.7	99.6
214	2.0	79,220	3.73	4.6	0.00	24.96	4.61	98.5	99.7
216	1.9	78,903	3.72	4.4	0.00	24.93	4.40	98.3	99.7
218	1.8	78,600	3.72	4.2	0.00	24.90	4.21	98.1	99.7
220	1.7	78,311	3.71	4.0	0.00	24.87	4.02	97.9	99.7
222	1.6	78,034	3.70	3.8	0.00	24.84	3.84	97.7	99.8

**Sediment Basin Hydrograph
25-Yr Storm**



Conclusion: The basin can pass the design storm without overtopping the dam and provide a settling efficiency greater than 75%.

Project: Old Salisbury Road C&D Landfill	Computed: <i>PAW</i>	Date: <i>7-11-02</i>
Subject: Drainage	Checked: <i>MDP</i>	Date: <i>7-11-02</i>
Task: Perimeter Channels	Sheet: <i>1</i>	Of: <i>2</i>

Objective Design the channels between the landfill unit and the access road such that a grass lining will be adequate and limited to a maximum flow depth of 1.8'.

- References**
1. Elements of Urban Stormwater Design, H. Rooney Malcom, P.E.
 2. NC Erosion and Sediment Control Planning and Design Manual
 3. North American Green Product Brochure version 4.11

Equations

Normal Depth Procedure (Mannings Eqn)

$$AR^{2/3} = Q n / 1.49s^{0.5} \quad \text{Area (A)} = bd + z(d^2) \quad Z_{av} = AR^{2/3}$$

$$Z_{req} = Q n / 1.49s^{0.5} \quad R = \text{Area} / (b + 2d((z^2 + 1)^{0.5})) \quad \text{Avg Shear Stress (T)} = K_b * d * s * \text{unit weight of water}$$

Design Channels along the access road

Min Channel Freeboard =	0.2	ft
Inside Channel Side Slope =	2	(enter X for X:1)
Outside Channel Side Slope =	2	(enter X for X:1)
Bottom Width, b =	4	ft
Runoff Coeff =	0.7	Ag land, smooth
I (in/hr) =	7.2	25-yr, 5-min Design Storm
Drainage Area (ac) =	8.6	Max Drainage Area
Q _P (cfs) = CIA =	43	

Various Lining Types

Lining Type	Lining Description	Mannings n	V _p (ft/sec)	Allowable Shear Stress psf
		depths of 0.5-2.0 ft		
A	Jute Net (HEC-15)	0.015	2.0	0.45
B	Erosion Control Blanket Single Net (Curlex 1)	0.034	5.0	1.55
C	Erosion Control Blanket Double Net (Curlex HV)	0.026	10.0	1.65
D	Ordinary Firm Loam (Ref 2)	0.020	3.5	2.0
E	Grass Lined (Ref 2)	0.030	5.0	2.0
F	6" Rip Rap (Ref 2, Ref 1)	0.069	9.0	2.0
G	Unvegetated Turf Reinforcement Mat (TRM) (NAG C350)	0.025	9.5	2.25
H	Class D Phase 2 (Partially vegetated) TRM (NAG C350)	0.048	14.0	3.34
I	12" Rip Rap (Ref 2, Ref 1)	0.078	12.5	4.0
J	Class B Phase 3 (Fully vegetated) TRM (NAG C350)	0.048	18.0	5.7
K	Concrete (HEC-15, EPA 832-F-99-002)	0.013	25.0	10.0

Select Lining System for each channel slope that will handle the design flow when vegetated and when initially placed

Project: Old Salisbury Road C&D Landfill	Computed: PAW	Date: 7-11-02
Subject: Drainage	Checked: MDP	Date: 7-11-02
Task: Perimeter Channels	Sheet: 2	Of: 2

Lining Type	Channel Slope	Z _{req}	Flow Depth d (ft)	Cross Sectional Area (sf)	R	Z _{avail}	Velocity (ft/sec)	Average Shear Stress (lb/sf)	
Permanent Lining									
E	0.5%	12.34	1.6	11.92	1.05	12.34	3.6	0.5	
E	1.0%	8.73	1.4	9.27	0.91	8.73	4.7	0.9	
J	2.0%	9.87	1.5	10.13	0.96	9.87	4.3	1.8	
J	3.0%	8.06	1.3	8.75	0.88	8.06	5.0	2.5	
J	4.0%	6.98	1.2	7.89	0.83	6.98	5.5	3.1	
J	5.0%	6.24	1.2	7.28	0.79	6.24	6.0	3.6	
J	6.0%	5.70	1.1	6.82	0.76	5.70	6.4	4.1	
J	7.0%	5.28	1.1	6.45	0.74	5.28	6.7	4.6	
J	8.0%	4.94	1.0	6.15	0.72	4.94	7.0	5.1	
J	9.0%	4.65	1.0	5.90	0.70	4.65	7.4	5.5	
K	10.0%	1.20	0.5	2.30	0.38	1.20	18.9	2.9	
Initial Lining									
B	0.5%	13.99	1.7	13.07	1.11	13.99	3.3	0.5	
B	1.0%	9.89	1.5	10.15	0.96	9.89	4.3	0.9	
G	2.0%	5.14	1.0	6.33	0.73	5.14	6.8	1.3	
G	3.0%	4.20	0.9	5.48	0.67	4.20	7.9	1.7	
G	4.0%	3.64	0.9	4.95	0.63	3.64	8.7	2.2	
G	5.0%	3.25	0.8	4.57	0.60	3.25	9.5	2.5	FAILURE
I	6.0%	9.26	1.4	9.67	0.94	9.26	4.5	5.3	FAILURE
K	7.0%	1.43	0.5	2.59	0.41	1.43	16.7	2.2	
K	8.0%	1.34	0.5	2.48	0.40	1.34	17.5	2.5	
K	9.0%	1.26	0.5	2.38	0.39	1.26	18.2	2.7	
K	10.0%	1.20	0.5	2.30	0.38	1.20	18.9	2.9	

Find Max Q for following max allowable channel velocities & shear stresses

Lining Type	Channel Slope	Q (cfs)	Z _{req}	Flow Depth d (ft)	Cross Sectional Area (sf)	R	Z _{avail}	Velocity (ft/sec)	Average Shear Stress (lb/sf)
G	5.0%	34.8	2.61	0.7	3.92	0.54	2.61	8.9	2.25
G	6.0%	27.4	1.88	0.6	3.12	0.47	1.88	8.8	2.25
G	7.0%	22.5	1.43	0.5	2.59	0.41	1.43	8.7	2.25
G	8.0%	19.0	1.13	0.5	2.21	0.37	1.13	8.6	2.25
G	9.0%	16.4	0.92	0.4	1.92	0.33	0.92	8.6	2.25
G	10.0%	14.5	0.77	0.4	1.70	0.30	0.77	8.5	2.25

CONCLUSION

Design Flow Channels

Channels with slopes of 1% or less to be grass lined with temporary lining.
Use Turf Reinforcement Mat (TRM) for channels with slopes >1%.

Restricted Flow Channels

Limit the maximum flow for channels with slopes 5% to 10% to the values above until the channel is fully vegetated with temporary diversion channels.

Project: Old Salisbury Road C&D Landfill	Computed: PAW	Date: 7-17-02
Subject: Drainage	Checked: MDP	Date: 7-12-02
Task: Sideslope Swales (Temporary Lining)	Sheet: 1	Of: 2

Objective: Determined if a temporary lining is adequate for the sideslope swales

- References:**
1. Elements of Urban Stormwater Design, H. Rooney Malcom, P.E.
 2. NC Erosion and Sediment Control Planning and Design Manual

Equations and Givens:

$Q \text{ (cfs)} = CIA = \text{Peak Flow}$
 Drainage Area, A (acres) = varies, see below
 Runoff Coefficient, C = 0.7
Design Storm: 25-Yr, 5-min
 Rainfall, P (inches) = 5.5 Ref 1, Figure 8.03k
 I (in/hr) = 7.2 Intensity for Design Storm

 Normal Depth Procedure (Ref 1)
 $AR^{2/3} = Qn/1.49s^{0.5}$ Area (A) = $bd + z(d^2)$ $Z_{av} = AR^{2/3}$
 $Z_{req} = Qn/1.49s^{0.5}$ $R = \text{Area}/(b + 2d((z^2) + 1)^{.5})$ $Q = CIA$
 Avg Shear Stress (T) = $K_b * d * s * \text{unit weight of water}$

- Desired Freeboard = 0.5 feet
- Bench Width = 12 feet
- Landfill Side Slope = 4
- Design Channel Slope (s) = 0.03 ft fall / foot run
- Mannings n = 0.034 Erosion Control Blanket Single Net, Curlex 1
- permissible velocity (ft/sec) = 5.0 Erosion Control Blanket Single Net, Curlex 1
- Allowable Shear Stress (psf) = 1.55 Erosion Control Blanket Single Net, Curlex 1

Scenario	Length (ft)	Vertical Spacing (ft)	Width / Spacing (ft)	Drainage Area (ac)	Q (cfs)	Inside Channel Side Slope (z)	Outside Channel Side Slope (m)	Bottom Width (ft)
1	982	30	132	3.0	15.0	4	2	3
2	924	30	132	2.8	14.3	4	2	2
3	627	30	132	1.9	13.8	4	2	1
4	363	30	132	1.1	12.8	4	2	0

Scenario	Flow Depth d (ft)	Cross Sectional Area A (sf)	Z_{req}	R	Z_{avail}	V (ft/sec)	Allowable Shear Stress (psf)	
1	0.7	3.32	1.98	0.46	1.98	4.5	1.25	OK
2	0.7	3.13	1.88	0.47	1.88	4.6	1.39	OK
3	0.8	3.01	1.82	0.47	1.82	4.6	1.59	FAILURE
4	1.0	2.84	1.69	0.46	1.69	4.5	1.82	FAILURE

Check Curlex II Lining

Project: Old Salisbury Road C&D Landfill	Computed: <i>PMB</i>	Date: <i>7-17-02</i>
Subject: Drainage	Checked: <i>MJP</i>	Date: <i>7-17-02</i>
Task: Sideslope Swales (Temporary Lining)	Sheet: <i>2</i>	Of: <i>2</i>

Mannings n = 0.026 Erosion Control Blanket Single Net, Curlex II
 permissible velocity (ft/sec) = 7.5 Erosion Control Blanket Single Net, Curlex II
 Allowable Shear Stress (psf) = 2 Erosion Control Blanket Single Net, Curlex II

Scenario	Flow Depth d (ft)	Cross Sectional A (sf)	Z _{req}	R	Z _{avail}	V (ft/sec)	Allowable Shear Stress (psf)	
3	0.8	3.0	1.39	0.47	1.82	4.6	1.59	OK
4	1.0	2.8	1.29	0.46	1.69	4.5	1.82	OK

CONCLUSION

Temporary Lining type = Curlex II
 Permanent Lining type = Grass

Project: Old Salisbury Road C&D Landfill	Computed: <i>PMW</i>	Date: <i>7-11-02</i>
Subject: Drainage	Checked <i>MJP</i>	Date <i>7-11-02</i>
Task: Sideslope Swales (Permenant Lining)	Sheet <i>1</i>	Of <i>3</i>

Objective

Determine max drainage area for sideslope swales based on constraints.

Constraints

Keep velocity relatively constant by varying the bottom width of channel.
Minimize the overall bench width.

References:

1. Elements of Urban Stormwater Design, H. Rooney Malcom, P.E.
2. NC Erosion and Sediment Control Planning and Design Manual

Drainage Area

Calculate Peak Flow

$$Q \text{ (cfs)} = CIA = \text{Peak Flow}$$

Drainage Area, A (acres) = to be determined

Runoff Coefficient, C = 0.7

Design Storm: 25-Yr, 5-min

Rainfall, P (inches) = 5.5 Ref 1, Figure 8.03k

I (in/hr) = 7.2 Intensity for Design Storm

Equations:

Normal Depth Procedure (Ref 1)

$$AR^{2/3} = Qn / 1.49s^{0.5} \quad \text{Area (A)} = bd + z(d^2) \quad Z_{av} = AR^{2/3}$$

$$Z_{req} = Qn / 1.49s^{0.5} \quad R = \text{Area} / (b + 2d((z^2) + 1)^{.5}) \quad Q = CIA$$

Set velocity near the maximum allowed for grass lined channel and find maximum drainage area

Desired Freeboard =	0.5	feet
Overall Bench Width =	12	feet
Landfill Side Slope =	4	
Channel Slope (s) =	0.9-2.6%	Winston-Salem Unlined Closure As-Built
Design Channel Slope (s) =	0.03	ft fall / foot run
Mannings n =	0.030	Grass Lined, 0.5-2.0 ft (Ref 2)
max permissible velocity (ft/sec) =	5.0	for 0.5-2.0 ft (Ref 2)
Allowable Shear Stress (psf) =	2.0	Grass Lined, 0.5-2.0 ft (Ref 2)

Project: Old Salisbury Road C&D Landfill	Computed: <i>PAW</i>	Date: <i>7-11-02</i>
Subject: Drainage	Checked: <i>MDP</i>	Date: <i>7-11-02</i>
Task: Sideslope Swales (Permenant Lining)	Sheet: <i>2</i>	Of: <i>3</i>

Scenario	Length (ft)	Vertical Spacing (ft)	Width / Spacing (ft)	Drainage Area (ac)	Q (cfs)	Inside Channel Side Slope (z)	Outside Channel Side Slope (m)	Bottom Width (ft)
1	982	30	132	3.0	15.0	4	2	3
2	924	30	132	2.8	14.3	4	2	2
3	627	30	132	1.9	13.8	4	2	1
4	363	30	132	1.1	12.8	4	2	0

Scenario	Flow Depth d (ft)	Cross Sectional A (sf)	Z _{req}	R	Z _{avail}	V (ft/sec)	Allowable Shear Stress (psf)	
1	0.6	3.03	1.74	0.44	1.74	5.0	1.17	ok
2	0.7	2.85	1.66	0.44	1.66	5.0	1.31	ok
3	0.8	2.73	1.60	0.45	1.60	5.0	1.50	ok
4	0.9	2.58	1.49	0.44	1.49	5.0	1.74	ok

Minimum Depth (ft) = 1.4 (includes freeboard)
 Set Total Depth = 2.0

Check velocity in bare earth condition

Mannings n = 0.020 Ordinary Firm Loam (Ref 2)
 max permissible velocity (ft/sec) = 3.5 Ordinary Firm Loam (Ref 2)
 Allowable Shear Stress (psf) = 2.0 Ordinary Firm Loam (Ref 2)

Scenario	Length (ft)	Vertical Spacing (ft)	Width / Spacing (ft)	Drainage Area (ac)	Q (cfs)	Inside Channel Side Slope (z)	Outside Channel Side Slope (m)	Bottom Width (ft)
1	982	30	132	3.0	15.0	4	2	3
2	924	30	132	2.8	14.3	4	2	2
3	627	30	132	1.9	13.8	4	2	1
4	363	30	132	1.1	12.8	4	2	0

Scenario	Flow Depth d (ft)	Cross Sectional A (sf)	Z _{req}	R	Z _{avail}	V (ft/sec)	
1	0.5	2.27	1.16	0.37	1.16	6.6	> 3.5 fps need temp lining
2	0.6	2.13	1.11	0.38	1.11	6.7	> 3.5 fps need temp lining
3	0.7	2.02	1.07	0.38	1.07	6.8	> 3.5 fps need temp lining
4	0.8	1.90	0.99	0.38	0.99	6.7	> 3.5 fps need temp lining

Project: Old Salisbury Road C&D Landfill	Computed: <i>PAW</i>	Date: <i>7-11-02</i>
Subject: Drainage	Checked: <i>MJP</i>	Date: <i>7-11-02</i>
Task: Sideslope Swales (Permenant Lining)	Sheet: <i>3</i>	Of: <i>3</i>

See attached calculations for Temporary Lining.

Check effects of settlement (flatter slope) on flow depth

Channel Slope After Settlement (s) = 0.015 ft fall / foot run (Assumed value)
 max permissible velocity (ft/sec) = 5.0 for 0.5-2.0 ft (Ref 2)
 Allowable Shear Stress (psf) = 2.0 Grass Lined, 0.5-2.0 ft (Ref 2)

Scenario	Length (ft)	Vertical Spacing (ft)	Width / Spacing (ft)	Drainage Area (ac)	Q (cfs)	Inside Channel Side Slope (z)	Outside Channel Side Slope (m)	Bottom Width (ft)
1	982	30	132	3.0	15.0	4	2	3
2	924	30	132	2.8	14.3	4	2	2
3	627	30	132	1.9	13.8	4	2	1
4	363	30	132	1.1	12.8	4	2	0

Scenario	Flow Depth d (ft)	Cross Sectional A (sf)	Z _{req}	R	Z _{avail}	V (ft/sec)	Allowable Shear Stress (psf)	
1	0.7	3.90	2.47	0.50	2.47	3.8	0.70	ok
2	0.8	3.69	2.35	0.51	2.35	3.9	0.77	ok
3	0.9	3.55	2.27	0.51	2.27	3.9	0.87	ok
4	1.1	3.34	2.10	0.50	2.10	3.8	0.99	ok

Flow Depths all less than 1.5' therefore channels all ok

Conclusion:

The swales should be constructed such that the bottom width is greater than or equal to the design width for the corresponding drainage areas.

The maximum drainage area for this swale design is 1.1 acres

Construct a trapezoidal shaped channel with the following dimensions:

- Vertical Spacing (ft) = 30
- Min Depth of Swale (ft) = 1.6 (includes freeboard)
- Set Depth of Swale (ft) = 2.0
- Outside Channel Side Slope (x:1) = 2
- Inside Channel Side Slope (x:1) = 4
- Design Channel Slope = 3%
- Bottom Width (ft) = Varies from 0 to 1.6 feet
- Permanent Lining type = Grass
- Temporary Lining type = See attached calcs

Project: Old Salisbury Road C&D Landfill	Computed: <i>PMW</i>	Date: <i>7-17-02</i>
Subject: Drainage	Checked <i>MOP</i>	Date <i>7-17-02</i>
Task: Slope Drain	Sheet <i>1</i>	Of <i>2</i>

Objective

Determine the largest drainage area for a down chute pipe to carry the flow from the side slope swales to the perimeter channels.

References

1. Elements of Urban Stormwater Design, H. Rooney Malcom, P.E.
2. NC Erosion and Sediment Control Planning and Design Manual
3. Crumpler Plastic Pipe

Equations

$$D = 16 * [Q * n / s^{0.5}]^{3/8}$$

D (in) = Theoretical Pipe Diameter (in) for just full flow

Q (cfs) = Flow

n = Manning's Roughness Coefficient

s = Slope, ft fall / ft run

$$Q \text{ (cfs)} = CIA$$

Q (cfs) = Flow

C = Runoff Coefficient

I (in/hr) = Intensity for Design Storm

A (acres) = Drainage Area

Assumptions

The drainage area may vary for each downchute, therefore determine the max drainage area that may be routed through the downchute.

Design Storm 25 yr, 5-min

Rational Coeff = 0.7

infiltration is restricted due to the final cover
for 25 yr, 5-min storm

Rainfall, P (inches) = 5.5

I (in/hr) = 7.2

n = 0.010

smooth Core Pipe

Ref 3

Slope, s (X:1) =	3		3.5		4		4.5	
Slope, s (%) =	33%		29%		25%		22%	
D (in)	Q (cfs)	A (ac)						
24	170.2	33.8	157.6	31.3	147.4	29.2	139.0	27.6
18	79.0	15.7	73.2	14.5	68.5	13.6	64.5	12.8
15	48.6	9.6	45.0	8.9	42.1	8.4	39.7	7.9
12	26.8	5.3	24.8	4.9	23.2	4.6	21.9	4.3
10	16.5	3.3	15.3	3.0	14.3	2.8	13.5	2.7
8	9.1	1.8	8.4	1.7	7.9	1.6	7.4	1.5

Set the max head then calculate the max drainage area to each inlet pipe to the downchute.

HDR Computation

| Job No. 00162-525-018 |

Project: Old Salisbury Road C&D Landfill	Computed: <i>PAW</i>	Date: <i>7-17-02</i>
Subject: Drainage	Checked <i>MJP</i>	Date <i>7-17-02</i>
Task: Slope Drain	Sheet <i>2</i>	Of <i>2</i>

Outlet Protection

Minimum Tailwater Depth is assumed in accordance with NC Guidelines p. 6.41.1. Stormwater that is outlet onto broad flat areas with no defined channel may be assumed to have a minimum tailwater condition.

Refer to NC Guidelines p. 8.06.3 to size the apron and median Rip-Rap Size.

Pipe Dia. (ft)	Entrance (ft)	Q (cfs)	Length (ft)	Width (ft)	Median Rip Rap d_{50}	Rip Rap Sizeto Use (in)
1.25	3.75	42.1	26	27	1.4	Class 1
1	3.00	23.2	22	23	1.1	Class 1

Conclusion

Use 12" and 15" pipe for downchutes depending on drainage areas
Confirm that drainage areas are not exceeded during installation in asbuilt conditions.
Provide a 12" minimum cover of good soil over the pipes.

Appendix B

TECHNICAL SPECIFICATIONS

1
2 **SECTION 02110**
3 **SITE CLEARING**

4 **PART 1 - GENERAL**

5 **1.1 SUMMARY**

- 6 A. Section Includes:
7 1. Site clearing, tree protection, stripping topsoil and demolition.
8 B. Related Sections include but are not necessarily limited to:
9 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
10 2. Division 1 - General Requirements.
11 3. Section 02220 - Sitework.
12 4. Section 02270 - Soil Erosion and Sediment Control.
13 5. Section 02485 - Seeding.

14 **1.2 QUALITY ASSURANCE**

- 15 A. North Carolina Erosion and Sediment Control Planning and Design Manual, Current Edition.

16 **PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SECTION)**

17 **PART 3 - EXECUTION**

18 **3.1 PREPARATION**

- 19 A. Protect existing trees and other vegetation to remain outside limits of clearing against damage.
20 1. Do not smother trees by stockpiling construction materials or excavated materials within
21 drip line.
22 2. Avoid foot or vehicular traffic or parking of vehicles within drip line.
23 3. Provide temporary protection as required.
24 B. Repair or replace trees and vegetation outside clearing limits damaged by construction
25 operations.
26 1. Repair to be performed by a qualified tree surgeon.
27 2. Remove trees which cannot be repaired and restore to full-growth status.
28 3. Replace with new trees of minimum 4 IN caliper.

29 **3.2 SITE CLEARING**

- 30 A. Topsoil within the limits of construction to be removed upon completion of the clearing and
31 grubbing. Topsoil to be stockpiled in a designated area. Do not use topsoil material as structural
32 fill and do not respread topsoil for seeding. CQA Consultant to define topsoil.
33 B. Clearing and Grubbing:
34 1. Clear from within limits of construction all trees not marked to remain.
35 a. Include shrubs, brush, downed timber, rotten wood, heavy growth of grass and weeds,
36 vines, rubbish, structures and debris.
37 2. Grub (remove) from within limits of construction all stumps, roots, root mats, logs and
38 debris encountered.
39 3. In areas where there is no grading to occur, only clearing and grubbing, completely grub the
40 area and fill in any depressions caused by stumps and prepare the area for permanent
41 seeding.

- 1 C. Disposal of Waste Materials (Non-Saleable Material):
2 1. Do not burn combustible materials on site.
3 2. Do not bury organic matter on site.
4 3. All waste materials shall be ground and stockpiled in an area designated by the Owner.

5 **3.3 ACCEPTANCE**

- 6 A. Upon completion of the site clearing, obtain Engineer's acceptance of the extent of clearing,
7 depth of stripping and rough grade.

8 **END OF SECTION**

1 **1.4 SOILS/GEOTECHNICAL**

- 2 A. The Owner will provide for the on-site services of a CQA Consultant (Soils Engineer) to selectively test
3 materials and monitor compliance with the requirements of these Specifications. This will be in addition
4 to Construction Quality Control (CQC), provided and paid for by the Contractor to be performed by the
5 CQC Consultant in accordance with these Specifications and the CQA Plan.
- 6 B. The Contractor will afford these representatives access to the job site for the performance of their duties
7 as described in the Contract Documents.
- 8 C. General Duties and Responsibilities of the Contractor's CQC Consultant: Under the direction of a
9 qualified registered engineer or geologist:
- 10 1. Perform stockpile and in-place testing of all soil and rock materials used in the work in conformance
11 with these Specifications.
 - 12 2. Inspect subgrades and excavations and evaluate/determine suitability of materials encountered.
13 Determine extent of any overexcavation required to remove unsuitable materials under roadways,
14 structures, or other areas of construction.
 - 15 3. Document placement of fill materials and perform testing to confirm compliance with these
16 Specifications.
 - 17 4. Evaluate the suitability of existing on-site materials for use in construction of embankments and fills
18 within the proposed grading shown on the Contract Drawings.
 - 19 5. Measure quantity of unsuitable materials under contract provisions for authorized overexcavation
20 and backfill.
 - 21 6. Provide to the CQA consultant on a weekly basis a summary of test results with a location map. The
22 Owner may withhold payment if results are not submitted in a timely fashion.
- 23 D. General Duties and Responsibilities of Owner's CQA Consultant:
- 24 1. Approve materials proposed for incorporation into the work as proposed by the CQC Consultant.
 - 25 2. Review subgrades and excavations and approve suitability of materials encountered as proposed by
26 the CQC Consultant. Approve extent of any overexcavation required to remove unsuitable materials
27 under roadways, structures, or other areas of construction, as proposed by the CQC Consultant.
 - 28 3. Observe placement of fill materials and testing by CQC Consultant for compliance with these
29 specifications.
 - 30 4. Review/approve the suitability of existing on-site materials for use in construction of embankments
31 and fills.
 - 32 5. Review construction operations and monitor for compliance with Contract Documents.
 - 33 6. Review/approve CQC Consultant quantity of unsuitable materials for payment on a unit price basis
34 under contract provisions for authorized overexcavation and backfill.
- 35 E. Available Subsurface Information: Where provided, data on subsurface soil conditions are not intended
36 as representations or warranties of the continuity of such conditions between borings or indicated
37 sampling locations. It shall be expressly understood that neither the Owner nor the Engineer will be
38 responsible for any interpretation or conclusion drawn therefrom by the Contractor. Data is made
39 available for the convenience of the Contractor.
- 40 F. Additional or supplementary soil borings or other exploratory operations may be made by the Contractor
41 at no additional cost to the Owner. The Contractor shall provide the Owner with a copy of any data
42 obtained/developed during such work. Such additional work shall be performed in a timely manner in
43 accordance with and not impacting or changing the project schedule set forth in the Contract Documents.

44 **1.5 TOLERANCES**

- 45 A. Grading shall be to a tolerance of + 0.1 FT unless otherwise noted in the construction documents and then
46 the stricter criteria shall be used.
47

1 **PART 2 - PRODUCTS**

2 **2.1 MATERIALS**

- 3 A. Fill and Backfill: Selected material approved by Soils Engineer and Owner from site excavation or from
4 site stockpile.
- 5 B. Structural Fill: Structural fill should conform to the following.

SIEVE SIZE	PERCENT FINER BY WEIGHT
3 IN	100
¼ IN	30-70
No. 40	5-40
No. 200	0-10

- 6 C. The Contractor shall conduct his own quantity and quality investigations and testing to determine
7 availability and suitability of (on-site) borrow materials, as allowed by the Owner.
- 8 D. All earth materials proposed for use in the Work shall be adequately characterized prior to the Work by
9 the CQC Consultant.

10 **PART 3 - EXECUTION**

11 **3.1 PROTECTION**

- 12 A. Protect existing surface and subsurface features on-site and adjacent to site as follows:
- 13 1. Provide barricades, coverings, or other types of protection necessary to prevent damage to existing
14 items indicated to remain in place.
- 15 2. Protect and maintain benchmarks, monitoring wells, existing structures, monuments, or other
16 established reference points and property corners. If disturbed or destroyed, replace at own expense
17 to full satisfaction of Owner and controlling agency.
- 18 3. Verify location of utilities. Omission or inclusion of utility items does not constitute non-existence or
19 definite location. Secure and examine local utility records for location data.
- 20 a. Take necessary precautions to protect existing utilities from damage due to any construction
21 activity.
- 22 b. Repair damages to utility items at own expense.
- 23 c. In case of damage, notify Engineer at once so required protective measures may be taken.
- 24 4. Maintain free of damage, existing sidewalks, structures, and pavement not indicated to be removed.
25 Any item known or unknown or not properly located that is inadvertently damaged shall be repaired
26 to original condition. All repairs to be made and paid for by Contractor.
- 27 5. Provide full access to public and private premises, fire hydrants, street crossings, sidewalks, and
28 other points as designated by Owner to prevent serious interruption of travel.
- 29 6. Maintain stockpiles and excavations in such a manner to prevent inconvenience or damage to
30 structures on-site or on adjoining property.
- 31 7. Avoid surcharge or excavation procedures which can result in heaving, caving, or slides.
- 32 8. Conduct operation with minimum interference to daily landfill operations.
- 33 B. Construct erosion and sedimentation controls prior to beginning earthwork.
- 34 C. Salvageable Items: Carefully remove items to be salvaged, and store on Owner's premises unless
35 otherwise directed.
- 36 D. Dispose of waste materials, legally, off site. Burning, as a means of waste disposal, is not permitted.
37

1 **3.2 SITE EXCAVATION AND GRADING**

- 2 A. The Work includes all operations in connection with excavation, borrow, construction of fills and
3 embankments, rough grading, and disposal of excess materials in connection with the preparation of the
4 site(s) for construction of the proposed facilities.
- 5 B. Excavation and Grading: Perform as required by the Contract Drawings.
- 6 1. Contract Drawings may indicate both existing grade and finished grade required for construction of
7 Project. Stake all units, structures, piping, roads, parking areas and walks and establish their
8 elevations. Perform other layout work required. Replace property corner markers to original location
9 if disturbed or destroyed.
- 10 2. Preparation of ground surface for embankments or fills: Before fill is started, scarify to a minimum
11 depth of 6 IN in all proposed embankment and fill areas. Where ground surface is steeper than one
12 vertical to four horizontal, plow surface in a manner to bench and break up surface so that fill
13 material will bind with existing surface.
- 14 3. Protection of finish grade: During construction, shape and drain embankment and excavations.
15 Maintain ditches and drains to provide drainage at all times. Protect graded areas against action of
16 elements prior to acceptance of work. Re-establish grade where settlement or erosion occurs.
- 17 C. Borrow: Provide necessary amount of approved fill compacted to density equal to that indicated in this
18 Specification. Include cost of all borrow material in original Bid. Fill material to be approved by Soils
19 Engineer prior to placement.
- 20 D. Construct embankments and fills as required by the Contract Drawings:
- 21 1. Construct embankments and fills at locations and to lines of grade indicated. Completed fill shall
22 correspond to shape of typical cross section or contour indicated regardless of method used to show
23 shape, size, and extent of line and grade of completed work.
- 24 2. Provide approved fill material which is free from roots, organic matter, trash, frozen material, and
25 stones having maximum dimension greater than 6 IN. Ensure that stones larger than 4 IN are not
26 placed in upper 6 IN of fill or embankment. Do not place material in layers greater than 12 IN loose
27 thickness. Place layers horizontally and compact each layer prior to placing additional fill.
- 28 3. Compact by sheepsfoot, pneumatic rollers, vibrators, or by other equipment as required to obtain
29 specified density. Control moisture for each layer necessary to meet requirements of compaction.
- 30 E. Upon reaching subgrade elevations shown, proofroll subgrade soils and obtain the CQC Consultant's
31 review/recommendation and CQA Consultant's approval. If unsuitable materials are encountered at the
32 subgrade elevation, repair as directed by the CQC Consultant and approved by the CQA Consultant to
33 remove unsuitable materials. Excavation of 1 cy or greater should be preapproved by the CQC
34 Consultant and CQA Consultant.
- 35 F. Proofrolling shall be conducted with a pneumatic-tired vehicle of at least 20 tons Gross Vehicle Weight
36 (GVW), approved by the CQC and CQA Consultants. An alternate approved by the CQA Consultant
37 may be used in constricted areas.
- 38 G. Where subgrade materials are determined to be unsuitable, such materials shall be removed to the lengths,
39 widths, and depths directed by the CQC Consultant and approved by the CQA Consultant, and backfilled
40 with suitable material unless further excavation or earthwork is required. No additional payment will be
41 made for such excavation and backfill 6 IN or less than the finished subgrade. Payment for unsuitable
42 material excavation greater than 6 IN beneath the finished subgrade shall be negotiated.
- 43 H. The subgrade of areas to receive fill shall be smooth and free of all vegetation, sticks, roots, rocks, and
44 debris.
- 45 I. Dewatering (as required): Provide and maintain dewatering of all surface water and/or groundwater as
46 required for excavation. Where groundwater is or is expected to be encountered during excavation,
47 install a dewatering system to prevent softening and disturbance of subgrade below foundations and fill
48 material, to allow foundations, fill material, and structures/backfill to be placed in the dry, and maintain a
49 stable excavation. Soils and hydrogeologic information may be reviewed before beginning excavation to
50 determine where groundwater is likely to be encountered during excavation. Employ a dewatering

1 specialist for selecting/designing, monitoring, and operating the dewatering system as needed. Keep
2 dewatering system in operation until dead load of structure exceeds possible buoyant uplift force on
3 structure or fill material. Dispose of groundwater to an area which will not interfere with construction
4 operations or damage existing construction as approved by the Owner. Install groundwater monitoring
5 points as necessary. Shut off dewatering system at such a rate so as to prevent a quick upsurge of water
6 that might weaken the subgrade. Installation, start-up, monitoring maintenance, and shut-off of the
7 dewatering system shall be at no additional cost to the Owner.

8 J. Do not place fill when the subgrade is frozen, wet, loose, or soft.

9 K. Moisture control:

- 10 1. Moisture content of materials prior to, and during compaction, shall be uniform throughout each
11 layer of material.
- 12 2. Granular materials shall be thoroughly wetted during or immediately prior to compaction.
- 13 3. Supplementary water shall be added as required to materials by sprinkling and mixing uniformly
14 throughout layer.
- 15 4. Materials too wet for placing shall be temporarily spread or aerated until moisture content is
16 acceptable. If these materials cannot be processed in time to use, the Contractor shall find
17 alternatives acceptable to the CQC Consultant and the CQA Consultant.

18 3.3 USE OF EXPLOSIVES

19 A. Blasting with any type of explosive must be in compliance with 3.4 of this Section.

20 3.4 ROCK EXCAVATION

- 21 A. Rock is defined as natural material that cannot be moved or ripped with a Caterpillar D9 equipped with a
22 single tooth ripper or approved equal. A demonstration is required. The Contractor shall not remove
23 rock until authorized by the Engineer.
- 24 B. All rock excavation shall be under one classification. This classification shall include solid ledge rock in
25 its natural location that requires systematic quarrying, drilling, and/or blasting for its removal and also
26 boulders that exceed 1 CY in volume.
- 27 C. When rock is encountered, strip free of earth. Employ an independent surveyor to determine rock
28 quantities before removal operation begins. In computing the volumetric content of rock excavation for
29 payment, the pay lines shall be taken as follows:
 - 30 1. For landfill cells: From rock surface to 2 FT below proposed subgrade and 10 FT outside the
31 construction baseline.
 - 32 2. For structures: 3 FT outside the exterior limits of foundations and from rock surface to 6 IN below
33 bottom of foundations.
 - 34 3. For piping and utilities: A width 18 IN wider than the outside diameter of the pipe or conduit and
35 from rock surface to 6 IN below bottom exterior surface of the pipe or conduit.
 - 36 4. For paving: 2 FT outside the exterior limits of paving and from rock surface to 6 IN below bottom of
37 pavement subbase.
- 38 D. The use of explosives shall be limited to the magnitude and location of the charge that will not cause
39 damage to adjacent existing construction and utilities through shock vibrations or other stress loadings.
40 Provide adequate blanket protection to ensure that there will not be fragments of rock or other debris
41 flying through the air when discharging explosives. Any damage to existing construction or other
42 features caused by blasting operations to be repaired and paid for by Contractor.
 - 43 1. Explosive permits shall be obtained from the appropriate local authorities by the Contractor.
 - 44 2. The Contract unit price for rock excavation shall include all permits, equipment and materials and
45 other work necessary for excavation and hauling the rock from the site, and for furnishing and
46 placing suitable replacement material as specified in its place.

- 1 E. Where explosives and blasting are used, comply with all laws and ordinances of municipal, state and
2 Federal agencies relating to the use of explosives. Use qualified personnel for blasting and take proper
3 precautions to protect persons, property or the work from damage or injury from blast or explosion.
4 Conduct preblast survey in the company of the CQA Consultant to aid in determining any damage caused
5 by blasting.

6 **3.5 FIELD QUALITY CONTROL**

- 7 A. Moisture density relations, to be established by the CQC Consultant are required for all materials to be
8 compacted.
- 9 B. Extent of compaction testing will be as necessary to assure compliance with Specifications.
- 10 C. Give minimum of 24 HR advance notice to CQC Consultant and CQA Consultant when ready for
11 compaction or subgrade testing and inspection.
- 12 D. Should any compaction density test or subgrade inspection fail to meet Specification requirements,
13 perform corrective work as necessary.
- 14 E. Pay for all costs associated with corrective work and retesting resulting from failing compaction density
15 tests.

16 **3.6 COMPACTION DENSITY REQUIREMENTS**

- 17 A. Obtain approval from Soils Engineer with regard to suitability of soils and acceptable subgrade prior to
18 subsequent operations.
- 19 B. Provide dewatering system necessary to successfully complete compaction and construction
20 requirements.
- 21 C. Remove frozen, loose, wet, or soft, material and replace with approved material as directed by Soils
22 Engineer.
- 23 D. Stabilize subgrade with well graded granular materials as directed by Soils Engineer.
- 24 E. Assure by results of testing that compaction densities comply with the following requirements:
25 1. Sitework:

SOIL TYPE	COMPACTION DENSITY
Cohesive Soils	95 percent, ASTM D698
Cohesionless Soils	75 percent relative density per ASTM D4253 and D4254

- 30 2. Perform testing at a minimum frequency of 1 test per lift per 10,000 square feet. Refer to paragraph
31 3.2.D of this section for definition of a lift.

32 **3.7 EXCAVATION, FILLING, AND BACKFILLING**

- 33 A. General:
- 34 1. In general, work includes, but is not necessarily limited to, excavation removal of undesirable
35 material, backfilling, filling, and subgrade compaction.
- 36 2. Obtain fill and backfill material necessary to produce grades required. Materials and source to be
37 approved by Soils Engineer. Excavated material approved by Soils Engineer may also be used for fill
38 and backfill.
- 39 3. In this Section of the Specifications, the word "foundations" includes footings, base slabs, foundation
40 walls, mat foundations, grade beams, piers and any other support placed directly on soil.
- 41 4. In the paragraphs of this Section of the Specifications, the word "soil" also includes any type of rock
42 subgrade that may be present at or below existing subgrade levels.

1 B. Filling and Backfilling. Prior to placing fill and backfill material, obtain optimum moisture and
2 maximum density properties for proposed material from Soils Engineer. Place fill and backfill material in
3 12 IN loose lifts. Compact material with equipment of proper type and size to obtain density specified.
4 Use only hand operated equipment for filling and backfilling next to walls and retaining walls. Do not
5 place fill or backfill material when temperature is less than 40 DegF and when subgrade to receive
6 material is frozen, wet, loose, or soft. Use vibratory equipment for compacting granular material; do not
7 use water.

8 **3.8 SPECIAL REQUIREMENTS**

9 A. Erosion Control: Conduct work to minimize erosion of site. Construct stilling areas to settle and detain
10 eroded material. Remove eroded material washed off site. Clean streets daily of any spillage of dirt,
11 rocks, or debris from equipment entering or leaving site.

12 **END OF SECTION**

13

1 **SECTION 02270**
2 **SOIL EROSION AND SEDIMENT CONTROL**

3 **PART 1 - GENERAL**

4 **1.1 SUMMARY**

- 5 A. Section Includes:
6 1. Soil erosion and sediment control.
7 B. Related Sections include but are not necessarily limited to:
8 1. Division 0 - Bid Requirements, Contract Forms, and Conditions of the Contract.
9 2. Division 1 - General Requirements.
10 3. Section 02220 - Earthwork.
11 4. Section 02485 - Seeding.
12 5. Section 02720 - Erosion Control Blankets.

13 **1.2 QUALITY ASSURANCE**

- 14 A. Referenced Standards:
15 1. North Carolina Erosion and Sediment Control Planning and Design Manual, current edition.
16 2. North Carolina State Department of Transportation Standard Specifications for Roads and Structures
17 Construction, current edition.

18 **1.3 SITE CONDITIONS**

- 19 A. The Owner has installed sediment control features for their operations with the existing landfill area.
20 B. The Contractor may use these existing features with the Owner's prior approval, provided the Contractor
21 maintains said features.
22 C. The Contractor shall protect streams and creeks from sediment laden runoff.

23 **1.4 SUBMITTALS**

- 24 A. See Section 01340.
25 B. Submit drawings indicating size, material, and length of materials to be used to construct erosion and
26 sediment control features.

27 **PART 2 - PRODUCTS**

28 **2.1 MATERIALS**

- 29 A. Pipe Riser and Barrel: gage, diameter, and material as indicated on Drawings.
30 B. Stone for Stone Filter: NCDOT #5 stone.
31 C. Grass Seed: Refer to Section 02485, Seeding.
32 D. Silt Fence: Premanufactured or constructed on site.
33 E. Erosion Control Blankets – Refer to Section 02720, Erosion Control Blankets.
34 F. Concrete – Minimum 3,000 psi for antifoatation device.
35 G. Geotextile – 8 oz/sy nonwoven under stone used for sediment and erosion control.
36 H. Stone for apron outlets sized as indicated on Drawings in accordance with Section 02271, Stone
37 Revetment.

1 **PART 3 - EXECUTION**

2 **3.1 PREPARATION**

- 3 A. Prior to General Stripping Topsoil, Tree Clearing, and Excavating:
- 4 1. Install silt fence, ditches, and channels.
- 5 2. Excavate and shape sediment basins.
- 6 3. Construct pipe spillways and install stone filter where required.
- 7 4. Machine compact all berms, dikes, and embankments for basins.
- 8 5. Refer to the construction sequence on the plans for further detail.
- 9 B. Temporarily seed basin slopes and stockpiles:
- 10 1. Rate: Refer to Section 02485, Seeding.
- 11 2. Reseed as required until good stand of grass is achieved.

12 **3.2 DURING CONSTRUCTION PERIOD**

- 13 A. Maintain Basins, Dikes, Stone Filters, Silt Fence, Etc.:
- 14 1. Inspect regularly especially after rainstorms.
- 15 2. Repair or replace damaged or missing items.
- 16 B. After rough grading, sow temporary grass cover over all exposed earth areas not draining into sediment
- 17 basin.
- 18 C. Provide necessary swales and ditches to direct all water towards and into sediment basins.
- 19 D. Provide check dams as necessary in swales and ditches.
- 20 E. Do not disturb existing vegetation (grass and trees).
- 21 F. Excavate sediment out of basins when capacity has been reduced by 50 percent.
- 22 1. Remove sediment from behind silt fence to prevent overtopping.
- 23 G. Topsoil and Fine Grade Slopes and Swales, Etc.:
- 24 1. Seed and mulch as soon as areas become ready.

25 **3.3 NEAR COMPLETION OF CONSTRUCTION**

- 26 A. Cleanout sediment from each erosion control feature used during construction. Grade to finished or
- 27 existing grades.
- 28 B. Fine grade all remaining earth areas, then seed and mulch in accordance with Section 02485, Seeding.

29 **END OF SECTION**

1 **SECTION 02271**
2 **STONE REVETMENT (RIP RAP)**

3 **PART 1 - GENERAL**

4 **1.1 DESCRIPTION**

5 A. General:

- 6 1. Furnish all labor, materials, tools, equipment and services for all stone revetment (rip rap) for
7 protection of earthen slopes against erosion as indicated, in accord with provisions of Contract
8 Documents.
9 2. Completely coordinate with work of all other trades.
10 3. Although such work is not specifically indicated, furnish and install all supplementary or
11 miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure,
12 complete and compatible installation.
13 4. See Division 1 for General Requirements.

14 B. Work required in project includes but is not necessarily limited to:

- 15 1. Drainage Channels.
16 2. Sediment Basins.
17 3. Other areas indicated.

18 **1.2 QUALITY STANDARDS**

19 A. Perform all tests under supervision of Owner at an approved independent laboratory at no cost to Owner.
20 Obtain samples in conformance with Corps of Engineers Specification CRD C 100-64 or other approved
21 method.

22 B. Source Tests: Supply certified tests and service records to determine acceptability and application of
23 stone materials. In event suitable test reports or a service record that is satisfactory are not available, as in
24 case of newly operated sources, subject material to tests necessary to determine its acceptability for use.
25 Tests to which materials may be subjected include but are not necessarily limited to:

- 26 1. Petrographic analysis.
27 2. Specific gravity.
28 3. Abrasion.
29 4. Absorption.
30 5. Wetting and drying.
31 6. Soundness in magnesium sulfate.
32 7. Freezing.
33 8. Thawing.
34 9. Such other tests as may be considered necessary to demonstrate satisfactorily that materials are
35 acceptable.

36 C. Material acceptability tests:

- 37 1. Initial test: On material from each ledge sampled, prior to start of construction:
38 a. Bulk specific gravity.
39 b. Soundness in magnesium sulfate solution.
40 c. Soundness in freezing and thawing.
41 2. Control tests: Perform control tests including one specific gravity, one soundness in magnesium
42 sulfate solution test, and one soundness in freezing and thawing test for each type of stone protection
43 material for every 1,000 tons of material.

44 D. Specific gravity test: ASTM C127.

- 45 1. Not less than 2.40 min.

46 E. Soundness in magnesium sulfate solution test: ASTM C88, except maintain samples immersed in solution
47 at a temperature of 80 degF (26 degC) plus or minus 2 deg.

1. Loss at 5 cycles: Not more than 12 percent.
- F. Soundness of aggregates in freezing and thawing test:
1. Ensure loss at 12 cycles of not more than 10 percent.
 2. Modify and use AASHTO Designation T 103 Method.
 3. Maintain temperature of cold liquid in range of -5 to 0 degF (-20 to -18 degC).
 4. Maintain thaw fluid temperature in range of 45 to 50 degF (7 to 10 degC).
 5. Permit length of freezing and of thawing cycles of two hours with one hour of freezing following by one hour of thawing.
 6. Perform thawing by circulating thaw fluid around pan containing stone immersed in a depth of 1/4 IN (6 mm) rather than by total immersion.

1.3 SUBMITTALS

- A. See Section 01300.
- B. Supplier's certification of all materials.
- C. Submit all tests and certification for stone revetment in a single coordinated submittal. Partial submittals will not be accepted.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stone: Approved durable broken stone quarry run.
1. Durable and of such quality that it will not disintegrate on exposure to water or weathering and free from structural fractures and defects.
 2. Not containing shale, unsound sandstone, or other material which will readily disintegrate.
 3. Graded within limits specified.
 4. Neither breadth nor thickness of any stone less than one-third of its length.
 5. Ensure that dirt and fines accumulated from interledge layers or from blasting or handling operation is less than 5 percent by weight.
 6. The gradation of the material shall be well-graded from small to large of the sizes as indicated on the plans or as directed by the Engineer. The rock shall be sized so as to permit its interlocking.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Trim and dress all areas to conform to the Plans as indicated with tolerance of 0.1 FT from theoretical slope lines and grades.
- B. Bring areas that are below allowable minus tolerance limit to grade by filling with embankment material similar to adjacent material.
- C. Compact to density specified in Section 02220, Earthwork.
- D. Do not place any stone material on prepared base prior to inspection and approval to proceed.
- E. Lay geotextile fabric on prepared subgrade prior to placing rip rap.

3.2 PLACING RIP RAP

- A. Place dumped rip rap on prepared foundation within limits indicated.
- B. Place on prepared base to produce a well-graded mass of rock with minimum practicable percentage of voids, to required thickness and grades.
- C. Place to full thickness in a single operation to avoid displacing the underlying material.

- 1 D. Distribute larger stones and entire mass in final position, roughly graded to conform to approximate
2 gradation specified.
- 3 E. Keep finished rip rap free from objectionable pockets of small stones or clusters of larger stone.
4 1. Hand place and rearrange individual stones as necessary to obtain a reasonably well-graded
5 distribution.
- 6 F. Ensure a final tolerance of within 3 IN (75 mm) from indicated grade lines.
7 1. Neither tolerance extreme continuous over an area greater than 200 SQ/FT (20 SM).
- 8 G. Distribute stones throughout mass either by selective loading at quarry or by controlled dumping of
9 successive loads during final placing or by a combination of these methods.
10 1. Do not place stone by dumping into chutes or by similar method likely to cause segregation.
- 11 H. Place stone revetment (rip rap) in conjunction with embankment construction at toe of revetment as
12 necessary to prevent mixture of embankment and stone protection materials.
13 1. Maintain stone revetment until accepted.
14 2. Replace any displaced material to lines and grades shown.

15

END OF SECTION

**SECTION 02485
SEEDING**

PART 1 - GENERAL

1.1 DESCRIPTION

A. General:

1. Furnish all labor, materials, tools, equipment and services for seeding in accordance with provisions of Contract Documents.
2. Completely coordinate with work of all other trades.
3. See Division 1 for General Requirements.

B. Related work specified elsewhere:

1. Section 02110 - Site Clearing.
2. Section 02220 - Earthwork.
3. Section 02221 - Trenching, Backfilling, and Compacting.

C. Location of work: All disturbed areas, exclusive of lined landfill area.

1.2 QUALITY ASSURANCE

A. Fertilizer testing: Current methods of Association of Official Agricultural Chemists.

1. Testing will be conducted at discretion of Engineer.

1.3 SUBMITTALS

A. See Section 01300.

B. Certificates for each grass seed mixture, stating botanical and common name, percentage by weight, and percentages of purity, germination, and weed seed. Certify that each container of seed delivered is fully labeled in accordance with Federal Seed Act and equals or exceeds specification requirements.

C. Copies of invoices for fertilizer, showing grade furnished and total quantity applied.

D. Indicate the mixture to be applied.

E. Indicate the application rate.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Establish a smooth, healthy, uniform, close strand of grass from specified seed.

B. Grass seed: Fresh, clean, latest available crop.

1. Species, proportions and minimum percentage of purity, germination, and maximum percentage of weed seed, as specified.
2. Provide following grass seed:

Botanical and Common Name	Min. pct. Germ	Min. pct. Purity
Kentucky 31 Fescue (tall)	80	97.0
Common Bermuda Grass	85	98.0
Lespedeza	85	97.0
Argentine Bahia Grass	85	98.0
Winter Rye	85	97.0

- C. Mulch: Clean, seed-free, threshed straw of oats, wheat, barley, rye, beans, or other locally available mulch material.
 - 1. Do not use mulch containing a quantity of matured noxious weed seeds or other species that will be detrimental to seeding, or provide a menace to surrounding land.
 - 2. Do not use mulch material which is fresh or excessively brittle, or which is decomposed and will smother or retard growth of grass.
- D. Fertilizer: Commercial grade fertilizer meeting applicable requirements of State and Federal law.
 - 1. Do not use cyanamic compounds of hydrated lime.
- E. Limestone: agricultural grade ground limestone containing not less than 85 percent of combined calcium and magnesium carbonates.
 - 1. 50 percent passing 100 mesh sieve.
 - 2. 90 percent passing 20 mesh sieve.
- F. Asphalt binder: Emulsified asphalt per State Specifications.
- G. Water: Potable, free of substances harmful to growth.
- H. Erosion Control Matting: Refer to Section 02720, Erosion Control Blankets. Contractor shall provide erosion control matting as required on slopes and ditchlines to obtain suitable vegetative cover.

2.2 DELIVERY, STORAGE AND HANDLING

- A. Deliver seed in standard sealed containers labeled with producer's name and seed analysis, and in accord with US Department of Agriculture Rules and Regulations under Federal Seed Act.
- B. Deliver fertilizer in original containers labeled with content analysis.

PART 3 - EXECUTION

3.1 JOB CONDITIONS

- A. This project shall comply with the planting regime for the Piedmont Region.
- B. Permanent Seeding – for areas where construction is complete, permanent seeding shall be completed in the time frame according to regulatory requirements. Engineer to verify surface prior to seeding.
 - 1. Spring (March 1 – April 30) and Fall (September 1 – November 15)
 - a. Kentucky-31: 175 lbs/ac.
 - b. Unhulled sercia lespedeza: 50 lbs/ac.
 - c. Rye grain: 1 bushel/ac.
 - 2. Winter (November 16 – February 28)
 - a. Kentucky-31: 200 lbs/ac.
 - b. Unhulled sercia lespedeza: 50 lbs/ac.
 - c. Rye Grain: 3 bushels/ac.
 - 3. Summer (May 1 – August 31)
 - a. Kentucky-31: 50 lbs/ac.
 - b. Unhulled sercia lespedeza: 50 lbs/ac.
 - c. Korean or kobe lespedeza: 50 lbs/ac.
 - d. Weeping love grass: 5 lbs/ac.
 - e. Bermuda grass: 10 lbs/ac.
 - f. Millet: 1 bushel/ac.
- C. Temporary Seeding-for areas where construction has temporarily ceased for the time frame according to regulatory requirements.
 - 1. Provide winter rye at a rate of 224 lbs/acre.

3.2 SOIL PREPARATION

- A. Limit preparation to areas which will be planted soon after preparation.
- B. Loosen surface to minimum depth of four (4) IN.

- 1 C. Remove stones over one inch in any dimension, sticks, roots, rubbish and other extraneous matter.
- 2 D. Test soil pH using test kits approved by USDA NRCS. Use test results to determine rate of lime
- 3 application needed to make soil circumneutral. Provide application rate to Engineer for approval prior to
- 4 its application.
- 5 E. Spread lime uniformly over designated areas at rate determined by soil testing.
- 6 F. After application of lime, prior to applying fertilizer, loosen areas to be seeded with double disc or other
- 7 suitable device if soil has become hard or compacted. Correct any surface irregularities in order to
- 8 prevent pocket or low areas which will allow water to stand.
- 9 G. Test soil fertility according to USDA NRCS approved methods. Use test results to determine rate of
- 10 fertilizer application. Engineer will approve fertilizer application rate prior to application.
- 11 H. Distribute fertilizer uniformly over areas to be seeded at a rate determined by soil testing.
- 12 1. Use suitable distributor.
- 13 2. Incorporate fertilizer into soil to depth of at least two IN.
- 14 3. Remove stones or other substances which will interfere with turf development or subsequent
- 15 mowing.
- 16 I. Grade seeded areas to smooth, even surface with loose, uniformly fine texture.
- 17 1. Roll and rake, remove ridges and fill depressions, as required to meet finish grades.
- 18 2. Fine grade just prior to planting.
- 19 J. Restore seeded areas to specified condition if eroded or otherwise disturbed between fine grading and
- 20 planting.
- 21 K. If fertilizer application rate is determined (by invoices submitted) to be less than that specified, apply
- 22 additional fertilizer.
- 23 L. Cover seeded areas with mulch.

24 **3.3 SEEDING**

- 25 A. Do not use seed which is wet, moldy, or otherwise damaged.
- 26 B. Use approved mechanical power driven drills or seeders, or mechanical hand seeders, or other approved
- 27 equipment.
- 28 C. Distribute seed evenly over entire area at not less than 7LB/1000 SF, 50 percent sown in one direction,
- 29 remainder at right angles to first sowing.
- 30 D. Stop work when work extends beyond most favorable planting season for species designated, or when
- 31 satisfactory results cannot be obtained because of drought, high winds, excessive moisture, or other
- 32 factors.
- 33 E. Resume work only when favorable condition develops.
- 34 F. Lightly rake seed into soil followed by light rolling or Culti-packing.
- 35 G. Immediately protect seeded areas against erosion by mulching or placing netting.
- 36 1. Spread mulch in a continuous blanket using 1-1/2 TON/ACRE to depth of 4 or 5 straws.
- 37 2. Immediately following spreading mulch, secure with evenly distributed emulsified asphalt at rate of
- 38 200 gal/acre.
- 39 3. Protect all seeded slopes greater than 3:1 (horizontal to vertical) and ditches against erosion with
- 40 approved erosion control netting or mats.
- 41 H. Immediately after planting, water to a reasonable depth.
- 42 I. Clean-up: Remove any soil or similar material from paved areas within same working day. Upon
- 43 completion of seeding, remove all excess soil, stones, and other debris from site or dispose as directed by
- 44 Owner. Repair all damages to existing construction caused by lawn operations to the satisfaction of
- 45 Engineer and Owner at no additional cost to Owner
- 46

1 **3.4 MAINTENANCE**

- 2 A. Remulch with new mulch in areas where mulch has been disturbed by wind or maintenance
3 operations sufficiently to nullify its purpose. Anchor as required to prevent displacement.
- 4 B. Replant bare areas using same materials specified.
- 5 C. Contractor shall supply sufficient water until grass is established.
- 6 D. Contractor shall warranty work for one year from date of project final completion.
- 7 E. Inspect all seeded areas and make necessary repairs of re-seedings within planting season, if possible. If
8 stand is over 60% damaged, re-establish planting area following recommendations specified for lime,
9 fertilizer and seeding

10

END OF SECTION

1
2

SECTION 02720
EROSION CONTROL BLANKETS

3 **PART 1 - GENERAL**

4 **1.1 SECTION INCLUDES**

- 5 A. The erosion control blankets are for the purpose of erosion control and revegetation as described herein.
- 6 B. This work shall consist of furnishing and installation of the erosion control blankets and turf reinforced
7 matting, including fine grading, blanketing, stapling, and miscellaneous related work, in accordance with
8 these standard specifications and at the location(s) identified on Drawings or designated by Engineer.
9 This work shall include all necessary materials, labor, supervision and equipment for installation of a
10 complete system.
- 11 C. All work of this Section shall be performed in accordance with the Conditions and Requirements of the
12 Contract Documents.
- 13 D. The erosion control blankets and turf reinforced matting shall be used where surface erosion is not
14 desirable. The material shall be suitable for the following applications:
15 1. Channel and ditch linings.
16 2. Slope protection.

17 **1.2 RELATED SECTIONS**

- 18 A. Section 1300 - Submittals.
- 19 B. Section 02220 - Earthwork.
- 20 C. Section 02485 - Seeding.

21 **1.3 PERFORMANCE REQUIREMENTS**

- 22 A. Erosion control blankets shall provide a temporary, biodegradable cover material to reduce erosion and
23 enhance revegetation.

24 **1.4 SUBMITTALS**

- 25 A. Submit product data on materials for erosion control blankets, and turf reinforced matting in accordance
26 with Section 01300.
- 27 B. Submit product samples in accordance with Section 01300.
- 28 C. Any alternative system submitted for approval shall include complete design data, including test evidence
29 of compliance to the essential design parameters of Project and reference installations similar in size and
30 scope to that specified for Project.

31 **1.5 DELIVERY, STORAGE AND HANDLING**

- 32 A. Each material shall be furnished in rolls and wrapped with suitable material to protect against moisture
33 and extended ultraviolet exposure prior to placement. Each roll shall be labeled to provide identification
34 sufficient for inventory and quality control purposes.
- 35 B. Each material shall be free of defects that would interfere with the proper installation or impair the
36 performance.
- 37 C. Each material shall be stored by Contractor in a manner which protects them from damage by
38 construction traffic.
39

1 **PART 2 - PRODUCTS**

2 **2.1 EROSION CONTROL BLANKETS**

- 3 A. Erosion control blankets shall have a minimum permissible unit shear stress of 1.85 lb/sq.ft.
4 B. Erosion control blankets shall be Curlex II Excelsior as manufactured by American Excelsior, or
5 approved equal.
6 C. Turf reinforced matting shall be C350 as manufactured by North American Green.

7 **PART 3 - EXECUTION**

8 **3.1 SITE PREPARATION**

- 9 A. Before placing erosion control or matting, the subgrade shall be inspected by Engineer to insure that it
10 has been properly compacted; has been graded smooth; has no depressed, void, soft or uncompacted
11 areas; is free from obstructions, such as tree roots, projecting stones or other foreign matter; and has been
12 seeded. Contractor shall not proceed until all unsatisfactory conditions have been remedied. By beginning
13 construction, Contractor signifies his approval of preceding work.
14 B. Contractor shall fine grade the subgrade by hand dressing where necessary to remove local deviations.
15 C. No vehicular traffic shall be permitted directly on the blankets.

16 **3.2 CHANNEL INSTALLATION**

- 17 A. Material shall be installed as directed by the Engineer in accordance with manufacturer's instructions. The
18 extent of erosion control blankets shall be as shown on Drawings.
19 B. Material shall be installed parallel to the flow of water. The first roll shall be centered longitudinally in
20 mid-channel and anchored. Subsequent rolls shall follow from channel center outward.
21 C. Successive lengths of material shall be overlapped ("shingled") sufficiently for a common row of
22 connections with the upstream end on top. Connect the overlap across the end of each of the overlapping
23 lengths.
24 D. A trench shall be located at the upstream termination. Material shall be connected to the bottom of the
25 trench. Backfill and compact the trench.

26 **3.3 SLOPE INSTALLATION**

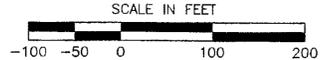
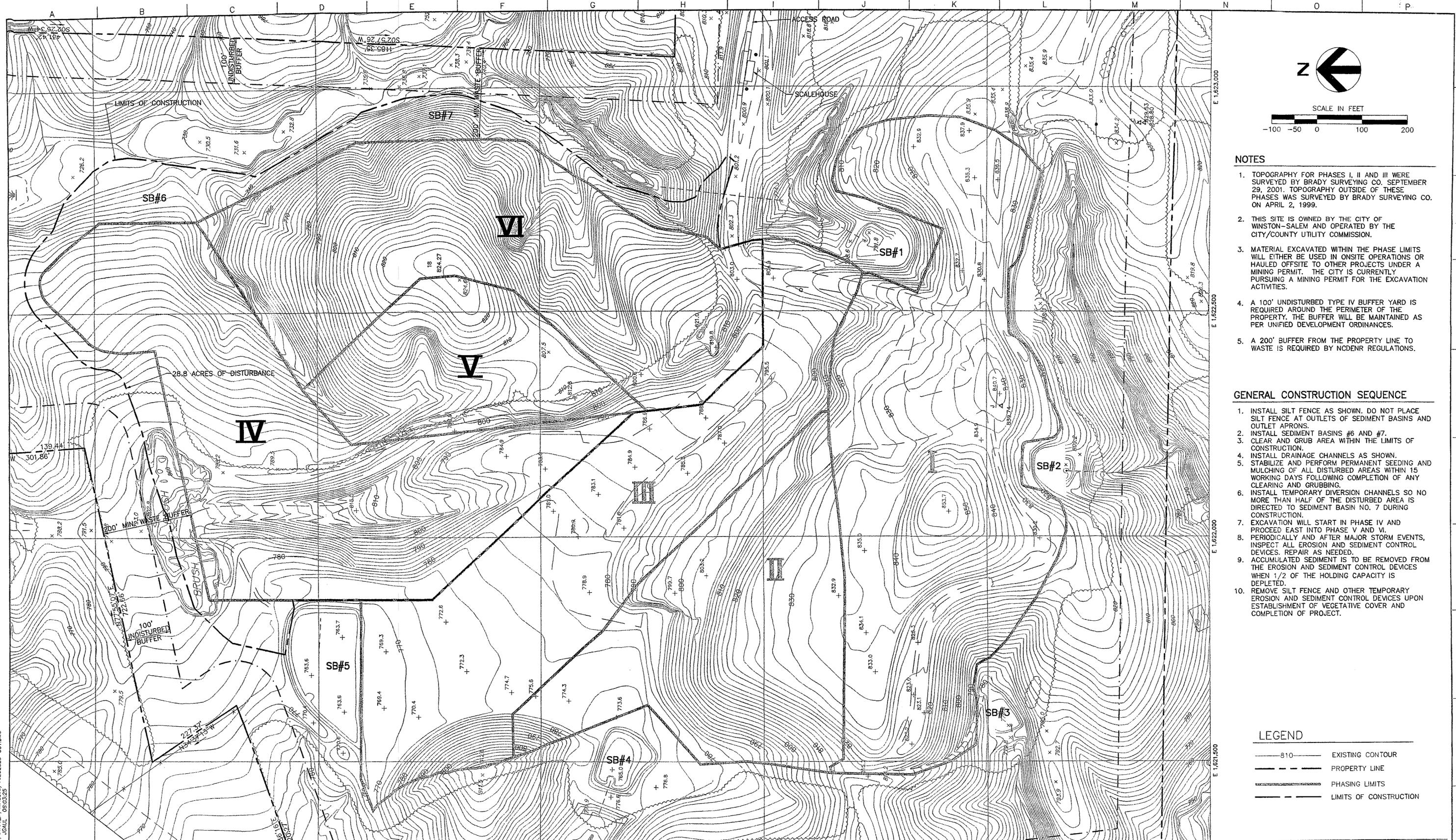
- 27 A. Before placing erosion control blanket, the subgrade shall be inspected by Contractor to insure that it has
28 been properly compacted; has been graded smooth; has no depressed, void, soft or uncompacted areas; is
29 free from obstructions, such as tree roots, projecting stones or other foreign matter; and has been seeded.
30 Contractor shall not proceed until all unsatisfactory conditions have been remedied. By beginning
31 construction, Contractor signifies his approval of preceding work.
32 B. Place on all slopes outside landfill construction baseline, excluding the stockpiles, on slopes greater than
33 or equal to 3H:1V.

34 **3.4 QUALITY ASSURANCE**

- 35 A. Material shall not be defective or damaged. Any such problems shall be corrected by Contractor at no
36 cost to Owner and to the satisfaction of Engineer.
37

Appendix C

DRAWINGS



NOTES

1. TOPOGRAPHY FOR PHASES I, II AND III WERE SURVEYED BY BRADY SURVEYING CO. SEPTEMBER 29, 2001. TOPOGRAPHY OUTSIDE OF THESE PHASES WAS SURVEYED BY BRADY SURVEYING CO. ON APRIL 2, 1999.
2. THIS SITE IS OWNED BY THE CITY OF WINSTON-SALEM AND OPERATED BY THE CITY/COUNTY UTILITY COMMISSION.
3. MATERIAL EXCAVATED WITHIN THE PHASE LIMITS WILL EITHER BE USED IN ONSITE OPERATIONS OR HAULED OFFSITE TO OTHER PROJECTS UNDER A MINING PERMIT. THE CITY IS CURRENTLY PURSUING A MINING PERMIT FOR THE EXCAVATION ACTIVITIES.
4. A 100' UNDISTURBED TYPE IV BUFFER YARD IS REQUIRED AROUND THE PERIMETER OF THE PROPERTY. THE BUFFER WILL BE MAINTAINED AS PER UNIFIED DEVELOPMENT ORDINANCES.
5. A 200' BUFFER FROM THE PROPERTY LINE TO WASTE IS REQUIRED BY NODENR REGULATIONS.

GENERAL CONSTRUCTION SEQUENCE

1. INSTALL SILT FENCE AS SHOWN. DO NOT PLACE SILT FENCE AT OUTLETS OF SEDIMENT BASINS AND OUTLET APRONS.
2. INSTALL SEDIMENT BASINS #6 AND #7.
3. CLEAR AND GRUB AREA WITHIN THE LIMITS OF CONSTRUCTION.
4. INSTALL DRAINAGE CHANNELS AS SHOWN.
5. STABILIZE AND PERFORM PERMANENT SEEDING AND MULCHING OF ALL DISTURBED AREAS WITHIN 15 WORKING DAYS FOLLOWING COMPLETION OF ANY CLEARING AND GRUBBING.
6. INSTALL TEMPORARY DIVERSION CHANNELS SO NO MORE THAN HALF OF THE DISTURBED AREA IS DIRECTED TO SEDIMENT BASIN NO. 7 DURING CONSTRUCTION.
7. EXCAVATION WILL START IN PHASE IV AND PROCEED EAST INTO PHASE V AND VI.
8. PERIODICALLY AND AFTER MAJOR STORM EVENTS, INSPECT ALL EROSION AND SEDIMENT CONTROL DEVICES. REPAIR AS NEEDED.
9. ACCUMULATED SEDIMENT IS TO BE REMOVED FROM THE EROSION AND SEDIMENT CONTROL DEVICES WHEN 1/2 OF THE HOLDING CAPACITY IS DEPLETED.
10. REMOVE SILT FENCE AND OTHER TEMPORARY EROSION AND SEDIMENT CONTROL DEVICES UPON ESTABLISHMENT OF VEGETATIVE COVER AND COMPLETION OF PROJECT.

LEGEND

- 810 — EXISTING CONTOUR
- - - - - PROPERTY LINE
- - - - - PHASING LIMITS
- - - - - LIMITS OF CONSTRUCTION

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Issue No.	Description	Date	Drawn	Chk'd	Resp. Engr.	Proj. Mgr.
A	ISSUED FOR APPROVAL					



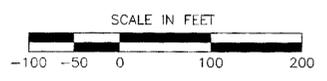
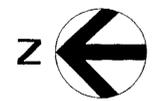
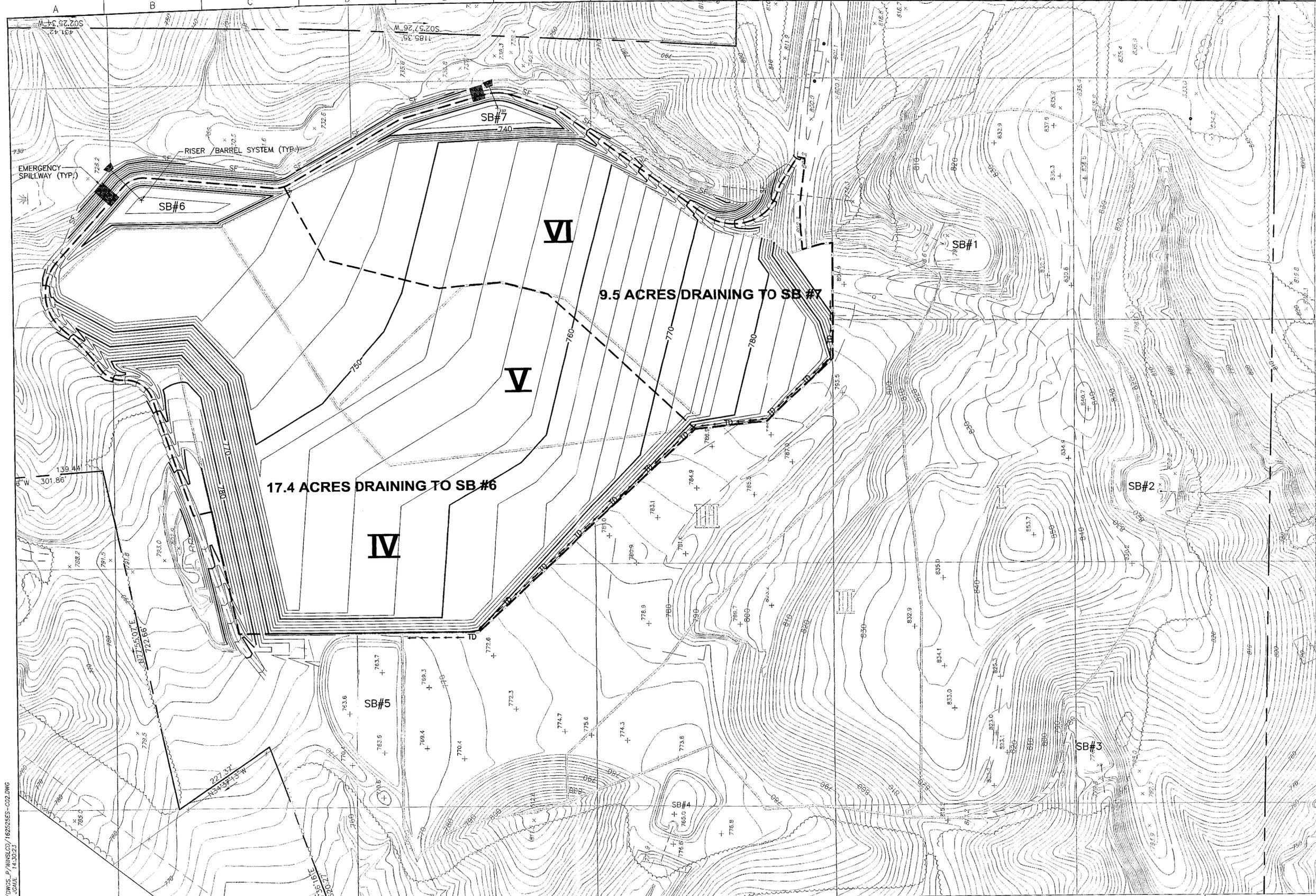
Project Manager
J.C. READLING, P.E.
 Designed
M.D. PLUMMER, P.E.
 Checked
J. GAUL

**OLD SALISBURY ROAD
 CONSTRUCTION AND DEMOLITION LANDFILL
 PHASE IV, V AND VI
 EROSION AND SEDIMENTATION CONTROL PLAN**

WINSTON-SALEM NORTH CAROLINA

EXISTING CONDITONS

Date	JUNE 2002	Project No.	00162-525-018	Drawing No.	ES-01	Issue	A
Scale	1"=100'	File Name	162525ES-C01				



- NOTES**
1. TOPOGRAPHY FOR PHASES I, II AND III WERE SURVEYED BY BRADY SURVEYING CO. SEPTEMBER 29, 2001. TOPOGRAPHY OUTSIDE OF THESE PHASES WAS SURVEYED BY BRADY SURVEYING CO. ON APRIL 2, 1999.
 2. THIS SITE IS OWNED BY THE CITY OF WINSTON-SALEM AND OPERATED BY THE CITY/COUNTY UTILITY COMMISSION.
 3. MAINTENANCE OF EROSION CONTROL FEATURES SHALL BE PERFORMED AFTER A MAJOR STORM EVENT AND AS OTHERWISE NEEDED.
 4. TEMPORARY DIVERSION CHANNELS WILL BE USED TO DIRECT DRAINAGE TO THE SEDIMENT BASIN WHILE VEGETATION IS ESTABLISHED IN THE PERIMETER CHANNELS.
 5. LINES AND GRADES WILL BE CONSTRUCTED IN A MANNER TO MINIMIZE EROSION AND PROMOTE STORMWATER DRAINAGE.
 6. BASEGRADES SHOWN ARE EDITED TO REFLECT THE CONSTRUCTION PERMIT APPLICATION GRADES AND ARE PENDING APPROVAL.

LEGEND

	EXISTING CONTOUR
	PROPOSED BASEGRADE CONTOURS
	PHASING LIMITS
	DRAINAGE DIVIDE
	SILT FENCE
	OUTLET APRON
	TEMPORARY DIVERSION CHANNEL

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Issue No.	Description	Date	Drwn.	Chkd.	Resp. Engr.	Proj. Mgr.
B	REVISED BASEGRADES FOR MAXIMUM DEPTH	6/24/02	Jac	MDP		
A	ISSUED FOR APPROVAL					

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Project Manager
 J.C. READLING, P.E.
 Designed
 M.D. PLUMMER, P.E.
 P.A. WESTMORELAND
 Checked
 Drawn
 J. GAUL

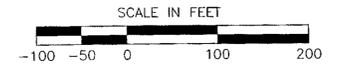
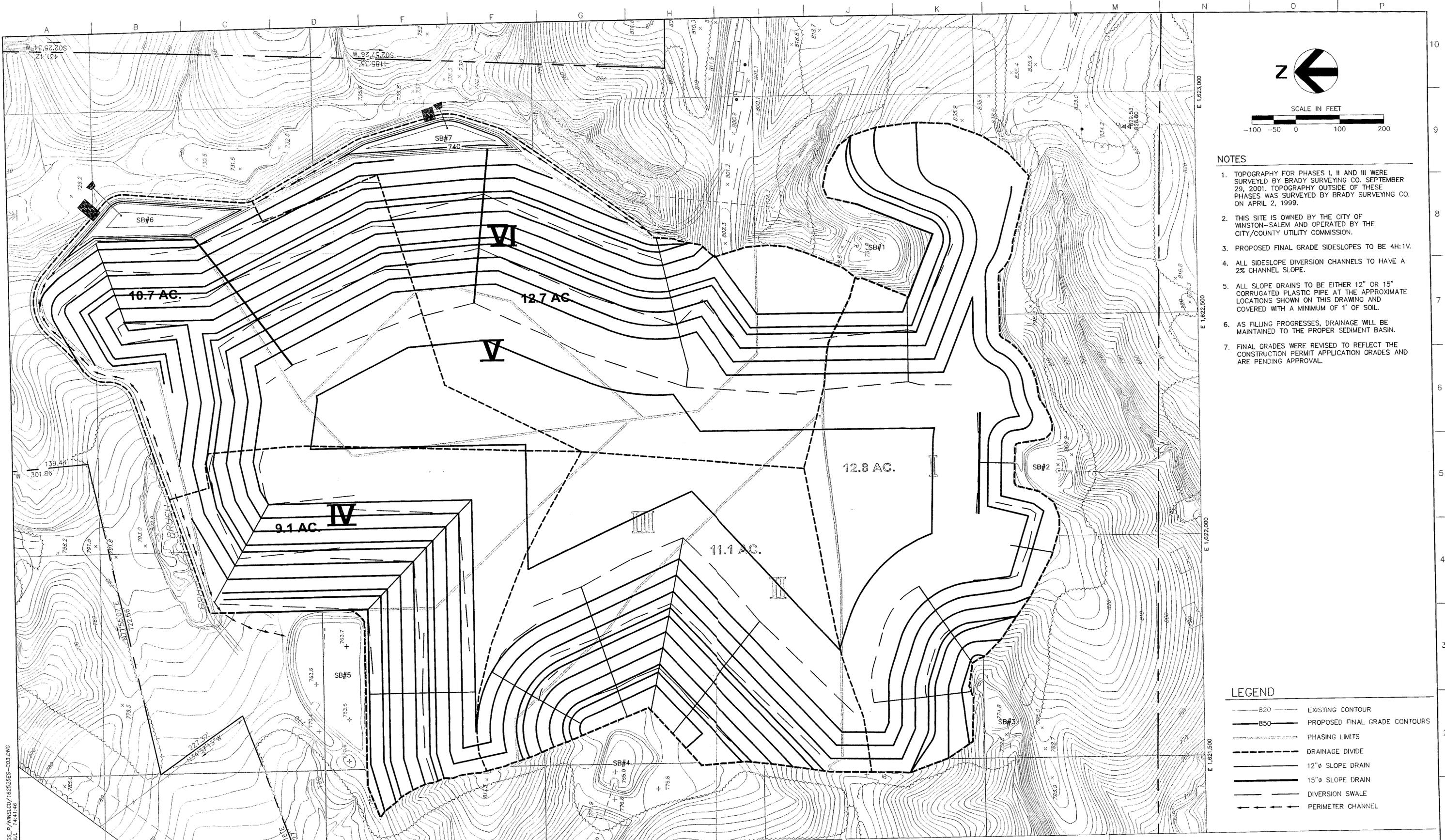
**OLD SALISBURY ROAD
 CONSTRUCTION AND DEMOLITION LANDFILL
 PHASE IV, V AND VI
 EROSION AND SEDIMENTATION CONTROL PLAN**

PROPOSED EXCAVATION PLAN

Date	JUNE 2002	Project No.	00162-525-018	Drawing No.	ES-02	Issue	B
Scale	1"=100'	File Name	162525ES-C02				



WINSTON-SALEM NORTH CAROLINA



NOTES

1. TOPOGRAPHY FOR PHASES I, II AND III WERE SURVEYED BY BRADY SURVEYING CO. SEPTEMBER 29, 2001. TOPOGRAPHY OUTSIDE OF THESE PHASES WAS SURVEYED BY BRADY SURVEYING CO. ON APRIL 2, 1999.
2. THIS SITE IS OWNED BY THE CITY OF WINSTON-SALEM AND OPERATED BY THE CITY/COUNTY UTILITY COMMISSION.
3. PROPOSED FINAL GRADE SIDESLOPES TO BE 4H:1V.
4. ALL SIDESLOPE DIVERSION CHANNELS TO HAVE A 2% CHANNEL SLOPE.
5. ALL SLOPE DRAINS TO BE EITHER 12" OR 15" CORRUGATED PLASTIC PIPE AT THE APPROXIMATE LOCATIONS SHOWN ON THIS DRAWING AND COVERED WITH A MINIMUM OF 1' OF SOIL.
6. AS FILLING PROGRESSES, DRAINAGE WILL BE MAINTAINED TO THE PROPER SEDIMENT BASIN.
7. FINAL GRADES WERE REVISED TO REFLECT THE CONSTRUCTION PERMIT APPLICATION GRADES AND ARE PENDING APPROVAL.

LEGEND

- 820 — EXISTING CONTOUR
- 850 — PROPOSED FINAL GRADE CONTOURS
- - - PHASING LIMITS
- - - DRAINAGE DIVIDE
- 12" SLOPE DRAIN
- 15" SLOPE DRAIN
- DIVERSION SWALE
- PERIMETER CHANNEL

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Issue No.	Description	Date	Drawn	Checked	Resp. Engr.	Proj. Mgr.
A	ISSUED FOR APPROVAL	10/22/02	SAG	JG		

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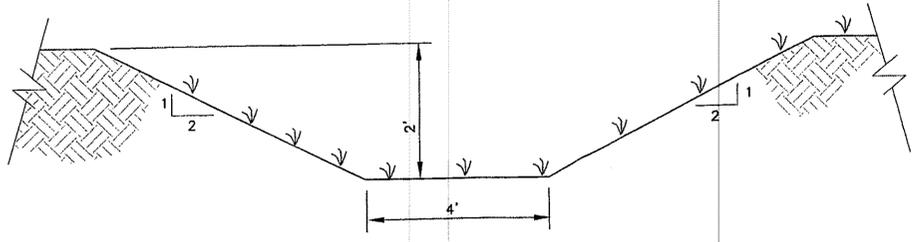
Project Manager	J.C. READLING, P.E.
Designed	M.D. PLUMMER, P.E.
Designed	P.A. WESTMORELAND
Checked	
Drawn	J. GAUL

**OLD SALISBURY ROAD
CONSTRUCTION AND DEMOLITION LANDFILL
PHASE IV, V AND VI
EROSION AND SEDIMENTATION CONTROL PLAN**

WINSTON-SALEM NORTH CAROLINA

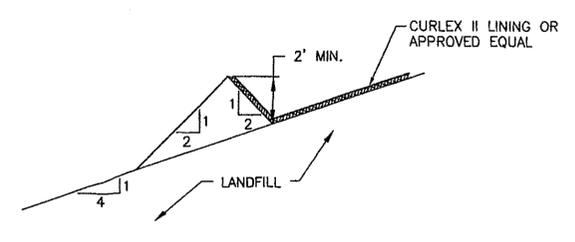
PROPOSED FINAL GRADING PLAN

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Scale	1"=100'	File Name	162525ES-C03				



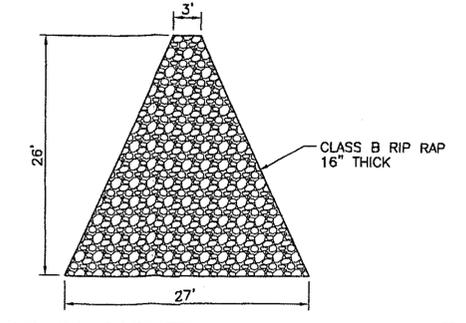
PERIMETER CHANNEL DETAIL

N.T.S.
NOTE:
USE TURF REINFORCED MATTING (NORTH AMERICAN GREEN C350) FOR PERIMETER CHANNEL OR APPROVED EQUAL.



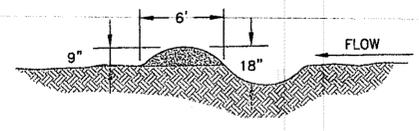
SIDESLOPE DIVERSION CHANNEL

N.T.S.



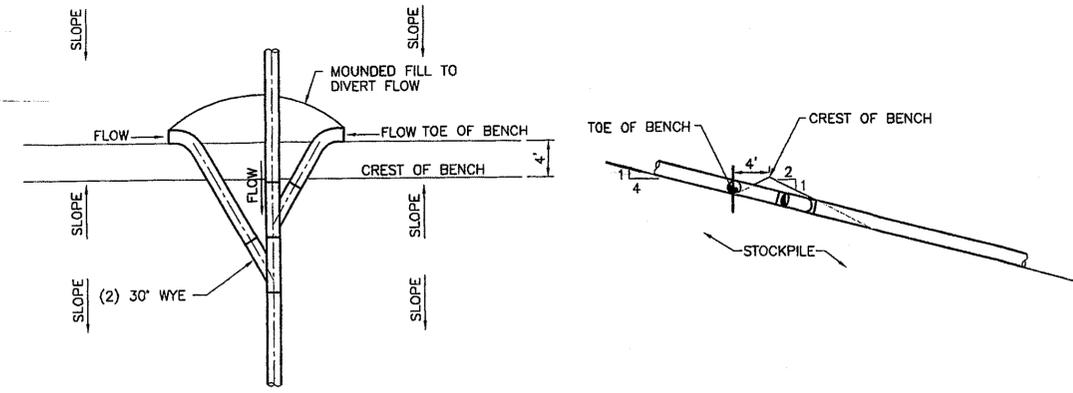
SLOPE DRAIN OUTLET

1"=10'



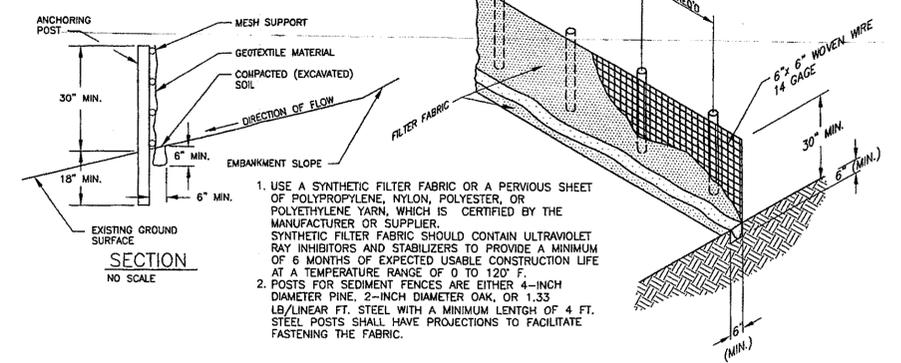
TEMPORARY DIVERSION CHANNEL

N.T.S.



SLOPE DRAIN

1"=10'
NOTE:
1. SLOPE DRAINS TO BE 12 OR 15 INCH DIAMETER CORRUGATED HDPE. CONTRACTOR TO PROVIDE ADEQUATE BALLASTS.



SILT FENCE

N.T.S.

//CLISMAN/DWCS.P/WINS/CD/162525ES-C04.DWG 07-18-02 JGAUL 14:16:17

Issue No.	Description	Date	Drwn.	Chkd.	Resp. Engr.	Proj. Mgr.
A	ISSUED FOR APPROVAL					

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Charlotte, NC 28202-5001
(704) 338-6700

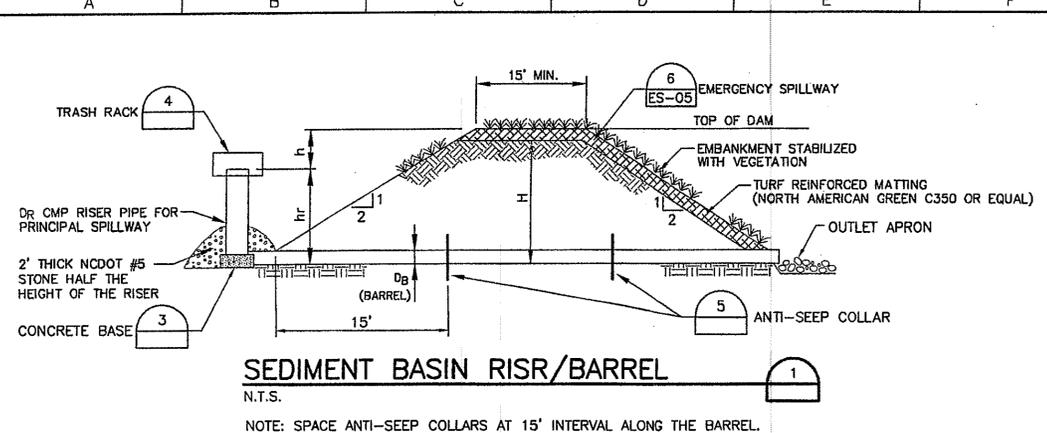
Project Manager	J.C. READLING, P.E.
Designed	M.D. PLUMMER, P.E.
Designed	P.A. WESTMORELAND
Checked	
Drawn	J. GAUL

**OLD SALISBURY ROAD
CONSTRUCTION AND DEMOLITION LANDFILL
PHASE IV, V AND VI
EROSION AND SEDIMENTATION CONTROL PLAN**

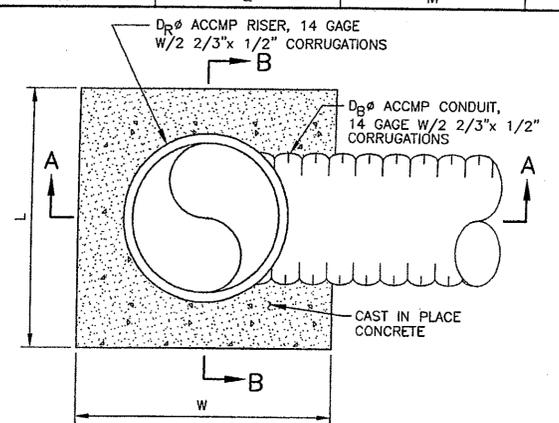
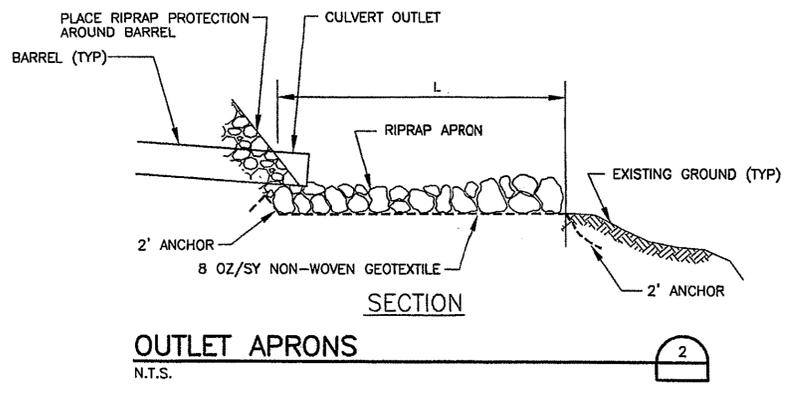
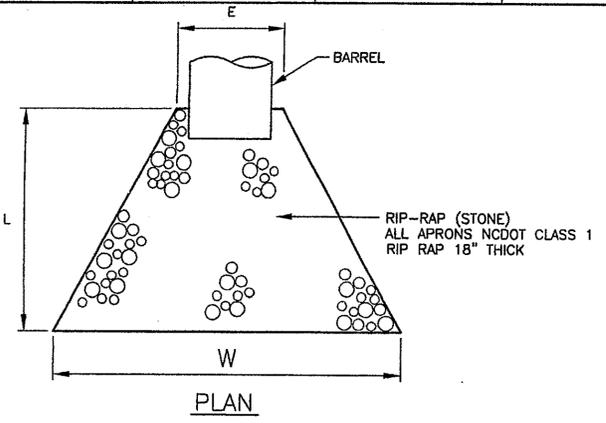
WINSTON-SALEM NORTH CAROLINA

**EROSION CONTROL DETAILS
(1 OF 2)**

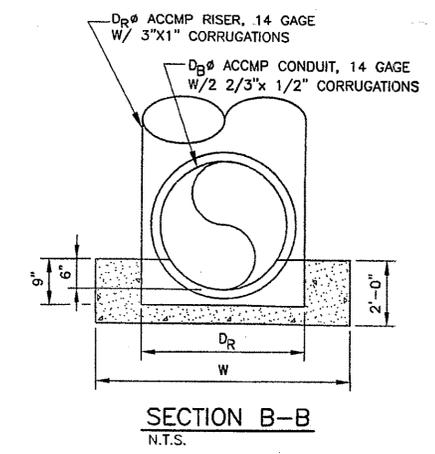
Date	JUNE 2002	Project No.	00162-525-018	Drawing No.	ES-04	Issue	A
Scale	AS SHOWN	File Name	162525ES-C04				



BASIN/APRON SCHEDULE								
BASIN ID	D _B (IN)	D _R (IN)	h _r (FT)	h (FT)	H (FT)	W (FT)	L (FT)	E (FT)
6	18	24	6	3	8	27	22	4.5
7	18	24	5	2	6	26	22	4.5

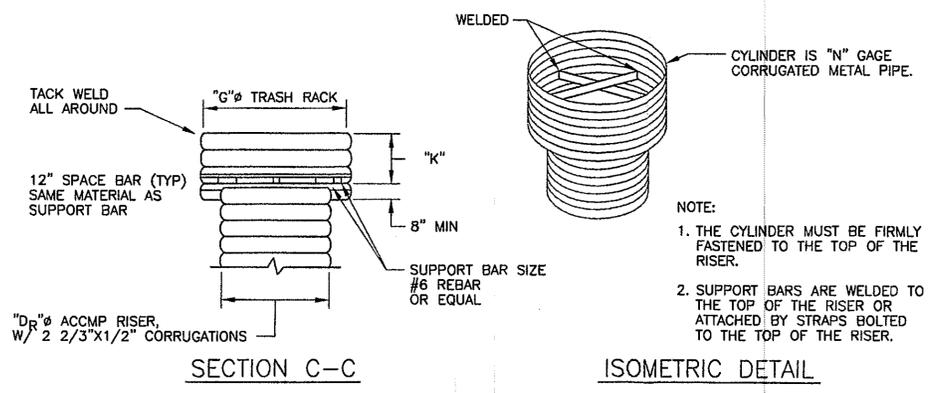


SB	DR (IN)	W (FT)	L (FT)	D _B (IN)
6	24	4	4	18
7	24	4	4	18



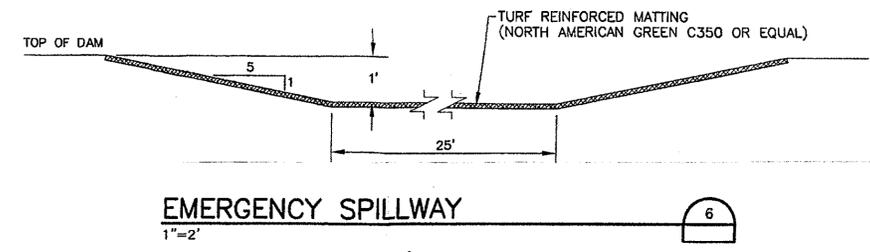
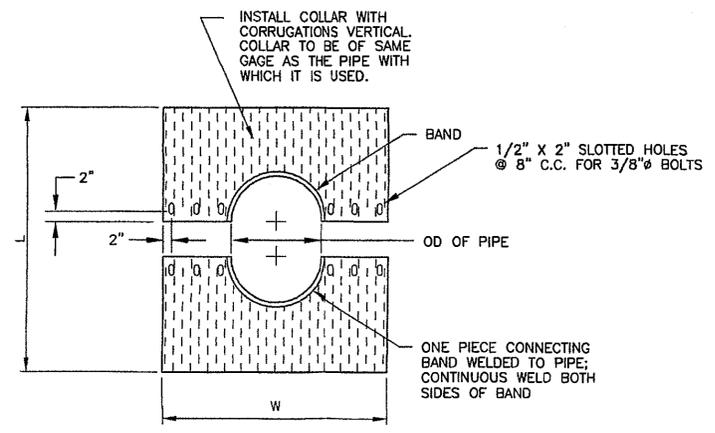
SEDIMENTATION BASIN RISER BASE PLAN
N.T.S.

NOTES:
1. CONTRACTOR TO REMOVE ASPHALT COATING FROM PERFORATIONS
2. USE STANDARD CONNECTING BAND WITH OVAL LUG CONNECTORS.



CONCENTRIC TRASH RACK AND ANTI-VORTEX DEVICE
N.T.S.

ANTI-VORTEX SCHEDULE				
BASIN ID	G (IN)	D _R (IN)	K (IN)	GAGE THICKNESS (IN)
6	36	24	5	16
7	36	24	5	16



C:\TSM\DWG\PL\WWSLCO\162525ES-C05.DWG 07-19-02 JSJUL 15:28:14

Issue No.	Description	Date	Drawn	Chkd.	Resp. Engr.	Proj. Mgr.
A	ISSUED FOR APPROVAL					

HDR
HDR Engineering, Inc.
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Project Manager
J.C. READLING, P.E.
Designed
M.D. PLUMMER, P.E.
Designed
P.A. WESTMORELAND
Checked
Drawn
J. GAUL

**OLD SALISBURY ROAD
CONSTRUCTION AND DEMOLITION LANDFILL
PHASE IV, V AND VI
EROSION AND SEDIMENTATION CONTROL PLAN**
WINSTON-SALEM NORTH CAROLINA

**EROSION CONTROL DETAILS
(2 OF 2)**

Date	JUNE 2002	Project No.	00162-525-018	Drawing No.	ES-05	Issue	A
Scale	AS SHOWN	File Name	162525ES-C05				

APPENDIX D

OPERATION PLAN

OPERATION PLAN

FOR THE OLD SALISBURY ROAD

CONSTRUCTION AND DEMOLITION LANDFILL

FORYTH COUNTY, NORTH CAROLINA

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APPENDICES

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I. INTRODUCTION

The purpose of this document is to identify protocols for the overall operation and maintenance of the Old Salisbury Road Construction and Demolition Landfill (Landfill), which is owned and operated by the City of Winston-Salem. This plan provides details of the procedures and policies, which shall be implemented throughout the life of the Landfill.

II. STANDARD OPERATING PROCEDURES

A. Hours and Days of Operating

The Landfill is normally open for operation between the hours of 7:00 am and 4:30 pm, Monday through Friday, and from 8:00 am and 12:00 noon on Saturday. These hours of operation may change based upon many factors. The Landfill is normally closed on Sundays except where prior permission has been given to receive waste for special instances such as a natural disaster. Normally the landfill is closed on the following observed holidays : New Years' Day, Martin Luther King, Jr. Day, Good Friday, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and the day after, and Christmas Day.

Special notices are to be posted at the scalehouse advising users of the observed holidays. Such notices are posted at least one week in advance of the observed holiday.

B. Weighing Procedures

All vehicles entering the Landfill are required to stop at the scalehouse, which is located at the entrance to the facility. Except for small vehicles, refuse transportation vehicles are weighed on permanent scales and the content of the load is assessed. The weighmaster requests from the driver of the vehicle a description of the waste to ensure that unacceptable waste is not entering the Landfill. The weighmaster then collects payment and visually checks the vehicle as it crosses the scale.

C. Wastes Accepted

This solid waste management facility will accept wastes as stated in it's permit. Some examples are:

- ◆ Land-Clearing Debris as defined in General Statutes 130A-290;

- ◆ Asphalt in accordance with General Statutes 130A-294(m);
- ◆ Construction and Demolition Debris defined as solid waste resulting solely from construction, remodeling, repair or demolition operations on pavement, buildings or other structures;
- ◆ Inert Debris defined as soil waste, which is virtually inert, such as brick, concrete, rock, and uncontaminated soil.
- ◆ Wooden pallets

NOTE: Yard waste defined as solid waste consisting solely of vegetative matter resulting from landscaping maintenance (see General Statutes 130A-290) is banned from disposal in this facility per NC General Statutes. Yard waste is to be directed to the Overdale Yard Waste Facility or the Forum 52 Yard Waste Facility.

D. Unacceptable Waste

The following wastes are prohibited from disposal at the Landfill:

- ◆ Whole Scrap Tires
- ◆ Used Oil
- ◆ Municipal Solid Waste
- ◆ Yard Waste
- ◆ White Goods
- ◆ Lead Acid Batteries
- ◆ Hazardous Waste
- ◆ Antifreeze
- ◆ Aluminum cans
- ◆ Oil filters
- ◆ Oyster shells
- ◆ Discarded computer equipment (after 4/1/2011)

E. Filling Procedures

Solid waste transportation vehicles will arrive at the working face in random intervals. There may be several vehicles unloading waste at one time, while other vehicles are waiting. Solid waste unloading in the Landfill is controlled to prevent disposal in locations other than those specified by the site management. This control confines the working face to the minimum area required which improves the overall landfill aesthetics and minimizes the amount of cover soil required. Normally, only one working face is active on any given day.

F. Cover Material Requirements

Waste shall be covered at a minimum of once per week with at least 6 inches of suitable cover. Areas that will not have additional waste placed on them for 3 months or more, but where final elevations have not been reached, shall be covered with one foot of soil cover. Within six months of termination of disposal operations, the final cover system shall be installed.

III. WASTE SCREENING PROCEDURES

In order to prevent unacceptable waste from entering the Landfill, the following screening procedures have been implemented; Waste received at the scalehouse entrance and waste taken to the working face is inspected by a trained personnel. These individuals are trained to spot indications of suspicious waste that include hazardous placards or markings, liquids, powders or dusts, sludges, bright or unusual colors, drums or commercial size containers and chemical odors. Screening procedures for visual and olfactory characteristics of prohibited wastes are an ongoing part of the Landfill operation.

A. Waste Receiving and Inspection

Approximately 10 percent of the Landfill traffic is selected for screening per quarter. Selected vehicles are directed to an area that is separate from the working face and the vehicle is unloaded. Waste is carefully spread using the appropriate equipment. A solid waste division employee trained to identify unacceptable material will inspect the waste discharged at the screening site. If unacceptable waste is found, including waste generated outside the service area, the load will be isolated and secured. For loads in which the entire load is unacceptable, the Landfill Manager will then notify officials with the Department of Environment, and Natural Resources (NCDENR), Division of Solid Waste Management within 24 hours of the attempted disposal to inform them of the unacceptable waste and determine the appropriate course of action. The hauler is responsible for removing unacceptable waste from the Landfill property.

B. Waste Screening Record Keeping Procedures

The following records are kept on-site to document all inspections:

- ◆ The date and times waste were received for inspection.
- ◆ Source and type of waste.

- ◆ Vehicle and driver identification.
- ◆ All observations made by the inspector.
- ◆ Final disposition of waste after inspection.

IV. PROGRESSION OF FILL

The boundaries of the phases are shown on Figure 1. The purpose of the boundaries is to illustrate the general concept and progression of filling. Filling of each Phase will begin only when the Phase is excavated to the designed base grade and then certified by survey.

Each phase should be filled from the high end to allow storm water to drain freely into the sediment basins. Waste should be placed in uniform lifts that are as thin as practical and compacted to maximize the landfill capacity. The area of the working face will vary depending on disposal demand but should be kept as small as practical to limit the requirement for cover soil. Waste should be placed in lifts across a phase and provide adequate maneuvering room for building subsequent lifts.

V. WORKER SAFETY AND TRAINING

All landfill operating personnel shall receive training, safety equipment, and supervision necessary to carry out their assigned duties.

A. Operations Training

The supervisor shall either be a Certified Manager of Landfill Operations (MOLO) by the Solid Waste Association of North America (SWANA) or a Certified Landfill Operations Specialist (LOS) by SWANA. In addition, site management will endeavor to require other employees to become LOS.

The employee will also participate in the waste screening program in order to gain hands on experience in determining inappropriate wastes.

B. Safety Equipment

All employees will be provided the following safety equipment: hard hat, safety vest, safety shoes, and safety glasses. All employees will be trained in the proper use of safety equipment. Additionally, the City of Winston-Salem regularly offers OSHA approved safety training classes for their employees.

C. Fires and Natural Disasters

i) Emergency Protocols

In the event of a fire or other natural disaster, all staff should follow the protocols outlined in the landfill emergency action plan. This plan was designed to meet the requirements of OSHA 1910.38a and 1910.120. It is incorporated herein as Appendix B.

ii) Follow up Procedures

The fire department will be notified in cases of landfill fires. A follow up report detailing the nature of the fire will be mailed to the section within 15 days of an emergency response.

VI. MISCELLANEOUS OPERATIONAL

A. Staffing

The facility will be staffed during all operating hours to ensure operational compliance.

B. Facility Access

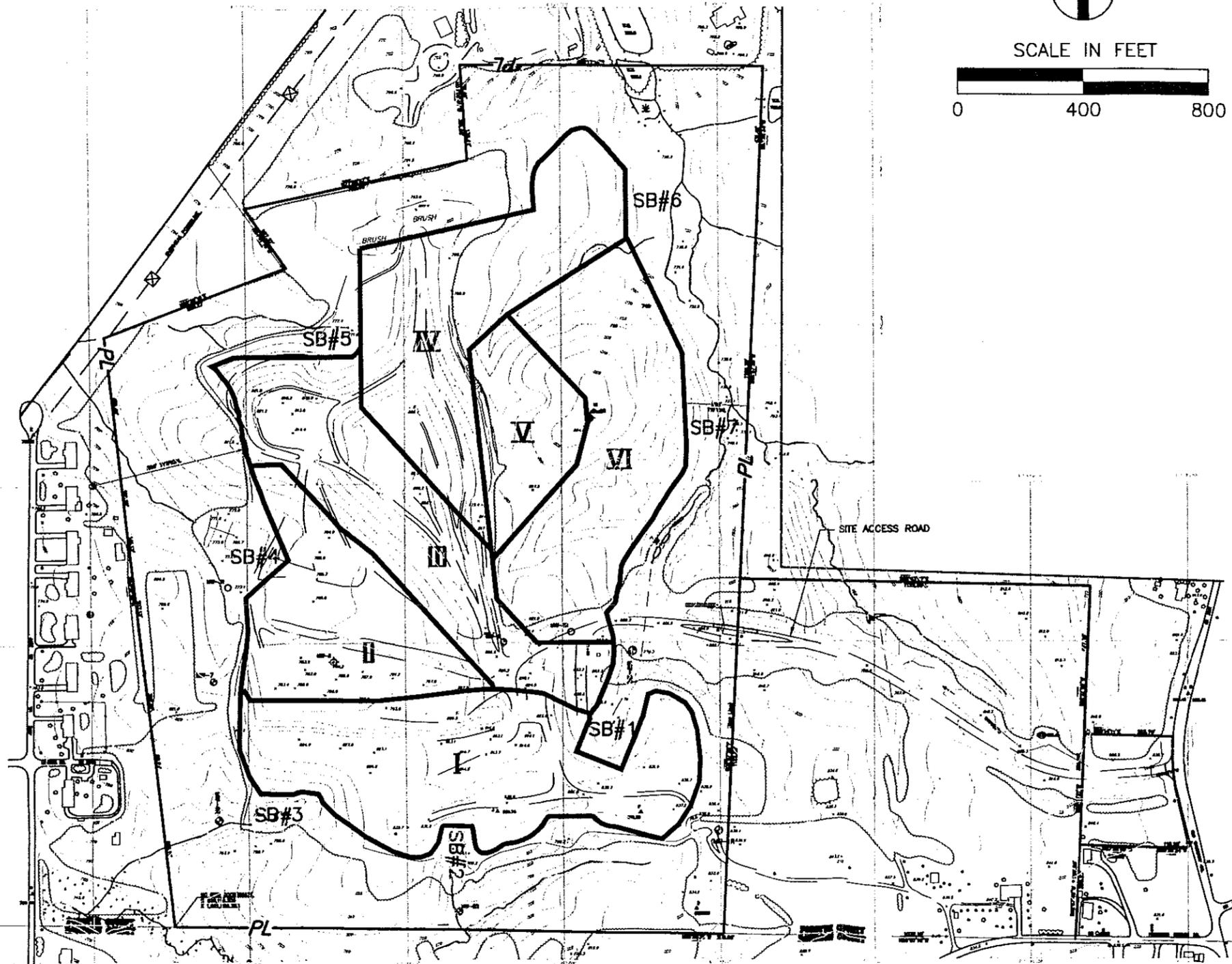
The access road to the working face will be constructed for all-weather use and kept in good working condition. Dust control and tracked mud will be controlled as needed.

Proper signage directing and informing facility users will be placed in high visibility areas. Signs shall indicate the types of material allowed in the facility.

APPENDIX A

Figure 1 – Site Map

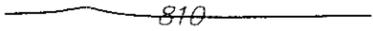
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SCALE IN FEET



LEGEND

-  810 EXISTING CONTOURS
-  PL PROPERTY BOUNDARY
-  COUNTY LINE
-  PHASING LIMITS
-  STREAM
-  GW MONITORING WELL
-  PRIVATE WATER SUPPLY WELL
-  SB#2 SEDIMENT BASIN

NOTES

1. TOPOGRAPHIC INFORMATION PROVIDED BY CARTOGRAPHIC AERIAL MAPPING FOR PHASES I, II AND III DATED SEPTEMBER 29, 2001 AND FOR THE REMAINDER OF THE SITE.
2. REMAINDER OF THE SITE.

PROPERTY SURVEY TAKEN FROM DATA SUPPLIED BY BRADY SURVEYING, INC. MARCH 14, 1994.

THIS SITE IS ANTICIPATED TO BE DEVELOPED AS A SERIES OF PHASES BEGINNING WITH PHASE IV AND ENDING WITH PHASE VI.

HDR
 HDR Engineering, Inc.
 of the Carolinas
 Suite 1400
 128 S. Tryon Street
 Charlotte, NC 28202-5001
 (704) 338-1800

**OLD SALISBURY ROAD
 CONSTRUCTION AND DEMOLITION LANDFILL
 SITE MAP**

WINSTON-SALEM

NORTH CAROLINA

Date	7/02
Figure	1

APPENDIX B

Landfill Emergency Action Plan

LANDFILL EMERGENCY ACTION PLAN

Approved by: _____
Ranking Official's Signature

Title: Utilities Superintendent

Date: _____

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D. Emergency Response Telephone Numbers	1
E. Emergencies	2
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ii) Tornado and Hurricane	2
iii) Evacuation	2

I. LANDFILL EMERGENCY ACTION PLAN

A. Purpose

The Landfill Emergency Action Plan is to provide all employees with the proper information to protect themselves, co-workers, and the public in the event of an emergency. This plan is designed to meet the requirements of OSHA 1910.38(a) and 1910.120.

B. Definitions

- i. Emergencies shall include such events as serious fires, explosions, tornadoes, hurricanes, or releases of hazardous or toxic materials. This plan will detail the appropriate emergency action for each.
- ii. Severe fires shall be any fire which is extinguishable by a portable fire extinguisher or a fire within a confined space which would require entering the space to extinguish it or a fire involving explosive or toxic materials.
- iii. Assembly Point shall be the area in which all employees gather in the event of an emergency.

C. Responsible Persons

The following person is responsible for implementing and training employees on the emergency action plan. If employees have questions, they should contact the supervisor for their section listed below.

Jimmy C. Lineberry – Senior Crew Coordinator – (336) 345-6451(w)

In the case of emergency evacuation, the supervisor is responsible for accountability of his/her employees and all visitors.

Every employee is responsible for his/her safety and for preventing job-related accidents or injuries by complying with all work place safety policies and related procedures.

D. Emergency Response Telephone Numbers

EMERGENCY (FIRE/POLICE)	911
Emergency Management (Local)	(336) 767-6161

Risk Management (Local)	(336) 727-2572
Winston-Salem Regional Office	(336) 771-5000
Division of Environmental Management	(336) 771-5000
National Response Center	1-800-424-8802
N.C. Emergency Management	1-919-575-4122
Chemtrec	1-800-262-8200
Poison Control Center	1-800-222-1222

*If possible, consult your supervisor before using the numbers listed.

E. Emergencies

i) Fires and Explosions

- a. In the event of a fire or explosion, all personnel shall evacuate the area with caution. There are no specific escape route assignments during the initial evacuation. **The assembly area is the front entrance of the landfill.**

ii) Tornado and Hurricane

- a. In the event of a tornado or hurricane with sufficient warning, all Landfill personnel shall move with caution to the nearest secure public structure. In the event of a tornado without warning, personnel should temporarily retreat to the nearest secure place – heavy equipment or lowest point in a ditch.

There are no specific escape route assignments during the initial evacuation.

iii) Evacuation

- a. To alert other personnel on the Landfill site, the highest ranking person shall notify the employees by two-way radio.
- b. Under no circumstances shall an employee remain in a hazardous area to operate equipment. Evacuation is mandatory.
- c. Employee Accounting

In the event of an emergency, the Landfill supervisor(s) or in his/her absence, the senior operator will take charge at the assembly point and account for all persons at the Landfill site.

The highest ranking supervisor(s) at the assembly point will be responsible for accounting for all persons onsite. Once everyone has been accounted for, no one may leave the assembly point without the assembly point supervisor's permission.

All persons should reach the assembly point within 10 minutes of the alarm. All persons unaccounted for after this time will be assumed to be down and their names and last known location will be provided to the fire/rescue personnel by the assembly point supervisor.

d. Assigned Responsibilities

In the event of an emergency evacuation the following personnel shall have these responsibilities:

Person discovering the emergency condition:

- ◆ Shall report the situation to 911.
- ◆ Shall take first aid kit to the assembly point.
- ◆ Report to the assembly point and begin accounting for persons on site.
- ◆ Coordinate actions with emergency response personnel; report all missing persons.

e. Employees are not required to administer medical attention but may offer first aid normally given to any accident victim. Only properly trained personnel shall attempt rescue of an employee in a hazardous atmosphere.

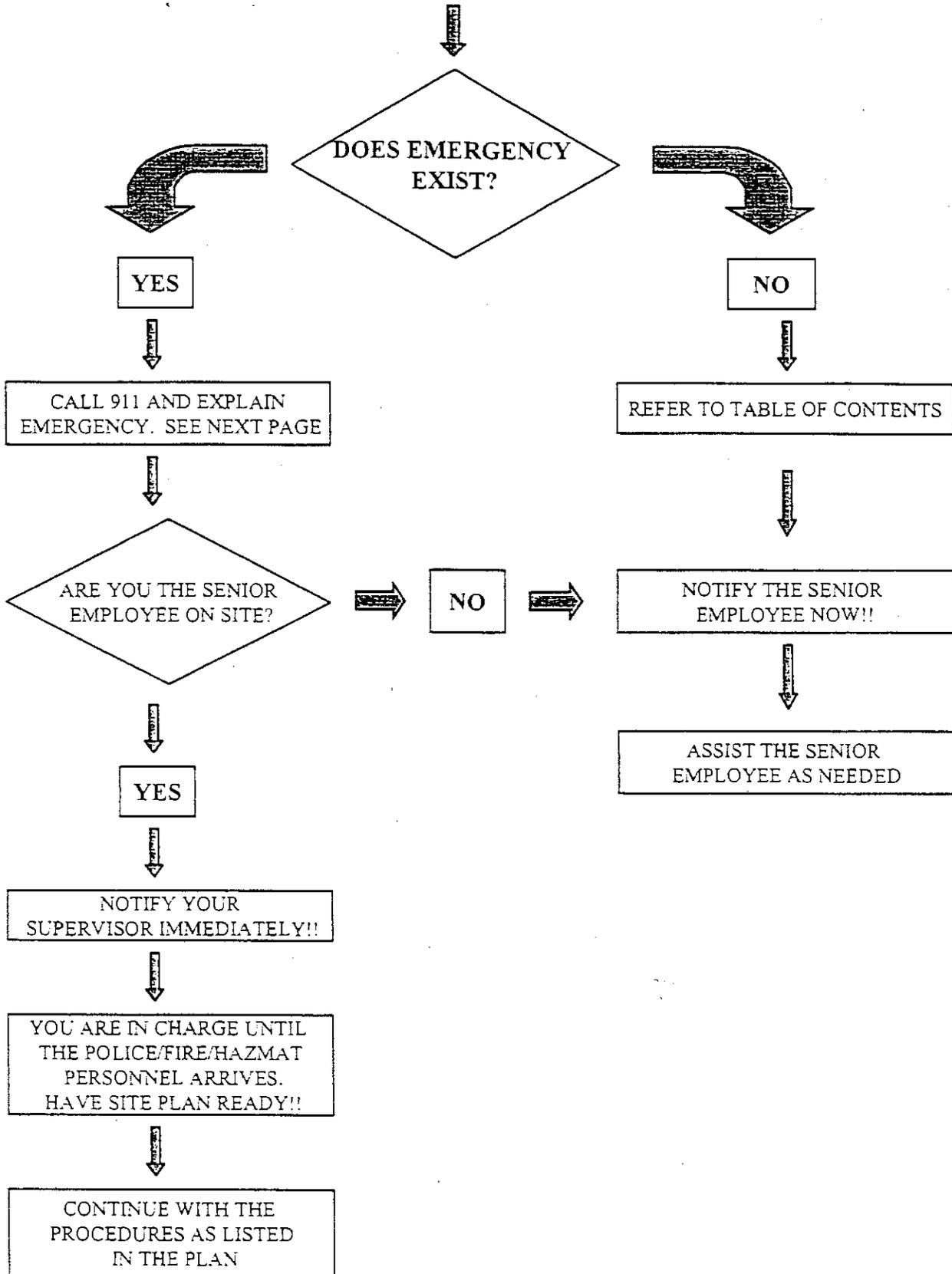
f. The preferred means of reporting an emergency is by telephone (i.e., call 911). The next preferred method of reporting is by radio (i.e., call supervisor). The least preferred method of reporting is by word of mouth. Under these conditions, no employee shall drive for help until weather conditions are safe for transit by automobile. Then an employee may seek help via Fire Station located on Peters Creek Parkway. In all cases, be sure to give emergency personnel an

address, phone number, injuries, if any are known, and type of emergency (see Appendix C).

APPENDIX C

Emergency Flow Chart/Telephone Procedures

EMERGENCY FLOW CHART



EMERGENCY TELEPHONE PROCEDURES

1. **DIAL 911 !!**
2. **Hello, my name is _____, I work at the Old Salisbury Road Construction and Demolition Landfill for the City of Winston-Salem.**
3. **There is a _____ emergency.**
(NOTE: If the emergency is a chemical release, give the wind direction.*)
4. **The Landfill is located at:**
Address: 3336 Old Salisbury Road
Phone #: (336) 650-7659
5. **There are _____ persons injured.**

***WIND DIRECTION CAN BE DETERMINED BY USING THE WIND SOCKS AND COORDINATES LOCATED AT EACH LANDFILL SITE.**

APPENDIX E

GROUNDWATER MONITORING PLAN

April 3, 2003 (Revised July 2003)

Mr. Bobby Lutfy, Hydrogeologist
North Carolina Department of Environment
and Natural Resources
Division of Solid Waste Management
Solid Waste Section
P. O. Box 27687
Raleigh, North Carolina 27611-7687

Re: Supplemental Revisions to Revised Ground-Water Monitoring Plan
Winston-Salem Construction and Demolition Landfill (No. 34-12)
Forsyth County, North Carolina
HDR Project No. 00162-525-018

Dear Mr. Lutfy:

HDR Engineering, Inc. of the Carolinas (HDR) is hereby submitting, on behalf of the City of Winston-Salem Utilities Division, the enclosed documents to be incorporated into the existing Revised Ground-Water Monitoring Plan (RGWMP), dated January 1996.

In response to the permitting of Phases IV, V, and VI at the Old Salisbury Road Construction and Demolition Landfill (Landfill), the abandonment and installation of ground-water monitoring wells will be conducted in a phased approach. With this phased approach, the abandonment and installations will take place immediately prior to filling of the respective phase, except where wells already exist.

A total of five additional ground-water monitoring wells are needed to adequately monitor the uppermost aquifer for a release from the proposed Phases IV, V, VI area. In keeping with the existing sequence, ground-water monitoring wells MW-9, MW-10, MW-11, MW-12, and 13 are being proposed at the approximate locations shown on the attached Drawing C-05. Ground-water monitoring wells MW-9 and MW-10 are positioned to monitor the downgradient extents of Phase IV. The remaining two Phases (V and VI) will be monitored by the installation of ground-water monitoring wells MW-11, MW-12, and MW-13 as shown on C-05.

With eight ground-water monitoring wells currently making up the monitoring well network, the horizontal distance between existing wells varies between 340 to 860 feet, with an average horizontal spacing of 630 feet. The distance from the edge of waste to each monitoring well also varies (between 75 to 275 feet). The placement of ground-water monitoring wells in the past has been predominantly based on the presence of presumed

subsurface features with the potential for preferential ground-water flow (i.e., small surface water features onsite being a surficial expression of subsurface fractures). However, ground-water level and water quality data from these wells for the past 6.5 years has not reported any C&D-related compound detections or has suggested that there is any preferential ground-water flow at these areas of the Site. Therefore, the horizontal placement of the proposed ground-water monitoring wells (approximately 500 feet apart and 50 to 100 feet from the edge of waste) is based on the potentiometric data and the estimated annual ground-water seepage velocity for the uppermost aquifer.

The zone of ground-water monitoring around most of the Phases IV, V, VI area is limited, with less than 100 feet available for monitoring well placement (e.g., along eastern stream). Therefore, these wells are expected to be installed at a distance of approximately 100 feet from the edge of waste based on the accessibility and practicality of installing a well that can be effectively monitored year round (i.e., areas prone to flooding). With a reported ground-water flow rate between 28.30 feet per year (ft/year) and 26.34 ft/year for the saprolite and transition zone hydrogeologic units. Assuming a worst-case scenario of a release at the edge of waste, it could potentially take 3.5 years for the proposed monitoring wells to detect this release given the aquifer properties and well spacing above. If one were to assume a release from the center of the waste unit, the distance to the monitoring network would be on the order of 375 feet, with a release detection potential of 13.2 years. Realistically, the scenario is somewhere in the middle (e.g., less than 200 feet). These scenarios assume no lateral dispersion, only particle movement perpendicular to the slope of the potentiometric surface (i.e., dispersion ratio of 1:1). However, ground-water movement is rarely without some component of lateral dispersion. Lateral dispersion in soils containing a significant percentage of fine-grained material can be significant. Without contaminant plume data to directly approximate dispersion at the Landfill, a conservative (estimated) dispersion coefficient or ratio of 1:2 was assumed. For every foot of ground-water movement in the primary direction of flow there is an estimated 2 feet of lateral dispersion. If these values are considered, then a particle released at a distance of approximately 200 feet upgradient of the proposed monitoring well network (125 feet inside the waste unit) could potentially require a horizontal well spacing of 800 feet. This approximation does not have the ability to take into account other factors that could affect the well spacing (i.e., increase spacing) such as the filling sequence and the relationship of the placement of early waste to the nearest ground-water monitoring well.

As shown on the attached Drawing C-05, the horizontal placement of monitoring wells is approximately 450-275 to 600-700 feet apart, well within the 800-foot spacing calculated above.

Before the construction of Phase VI, monitoring well MW-6R will be permanently abandoned in accordance with North Carolina Department of Environment and Natural Resources (NCDENR) Well Abandonment Regulations. No replacement is currently planned for this well. These monitoring wells will not be sampled until the scheduled sampling event six months prior to their respective phase of the Landfill begins to receive waste. An initial sample will be collected and analyzed in accordance with the existing RGWMP for Appendix I volatile organic compounds (VOCs) and the eight RCRA metals during each sampling event. The enclosed site plan (Drawing C-05) shows the location of all abandoned, existing, and proposed ground-water monitoring wells at the Landfill. The following table summarizes the anticipated well construction details for the proposed detection monitoring wells for the Phases IV, V, VI area.

Summary of Proposed Ground-Water Monitoring Well Construction			
Proposed Well	Water Table Elevation (MSL)	Estimated Screened Interval (MSL)	Estimated Total Well Depth
MW-9	731	736 - 721	70
MW-10	725	730 - 715	20
MW-11	725	730 - 715	20
MW-12	730	735 - 720	20
MW-13	730	735 - 720	20

MSL – mean sea level

All data is in feet.

Prior to well construction, each soil boring will be sampled at 5-foot intervals starting from 5 feet below land surface to the total depth of the boring. The samples will be collected using a standard 1.375-inch inside diameter (ID), 2-inch outside diameter (OD), 24-inch long stainless steel split-barrel sampler. In accordance with ASTM practice D1586, the sampler will be driven into the undisturbed soil ahead of the advancing augers using a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final 12 inches will be recorded as the designated penetration resistance value (N-value). The recovered soil samples will be visually inspected in the field by an HDR geologist and classified in general accordance with the Unified Soil Classification System (USCS). Soil boring logs for each location will be prepared.

Once each soil boring is completed to its final depth below the water table, a 2-inch diameter ground-water monitoring well will be constructed in accordance with the North Carolina Well Standards and Regulations. Each well will consist of 2-inch ID Schedule 40 polyvinyl chloride well pipe, which is flush-threaded to factory-slotted well screen with 0.010-inch openings. Each shallow well will be fitted with a 15-foot well screen positioned at the water table interface to allow for seasonal fluctuation (historically less than a foot).

Each monitoring well will be constructed by lowering the well string through the center of the hollow stem augers to the bottom of the borehole. A washed, graded (No. 2) silica sand will be placed through the augers and allowed to settle (by gravity) around the annulus between the well screen and the augers. Upon removal of each 5-foot auger flight, the silica sand will be allowed to settle around the well screen, filling the annulus between the well screen and the wall of the borehole. The sand pack will be placed to a depth of ~~2 feet~~ 1 foot above the top of the well screen. A 2-foot annular seal consisting of 3/8-inch high-yield Wyoming bentonite chips will be placed above the sand pack (by gravity) and allowed to hydrate (swell). The remaining annular space from the top of the bentonite seal to ground surface will be sealed with a Portland Type I cement/3 percent bentonite mixture placed using a tremie pipe.

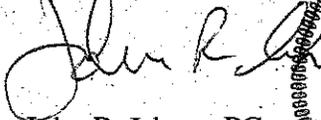
The wells will be permanently finished above-grade with a stickup of approximately 2.5 feet. The piezometer pipes will be secured against accidental opening or tampering with a locked, steel well box finished with an ID tag and concrete pad. A ground-water monitoring well construction record drawing for each of the proposed monitoring wells will be prepared and submitted upon completion of this task.

In addition to the ground-water monitoring wells, six methane probes (MM-7 through MM-12) will be installed around Phases IV, V, and VI for methane detection monitoring. A North Carolina licensed well driller will bore down to the top of the ground-water table and a Schedule 40 PVC gas probe will be inserted through the center of the borehole. Each probe will be constructed with flush-threaded joints and an appropriate screened interval of 0.020-inch, factory-slotted well screen. A coarse-grained silica gravel will be placed around the screen interval by gravity settling. The gravel pack will extend to a minimum of 6 inches above the top of the screen. A 6-inch minimum bentonite seal will be placed immediately above the gravel pack. The remaining probe annulus will be sealed to surface grade using a Portland Type I cement mixture. Each probe station will be completed above grade and protected by a 4-inch square steel locked well box secured in place with a 3-foot by 3-foot concrete pad. The outside of each station will be fitted with an identification tag indicating the station number, installation date, driller name and registration, completion depth, and, screened interval. A methane probe construction record drawing for each of the proposed probes will be prepared and submitted upon completion of this task. See Drawing C-05 for the approximate locations of the proposed methane monitoring probes.

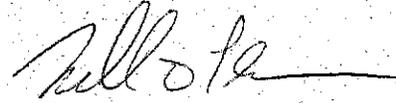
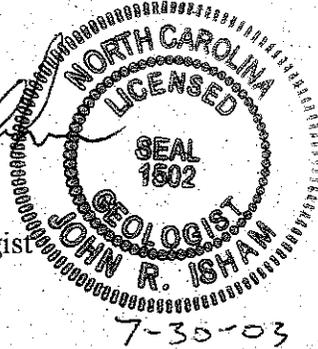
Mr. Bobby Lutfy, Hydrogeologist
April 3, 2003(Revised July 2003)
Page 5

If you have any questions or comments concerning the information summarized in this letter or on the enclosures, please do not hesitate to contact me or Mike Plummer at (704) 338-6700.

Sincerely,



John R. Isham, PG
Senior Hydrogeologist



Michael D. Plummer, PE
Project Engineer

JRI/MDP/jvd

Enclosures: Existing and Proposed Ground-Water Monitoring Well Locations (C-05)

cc: Edward L. Gibson, City of Winston-Salem (w/attachments)
Larry Rose, NCDENR Solid Waste Section (w/attachments)
Tim Jewett, NCDENR Solid Waste Section (w/attachments)
Brock Turner, Forsyth County Health Department (w/attachments)

April 3, 2003

Mr. Bobby Lutfy, Hydrogeologist
North Carolina Department of Environment
and Natural Resources
Division of Solid Waste Management
Solid Waste Section
P. O. Box 27687
Raleigh, North Carolina 27611-7687

Re: Supplemental Revisions to Revised Ground-Water Monitoring Plan
Winston-Salem Construction and Demolition Landfill (No. 34-12)
Forsyth County, North Carolina
HDR Project No. 00162-525-018

Dear Mr. Lutfy:

HDR Engineering, Inc. of the Carolinas (HDR) is hereby submitting, on behalf of the City of Winston-Salem Utilities Division, the enclosed documents to be incorporated into the existing Revised Ground-Water Monitoring Plan (RGWMP), dated January 1996.

In response to the permitting of Phases IV, V, and VI at the Old Salisbury Road Construction and Demolition Landfill (Landfill), the abandonment and installation of ground-water monitoring wells will be conducted in a phased approach. With this phased approach, the abandonment and installations will take place immediately prior to filling of the respective phase, except where wells already exist.

A total of five additional ground-water monitoring wells are needed to adequately monitor the uppermost aquifer for a release from the proposed Phases IV, V, VI area. In keeping with the existing sequence, ground-water monitoring wells MW-9, MW-10, MW-11, MW-12, and 13 are being proposed at the approximate locations shown on the attached Drawing C-05. Ground-water monitoring wells MW-9 and MW-10 are positioned to monitor the downgradient extents of Phase IV. The remaining two Phases (V and VI) will be monitored by the installation of ground-water monitoring wells MW-11, MW-12, and MW-13 as shown on C-05.

With eight ground-water monitoring wells currently making up the monitoring well network, the horizontal distance between existing wells varies between 340 to 860 feet, with an average horizontal spacing of 630 feet. The distance from the edge of waste to each monitoring well also varies (between 75 to 275 feet). The placement of ground-water monitoring wells in the past has been predominantly based on the presence of presumed

Mr. Bobby Lutfy, Hydrogeologist

April 3, 2003

Page 2

subsurface features with the potential for preferential ground-water flow (i.e., small surface water features onsite being a surficial expression of subsurface fractures). However, ground-water level and water quality data from these wells for the past 6.5 years has not reported any C&D-related compound detections or has suggested that there is any preferential ground-water flow at these areas of the Site. Therefore, the horizontal placement of the proposed ground-water monitoring wells (approximately 500 feet apart and 50 to 100 feet from the edge of waste) is based on the potentiometric data and the estimated annual ground-water seepage velocity for the uppermost aquifer.

The zone of ground-water monitoring around most of the Phases IV, V, VI area is limited, with less than 100 feet available for monitoring well placement (e.g., along eastern stream). Therefore, these wells are expected to be installed at a distance of approximately 100 feet from the edge of waste based on the accessibility and practicality of installing a well that can be effectively monitored year round (i.e., areas prone to flooding). With a reported ground-water flow rate between 28.30 feet per year (ft/year) and 26.34 ft/year for the saprolite and transition zone hydrogeologic units. Assuming a worst-case scenario of a release at the edge of waste, it could potentially take 3.5 years for the proposed monitoring wells to detect this release given the aquifer properties and well spacing above. If one were to assume a release from the center of the waste unit, the distance to the monitoring network would be on the order of 375 feet, with a release detection potential of 13.2 years. Realistically, the scenario is somewhere in the middle (e.g., less than 200 feet). These scenarios assume no lateral dispersion, only particle movement perpendicular to the slope of the potentiometric surface (i.e., dispersion ratio of 1:1). However, ground-water movement is rarely without some component of lateral dispersion. Lateral dispersion in soils containing a significant percentage of fine-grained material can be significant. Without contaminant plume data to directly approximate dispersion at the Landfill, a conservative (estimated) dispersion coefficient or ratio of 1:2 was assumed. For every foot of ground-water movement in the primary direction of flow there is an estimated 2 feet of lateral dispersion. If these values are considered, then a particle released at a distance of approximately 200 feet upgradient of the proposed monitoring well network (125 feet inside the waste unit) could potentially require a horizontal well spacing of 800 feet. This approximation does not have the ability to take into account other factors that could affect the well spacing (i.e., increase spacing) such as the filling sequence and the relationship of the placement of early waste to the nearest ground-water monitoring well.

As shown on the attached Drawing C-05, the horizontal placement of monitoring wells is approximately 450 to 600 feet apart, well within the 800-foot spacing calculated above.

Before the construction of Phase VI, monitoring well MW-6R will be permanently abandoned in accordance with North Carolina Department of Environment and Natural Resources (NCDENR) Well Abandonment Regulations. No replacement is currently planned for this well. These monitoring wells will not be sampled until the scheduled sampling event six months prior to their respective phase of the Landfill begins to receive waste. An initial sample will be collected and analyzed in accordance with the existing RGWMP for Appendix I volatile organic compounds (VOCs) and the eight RCRA metals during each sampling event. The enclosed site plan (Drawing C-05) shows the location of all abandoned, existing, and proposed ground-water monitoring wells at the Landfill. The following table summarizes the anticipated well construction details for the proposed detection monitoring wells for the Phases IV, V, VI area.

Summary of Proposed Ground-Water Monitoring Well Construction			
Proposed Well	Water Table Elevation (MSL)	Estimated Screened Interval (MSL)	Estimated Total Well Depth
MW-9	731	736 - 721	70
MW-10	725	730 - 715	20
MW-11	725	730 - 715	20
MW-12	730	735 - 720	20
MW-13	730	735 - 720	20

MSL – mean sea level

All data is in feet.

Prior to well construction, each soil boring will be sampled at 5-foot intervals starting from 5 feet below land surface to the total depth of the boring. The samples will be collected using a standard 1.375-inch inside diameter (ID), 2-inch outside diameter (OD), 24-inch long stainless steel split-barrel sampler. In accordance with ASTM practice D1586, the sampler will be driven into the undisturbed soil ahead of the advancing augers using a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final 12 inches will be recorded as the designated penetration resistance value (N-value). The recovered soil samples will be visually inspected in the field by an HDR geologist and classified in general accordance with the Unified Soil Classification System (USCS). Soil boring logs for each location will be prepared.

Mr. Bobby Lutfy, Hydrogeologist

April 3, 2003

Page 4

Once each soil boring is completed to its final depth below the water table, a 2-inch diameter ground-water monitoring well will be constructed in accordance with the North Carolina Well Standards and Regulations. Each well will consist of 2-inch ID Schedule 40 polyvinyl chloride well pipe, which is flush-threaded to factory-slotted well screen with 0.010-inch openings. Each shallow well will be fitted with a 15-foot well screen positioned at the water table interface to allow for seasonal fluctuation (historically less than a foot).

Each monitoring well will be constructed by lowering the well string through the center of the hollow stem augers to the bottom of the borehole. A washed, graded (No. 2) silica sand will be placed through the augers and allowed to settle (by gravity) around the annulus between the well screen and the augers. Upon removal of each 5-foot auger flight, the silica sand will be allowed to settle around the well screen, filling the annulus between the well screen and the wall of the borehole. The sand pack will be emplaced to a depth of 2 feet above the top of the well screen. A 2-foot annular seal consisting of 3/8-inch high-yield Wyoming bentonite chips will be placed above the sand pack (by gravity) and allowed to hydrate (swell). The remaining annular space from the top of the bentonite seal to ground surface will be sealed with a Portland Type I cement/3 percent bentonite mixture placed using a tremie pipe.

The wells will be permanently finished above-grade with a stickup of approximately 2.5 feet. The piezometer pipes will be secured against accidental opening or tampering with a locked, steel well box finished with an ID tag and concrete pad. A ground-water monitoring well construction record drawing for each of the proposed monitoring wells will be prepared and submitted upon completion of this task.

In addition to the ground-water monitoring wells, six methane probes (MM-7 through MM-12) will be installed around Phases IV, V, and VI for methane detection monitoring. A North Carolina licensed well driller will bore down to the top of the ground-water table and a Schedule 40 PVC gas probe will be inserted through the center of the borehole. Each probe will be constructed with flush-threaded joints and an appropriate screened interval of 0.020-inch, factory-slotted well screen. A coarse-grained silica gravel will be placed around the screen interval by gravity settling. The gravel pack will extend to a minimum of 6 inches above the top of the screen. A 6-inch minimum bentonite seal will be placed immediately above the gravel pack. The remaining probe annulus will be sealed to surface grade using a Portland Type I cement mixture. Each probe station will be completed above grade and protected by a 4-inch square steel locked well box secured in place with a 3-foot by 3-foot concrete pad. The outside of each station will be fitted with an identification tag indicating the station number, installation date, driller name and registration, completion depth, and, screened interval. A methane probe construction record drawing for each of the proposed probes will be prepared and submitted upon completion of this task. See Drawing C-05 for the approximate locations of the proposed methane monitoring probes.

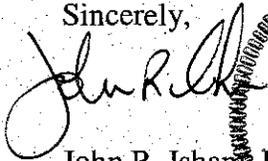
Mr. Bobby Luffy, Hydrogeologist

April 3, 2003

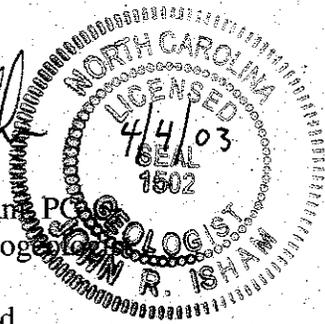
Page 5

If you have any questions or comments concerning the information summarized in this letter or on the enclosures, please do not hesitate to contact me or Mike Plummer at (704) 338-6700.

Sincerely,



John R. Isham, P.C.
Senior Hydrogeologist



Michael D. Plummer, PE
Project Engineer

JRI/MDP/jvd

Enclosures: Existing and Proposed Ground-Water Monitoring Well Locations (C-05)

cc: Edward L. Gibson, City of Winston-Salem (w/attachments)
Larry Rose, NCDENR Solid Waste Section (w/attachments)
Tim Jewett, NCDENR Solid Waste Section (w/attachments)
Brock Turner, Forsyth County Health Department (w/attachments)

October 22, 2002

Mr. Bobby Lutfy, Hydrogeologist
North Carolina Department of Environment
and Natural Resources
Division of Solid Waste Management
Solid Waste Section
P. O. Box 27687
Raleigh, North Carolina 27611-7687

Re: Supplemental Revisions to Revised Ground-Water Monitoring Plan
Winston-Salem Construction and Demolition Landfill (#34-12)
Forsyth County, North Carolina
HDR Project No. 00162-525-018

Dear Mr. Lutfy:

HDR Engineering, Inc. of the Carolinas (HDR) is hereby submitting, on behalf of the City of Winston-Salem Utilities Division, the enclosed documents to be incorporated into the existing Revised Ground-Water Monitoring Plan, dated January 1996.

In response to the permitting of Phases IV, V, and VI at the Old Salisbury Road Construction and Demolition Landfill (Landfill), the abandonment and installation of ground-water monitoring wells will be conducted in a phased approach. With this phased approach, the abandonment and installations will take place immediately prior to filling of the respective phase, except where wells already exist. Monitoring wells MW-9 and MW-10 will be installed prior to Phase IV landfilling and will perform downgradient ground-water detection monitoring for both Phases IV and V. Before the construction of Phase VI, monitoring wells MW-6R, B-21A, and B-21B will be permanently abandoned according to North Carolina Department of Environment and Natural Resources (NCDENR) Well Abandonment Regulations. A replacement ground-water monitoring well (MW-6RR) will be installed in accordance with the locations approved by the Solid Waste Section immediately prior to filling in Phase VI. Ground-water monitoring wells MW-6RR, PZ-27 (will be renamed MW-11), and PZ-29 (will be renamed MW-12) will perform downgradient ground-water detection monitoring for Phase VI. These monitoring wells will not be monitored and sampled on a semiannual basis until their respective phase of the Landfill begins to receive waste. The enclosed site plan (Drawing C-5) shows the location of all abandoned, existing, and proposed ground-water monitoring wells at the Landfill. The following table summarizes the anticipated well construction details for the proposed detection monitoring wells for Phases IV through VI.

Summary of Proposed Ground-Water Monitoring Well Construction			
Proposed Well	Water Table Elevation (MSL)	Estimated Screened Interval (MSL)	Estimated Total Well Depth
MW-6RR	746	746 - 736	15
MW-9	737	737 - 727	65
MW-10	731	731 - 721	60
MW-11*	725	719 - 709	18
MW-12**	730	730 - 720	14

* Previously PZ-27

** Previously PZ-29

MSL – mean sea level

All data is in feet.

Each soil boring will be sampled at 5-foot intervals starting from 5 feet below land surface to the total depth of the boring. Where they are paired with shallow borings, deep soil borings will be sampled at the deeper intervals only. The samples will be collected using a standard 1.375-inch inside diameter (ID), 2-inch outside diameter (OD), 24-inch long stainless steel split-barrel sampler. In accordance with ASTM practice D1586, the sampler will be driven into the undisturbed soil ahead of the advancing augers using a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final 12 inches will be recorded as the designated penetration resistance value (N-value). The recovered soil samples will be visually inspected in the field by an HDR geologist and classified in general accordance with the Unified Soil Classification System (USCS). Soil boring logs for each location will be prepared.

Once each soil boring is completed to its final depth below the water table, a 2-inch diameter ground-water piezometer will be constructed in accordance with the North Carolina Well Standards and Regulations. Each piezometer will consist of 2-inch ID Schedule 40 polyvinyl chloride well pipe, which is flush-threaded to factory-slotted well screen with 0.010-inch openings. Each shallow piezometer will be fitted with a 10-foot well screen positioned just below the top of the water table.

Each piezometer will be constructed by lowering the well string through the center of the hollow stem augers to the bottom of the borehole. A washed, graded (No. 2) silica sand will be placed through the augers and allowed to settle (by gravity) around the annulus between the piezometer screen and the augers. Upon removal of each 5-foot auger flight, the silica sand will be allowed to settle around the piezometer screen, filling the annulus between the piezometer screen and the wall of the borehole. The sand pack will be emplaced to a depth of 2 feet above the top of the piezometer screen. A 2-foot annular seal consisting of 3/8-inch high-yield Wyoming bentonite chips will be placed above the sand pack (by gravity) and allowed to hydrate (swell). The remaining annular space from the top of the bentonite seal to ground surface will be sealed with a Portland Type I cement/3 percent bentonite mixture placed using a tremie pipe.

Mr. Bobby Lutfy, Hydrogeologist

October 22, 2002

Page 3

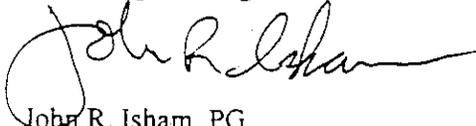
The piezometers will be permanently finished above-grade with a stickup of approximately 2.5 feet. The piezometer pipes will be secured against accidental opening or tampering with a locked, steel well box finished with an I.D. tag and concrete pad. A ground-water piezometer construction record drawing for each of the proposed monitoring wells will be prepared and submitted upon completion of this task.

In addition to the ground-water monitoring wells, six methane probes will be installed around Phases IV, V, and VI for methane detection monitoring. A NC licensed well driller will bore down to the top of the ground-water table and a Schedule 40 PVC gas probe will be inserted through the center of the borehole. Each probe will be constructed with flush-threaded joints and an appropriate screened interval of 0.020-inch, factory-slotted well screen. A coarse-grained silica gravel will be placed around the screen interval by gravity settling. The gravel pack will extend to a minimum of 6 inches above the top of the screen. A 6-inch minimum bentonite seal will be placed immediately above the gravel pack. The remaining probe annulus will be sealed to surface grade using a Portland Type I cement mixture. Each probe station will be completed above grade and protected by a 4-inch square steel locked well box secured in place with a 3-foot by 3-foot concrete pad. The top of each well probe will be fitted with a laboratory-type stop-cock valve for gas sample collection. The outside of each station will be fitted with an identification tag indicating the station number, installation date, driller name and registration, completion depth, and, screened interval. A methane probe construction record drawing for each of the proposed probes will be prepared and submitted upon completion of this task. See drawing C-5 for the approximate locations of the proposed methane monitoring probes.

If you have any questions or comments concerning the information summarized in this letter or on the enclosures, please do not hesitate to contact me at (704) 338-6700.

Sincerely,

HDR Engineering, Inc. of the Carolinas



John R. Isham, PG
Senior Hydrogeologist

JRI/jyd

Enclosures: Existing and Proposed Ground-Water Monitoring Well Locations (C-5)

cc: Edward L. Gibson, City of Winston-Salem (w/attachments)
Larry Rose, NCDENR Solid Waste Section (w/attachments)
Tim Jewett, NCDENR Solid Waste Section (w/attachments)
Brock Turner, Forsyth County Health Department (w/attachments)

HDR Engineering, Inc. of the Carolinas

October 8, 1999



Mr. Tim Jewett, P.E.
North Carolina Department of Environment
and Natural Resources
Division of Solid Waste Management
Solid Waste Section
585 Waughtown Street
Winston-Salem, North Carolina 27107-2241

Re: Existing Ground-Water Monitoring Plan
Winston-Salem Construction and Demolition Landfill (#34-12)
Forsyth County, North Carolina
HDR Project No. 00162-090-018

Dear Mr. Jewett:

HDR Engineering, Inc. of the Carolinas (HDR) is hereby submitting, on behalf of the City of Winston-Salem Utilities Division, the enclosed documents for inclusion with the existing Construction Permit Application for the construction of Phases II and III of the Old Salisbury Road Construction and Demolition (C&D) Landfill at the above-referenced location.

At the October 5, 1999, meeting with Jim Coffey regarding the permitting of Phases II and III, questions were raised concerning the ground-water monitoring program at the landfill. This letter and attached documentation is intended to provide a clearer understanding of the evolution of ground-water monitoring activities at the referenced facility.

The original Ground-Water Monitoring Plan for the C&D landfill was prepared by S&ME, Inc. in December of 1994. Attached is a copy of this plan. From December of 1994 until January of 1996, the ground-water monitoring well network at the site consisted of an upgradient monitoring well (MW-1) and four downgradient monitoring wells (MW-2 through MW-5). Figure 3 from this plan shows the location of the existing and proposed ground-water monitoring wells stated in this plan. The proposed analytical parameters to be sampled during this period are summarized in Table 2 of this plan.

In June of 1995, HDR amended the analytical parameters list of this proposed plan to include the current analytical parameters required for detection monitoring of C&D landfills. This amendment was in response to a memorandum from the Solid Waste Section.

HDR Engineering, Inc.
of the Carolinas

Employee Owned

128 S. Tryon Street
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Charlotte, North Carolina
28202-5001

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704 338-6700
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704 338-6760

Mr. Tim Jewett, P.E.

October 8, 1999

Page 2

In response to a Solid Waste Section letter dated September 27, 1995, additional revisions to the original Ground-Water Monitoring plan were implemented. During the design and permitting of Phase I of the landfill, it was noted that background monitoring well MW-1 was positioned within the proposed footprint of Phase I. Therefore, HDR modified the existing Ground-Water Monitoring Plan to include the abandonment and installation of a replacement for background monitoring well MW-1. This installation was coupled with the replacement of ground-water monitoring wells MW-2, MW-4, and MW-5 to better monitor several of the "local" drainage features. These replacement wells (MW-1R, MW-2R, MW-4R, and MW-5R) were installed in December of 1995 in addition to two new monitoring wells (MW-6 and MW-7) to complete the ground-water monitoring well network for Phase I of the landfill. A Revised Ground-Water Monitoring Plan was prepared (by HDR) with these amendments and submitted to the Solid Waste Section in January of 1996 (including the initial sampling results from the wells). A copy of this plan is also included.

From January 1996 to August 1999, the ground-water monitoring well network at the landfill consisted of seven wells (MW-1R, MW-2R, MW-3, MW-4R, MW-5R, MW-6, and MW-7), of which MW-3 was the only remaining well from the original plan. These wells were sampled on a semiannual basis and reported to the Section.

More recently, the permitting of Phases II and III at the landfill prompted additional modifications to the Revised Ground-Water Monitoring Plan (HDR, 1996). Ground-water monitoring wells MW-3 and MW-6 were positioned within the proposed footprints of Phases II and III, respectively. Also, monitoring well MW-8 would be necessary to monitor the downgradient reach of Phase III. A plan to address these issues was presented to Mr. Bobby Lutfy of the Solid Waste Section prior to implementation. In July of 1999, ground-water monitoring wells MW-3 and MW-6 were abandoned (in accordance with proper well abandonment regulations) and replaced with monitoring wells MW-3R and MW-6R, and MW-8 was also installed. An amendment to the Revised Ground-Water Monitoring Plan of January 1996 was submitted to the Section on August 19, 1999. A copy of this amendment is attached to this submittal. Beginning with the fall 1999 semiannual sampling event and continuing at least until the initiation of permitting of Phase IV at the landfill, the ground-water monitoring plan for the subject site will consist of the following eight monitoring wells (MW-1R, MW-2R, MW-3R, MW-4R, MW-5R, MW-6R, MW-7, and MW-8). Keep in mind that the semiannual sampling of monitoring well MW-8 is not planned to begin until Phase III of the landfill is ready to receive waste.

We hope that this sequential summary of events leading up to the current Ground-Water Monitoring Plan at the Old Salisbury Road C&D Landfill will be helpful to the Section's review and approval of the pending Construction Permit Application for Phases II and III.

Mr. Tim Jewett, P.E.

October 8, 1999

Page 3

If you have any questions or comments concerning the information summarized in this letter or on the attachments, please do not hesitate to contact me at (704) 338-6832.

Sincerely,

HDR Engineering, Inc. of the Carolinas



John R. Isham, P.G.

Project Hydrogeologist

JRI/nct

Attachments: Ground-Water Monitoring Plan (S&ME, 1994)
Revised Ground-Water Monitoring Plan (HDR, 1996)
Supplemental Revisions to Revised Ground-Water Monitoring Plan (HDR, 1999)

cc: Edward L. Gibson, City of Winston-Salem (w/attachments)
Larry Rose, NCDENR Solid Waste Section (w/attachments)
Ellen Lorscheider, NCDENR Solid Waste Section (w/attachments)

SUPPLEMENTAL REVISIONS TO THE REVISED GROUND-WATER
MONITORING PLAN

HDR ENGINEERING, INC. OF THE CAROLINAS

AUGUST 1999

B-10



August 19, 1999

Mr. Bobby Lutfy, Hydrogeologist
North Carolina Department of Environment
and Natural Resources
Division of Solid Waste Management
Solid Waste Section
P. O. Box 27687
Raleigh, North Carolina 27611-7687

Re: Supplemental Revisions to Revised Ground-Water Monitoring Plan
Winston-Salem Construction and Demolition Landfill (#34-12)
Forsyth County, North Carolina
HDR Project No. 00162-090-018

Dear Mr. Lutfy:

HDR Engineering, Inc. of the Carolinas (HDR) is hereby submitting, on behalf of the City of Winston-Salem Utilities Division, the enclosed attachments to be incorporated into the existing Revised Ground-Water Monitoring Plan, dated January 1996.

In response to the permitting of Phases II and III at the landfill, two previously sampled ground-water monitoring wells (MW-3 and MW-6) were abandoned as a result of being inside the proposed areas being permitted (North Carolina abandonment records are attached). Two replacement ground-water monitoring wells (MW-3R and MW-6R) were installed in accordance with the locations approved by the Solid Waste Section. An additional ground-water monitoring well (MW-8) was also installed downgradient of the proposed Phase III area of the landfill. However, this monitoring well will not be monitored and sampled on a semiannual basis until this portion of the landfill begins to receive waste. The geologists logs and monitoring well construction record drawings for each of the newly installed monitoring wells are attached to this submittal. The enclosed site plan (Drawing C-5) shows the location of all abandoned, existing, and proposed ground-water monitoring wells at the Old Salisbury Road C&D Landfill. Future semiannual, detection monitoring of the landfill will include monitoring wells MW-1R (background), MW-2R, MW-3R, MW-4R, MW-5R, MW-6R, and MW-7 for Appendix I volatile organic compounds (VOCs) and the eight RCRA metals.

HDR Engineering, Inc.
of the Carolinas

Employee-owned

Suite 1400
128 S. Tryon Street
Charlotte, North Carolina
28202-5001

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704 338-6700
Fax
704 338-6760

Mr. Bobby Lutfy, Hydrogeologist

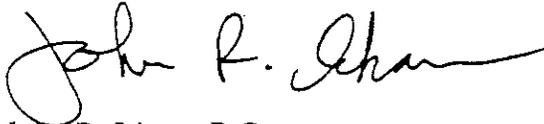
August 19, 1999

Page 2

If you have any questions or comments concerning the information summarized in this letter or on the attachments, please do not hesitate to contact me at (704) 338-6832.

Sincerely,

HDR Engineering, Inc. of the Carolinas



John R. Isham, P.G.

Project Hydrogeologist

JRI/nct

Attachments: Geologists Log B-3R (MW-3R)
Geologists Log B-6R (MW-6R)
Geologists Log B-8 (MW-8)
Well Abandonment Records (MW-3 and MW-6)
Existing and Proposed Ground-Water Monitoring Well Locations (C-5)

cc: Edward L. Gibson, City of Winston-Salem (w/attachments)
Mark Poindexter, NCDENR Solid Waste Section (w/Drawing C-5)
Larry Rose, NCDENR Solid Waste Section (w/attachments)
Tim Jewett, NCDENR Solid Waste Section (w/Drawing C-5)
Brock Turner, Forsyth County Health Department (w/attachments)

Project No: 00162-090-018

Project: Winston-Salem C&D Landfill

Client: City of Winston-Salem

Location: Old Salisbury Road

Geologist Log B-3R (MW-3R)

Ground Elevation: 772.9' MSL

Geologist: John R. Isham, PG.



SUBSURFACE PROFILE				SAMPLE										
Depth	Symbol	Description	Depth/Elev.	Number	Type	Blows/ft	Recovery	Shear Strength				Well Data	Remarks	
								20	40	60	80			
0		Ground Surface	0											
0		RESIDUUM	773											
1		Dark to medium brown, micaceous silty clayey sand, slightly plastic, slightly moist, organics mixed, rooted.	772											
3		CLAYEY SAND (SC)												
4		Orange-brown to tan, micaceous clayey sand, fine to medium-grained, some quartz granules, slightly plastic, moist.												
5														
6				1		8	40%							
7			7											
7			766											
8														
9														
10														
11		SANDY CLAY (CL)												
12		Gray, soft, plastic, micaceous, mottled with orange-brown iron oxide staining, medium to coarse-grained quartz grains, very moist.												
13														
14														
15														
16				2		5	40%							
17														
17			17.5											
18			755											
19														
20														

Portland Type I Cement with 3% Bentonite

3/8-inch Bentonite Chips

Old Creek Deposits

Granitic Saprolite

Drilled By: Engineering Tectonics, PA.

Drill Method: 4.25-inch ID HSA

Drill Date: July 7, 1999

HDR Engineering, Inc. of the Carolinas
 128 S. Tryon Street
 Suite 1400
 Charlotte, NC. 28202

Hole Size 8-inch Diameter

Top-of-Casing 776.6' MSL

Sheet: 1 of 2

Project No: 00162-090-018

Geologist Log B-3R (MW-3R)



Project: Winston-Salem C&D Landfill

Client: City of Winston-Salem

Ground Elevation: 772.9' MSL

Location: Old Salisbury Road

Geologist: John R. Isham, PG.

SUBSURFACE PROFILE			SAMPLE				SHEAR STRENGTH				Well Data	Remarks	
Depth	Symbol	Description	Depth/Elev.	Number	Type	Blows/ft	Recovery	blows/ft					
								20	40	60	80		
21		SILTY SAND (SM) Gray, white, and black, micaceous, medium-dense, fine to medium-grained, mottled with iron oxide staining, weak mineral alignment, very moist.		4		9	50%					2-inch Diameter SCH 40 PVC 0.010-inch Slots	
22													
23													
24													
25													
26				5		18	50%						
27			27										
28		End of Borehole	746										
29													
30													
31													
32													
33													
34													
35													
36													
37													
38													
39													
40													

Drilled By: Engineering Tectonics, PA.

HDR Engineering, Inc. of the Carolinas
 128 S. Tryon Street
 Suite 1400
 Charlotte, NC. 28202

Hole Size 8-inch Diameter

Drill Method: 4.25-inch ID HSA

Top-of-Casing 776.6' MSL

Drill Date: July 7, 1999

Sheet: 2 of 2

Project No: 00162-090-018

Geologist Log B-6R (MW-6R)



Project: Winston-Salem C&D Landfill

Client: City of Winston-Salem

Ground Elevation: 817.8' MSL

Location: Old Salisbury Road

Geologist: John R. Isham, PG.

SUBSURFACE PROFILE				SAMPLE				Shear Strength				Well Data	Remarks
Depth	Symbol	Description	Depth/Elev.	Number	Type	Blows/ft	Recovery	blows/ft					
								20	40	60	80		
0		Ground Surface	0										
0		RESIDUUM	818										
1		Tan to light brown sandy loam.											
2		SANDY SILT (ML)											
3		Orange-brown, micaceous, fine-grained quartz grains, dry.	3.5										
4			814										
5													
6				1		8	60%						
7													
8													
9													
10													
11				2		7	75%						
12		SILTY SAND (SM)											
13		Tan to yellow-brown, micaceous, fine to coarse-grained quartz grains, weak mineral alignment (horizontal), iron oxide staining, mottled, dry.											
14													
15													
16				3		8	75%						
17													
18													
19													
20													

Portland Type I Cement with 3% Bentonite

Drilled By: Engineering Tectonics, PA.

HDR Engineering, Inc. of the Carolinas
 128 S. Tryon Street
 Suite 1400
 Charlotte, NC. 28202

Hole Size 8-inch Diameter

Drill Method: 4.25-inch ID HSA

Top-of-Casing 820.4' MSL

Drill Date: July 8, 1999

Sheet: 1 of 3

Project No: 00162-090-018

Project: Winston-Salem C&D Landfill

Client: City of Winston-Salem

Location: Old Salisbury Road

Geologist Log B-6R (MW-6R)

Ground Elevation: 817.8' MSL

Geologist: John R. Isham, PG.



SUBSURFACE PROFILE			SAMPLE				Shear Strength				Well Data	Remarks	
Depth	Symbol	Description	Depth/Elev.	Number	Type	Blows/ft	Recovery	blows/ft					
								20	40	60	80		
21	[Symbol: Silty Sand]	SILTY SAND (SM) Tan to yellow-brown, micaceous, fine to coarse-grained quartz grains, weak mineral alignment (horizontal), iron oxide staining, mottled, dry.	23 795	4	[Symbol: Silty Sand]	12	80%	●				Granitic Saprolite	
22													
23	[Symbol: Silty Sand]	SILTY SAND (SM) Same as above, becoming mixed with partially weathered rock lenses, dry.	34 784	5	[Symbol: Silty Sand]	15	75%	●				Portland Type I Cement with 3% Bentonite	
24													
25													
26	[Symbol: Silty Sand w/ Gravel]	SILTY SAND w/ GRAVEL White, to light gray and tan, micaceous, mottled with iron oxide staining, fine to coarse-grained quartz, feldspar, mica, weak foliation as mineral alignment, dry.		6	[Symbol: Silty Sand w/ Gravel]	27	75%	●					
27													
28	[Symbol: Silty Sand w/ Gravel]			7	[Symbol: Silty Sand w/ Gravel]	48	85%	●					
29													
30													
31													
32													
33													
34													
35													
36													
37													
38													
39													
40													

Drilled By: Engineering Tectonics, PA.

Drill Method: 4.25-inch ID HSA

Drill Date: July 8, 1999

HDR Engineering, Inc. of the Carolinas
128 S. Tryon Street
Suite 1400
Charlotte, NC, 28202

Hole Size 8-inch Diameter

Top-of-Casing 820.4' MSL

Sheet: 2 of 3

Project No: 00162-090-018

Geologist Log B-6R (MW-6R)



Project: Winston-Salem C&D Landfill

Client: City of Winston-Salem

Ground Elevation: 817.8' MSL

Location: Old Salisbury Road

Geologist: John R. Isham, PG.

SUBSURFACE PROFILE				SAMPLE				Shear Strength				Well Data	Remarks	
Depth	Symbol	Description	Depth/Elev.	Number	Type	Blows/ft	Recovery	blows/ft						
								20	40	60	80			
41		SILTY SAND w/ GRAVEL White, to light gray and tan, micaceous, mottled with iron oxide staining, fine to coarse-grained quartz, feldspar, mica, weak foliation as mineral alignment, dry.		8		84	75%						3/8-inch Bentonite Chips #2 Silica Sand Pack	
42														
43														
44														
45				9		90	10%							
46														
47														
48			48										Partially Weathered Rock @ 48'	
49		PWR Gray, white and tan, micaceous granite saprolite with partially weathered rock lenses, fine to coarse-grained.	770											
50														
51			51	10		90	1%						Auger Refusal @ 51'	
52			767											
53		PWR As above, visual identification based on cuttings from air hammer drilling from 51 to 60'.											2-inch Diameter SCH 40 PVC 0.010-inch Slots	
54														
55														
56					11									
57														
58														
59														
60				60										
			758											

Drilled By: Engineering Tectonics, PA.

HDR Engineering, Inc. of the Carolinas
128 S. Tryon Street
Suite 1400
Charlotte, NC. 28202

Hole Size 8-inch Diameter

Drill Method: 4.25-inch ID HSA

Top-of-Casing 820.4' MSL

Drill Date: July 9, 1999

Sheet: 3 of 3

Project No: 00162-090-018

Geologist Log B-8 (MW-8)



Project: Winston-Salem C&D Landfill

Client: City of Winston-Salem

Ground Elevation: 759.8' MSL

Location: Old Salisbury Road

Geologist: John R. Isham, PG.

SUBSURFACE PROFILE				SAMPLE				Shear Strength			Well Data	Remarks	
Depth	Symbol	Description	Depth/Elev.	Number	Type	Blows/ft	Recovery	blows/ft					
								20	40	60	80		
0		Ground Surface	0										
0		TOPSOIL	760										
1		Brown silty sandy loam, rooted, organic-rich.	759										
2		SANDY SILT (ML) Tan to yellow-brown.											
4		CLAYEY SAND (SC) Yellow-brown to tan, micaceous, fine to coarse-grained quartz grains, mottled with iron oxide staining, very moist.		1	SC	24	80%						Portland Type I Cement with 3% Bentonite
8			752										3/8-inch Bentonite Chips
10		SANDY CLAY (CL) Gray and tan, fine to very coarse-grained quartz grains, iron oxide staining, no mica, plastic, sticky, very moist.		2	CL	12	75%						Old Creek Deposits 8-23.5'
14.5			745										2-inch Diameter SCH 40 PVC 0.010-inch Slots
16		CLAYEY SAND (SC) Tan to yellow-brown, slightly plastic, fine to coarse-grained quartz grains, no structure, very moist to wet.		3	SC	9	100%						
20													

Drilled By: Engineering Tectonics, PA.

HDR Engineering, Inc. of the Carolinas
128 S. Tryon Street
Suite 1400
Charlotte, NC. 28202

Hole Size 8-inch Diameter

Drill Method: 4.25-inch ID HSA

Top-of-Casing 752.5' MSL

Drill Date: July 7, 1999

Sheet: 1 of 2

Project No: 00162-090-018

Geologist Log B-8 (MW-8)



Project: Winston-Salem C&D Landfill

Client: City of Winston-Salem

Ground Elevation: 759.8' MSL

Location: Old Salisbury Road

Geologist: John R. Isnam, PG.

SUBSURFACE PROFILE				SAMPLE										
Depth	Symbol	Description	Depth/Elev.	Number	Type	Blows/ft	Recovery	Shear Strength				Well Data	Remarks	
								20	40	60	80			
21		CLAYEY GRAVEL (GM) Yellow-brown to tan, poorly graded, large angular quartz gravel, limonite staining, very wet.	21 739	4		14	100%						2-inch Diameter SCH 40 PVC 0.010-inch Slots	Granitic Saprolite @ 23.5'
22														
23		SILTY SAND (SM) Brown, white and tan, micaceous, fine to very coarse-grained quartz grains, weak horizontal mineral alignment, pegmatite zone at base, wet.	23.5 736	5		14	90%							
24														
25														
26														
27		End of Borehole	27 733											
28														
29														
30														
31														
32														
33														
34														
35														
36														
37														
38														
39														
40														

Drilled By: Engineering Tectonics, PA.

HDR Engineering, Inc. of the Carolinas
128 S. Tryon Street
Suite 1400
Charlotte, NC. 28202

Hole Size 8-inch Diameter

Drill Method: 4.25-inch ID HSA

Top-of-Casing 762.5' MSL

Drill Date: July 7, 1999

Sheet: 2 of 2

North Carolina
 Department of Natural Resources and Community Development
 Division of Environmental Management
 Groundwater Section
 P.O. Box 27687 - Raleigh, N.C. 27611

WELL ABANDONMENT RECORD

CONTRACTOR Engineering Tectonics, PA REG. NO. 835

1. WELL LOCATION: (Show a sketch of the location on back of form.)
 Nearest Town: Old Salisbury Road Landfill County Forsyth
Old Salisbury Road, Winston-Salem
 (Road, Community, Subdivision, Lot No.) Quadrangle No.

2. OWNER: City of Winston-Salem

3. ADDRESS: _____

4. TOPOGRAPHY : draw, slope, hilltop valley, flat

5. USE OF WELL: monitoring DATE: 7-9-99

6. TOTAL DEPTH: 39.0' DIAMETER: 2.0"

7. CASING REMOVED:

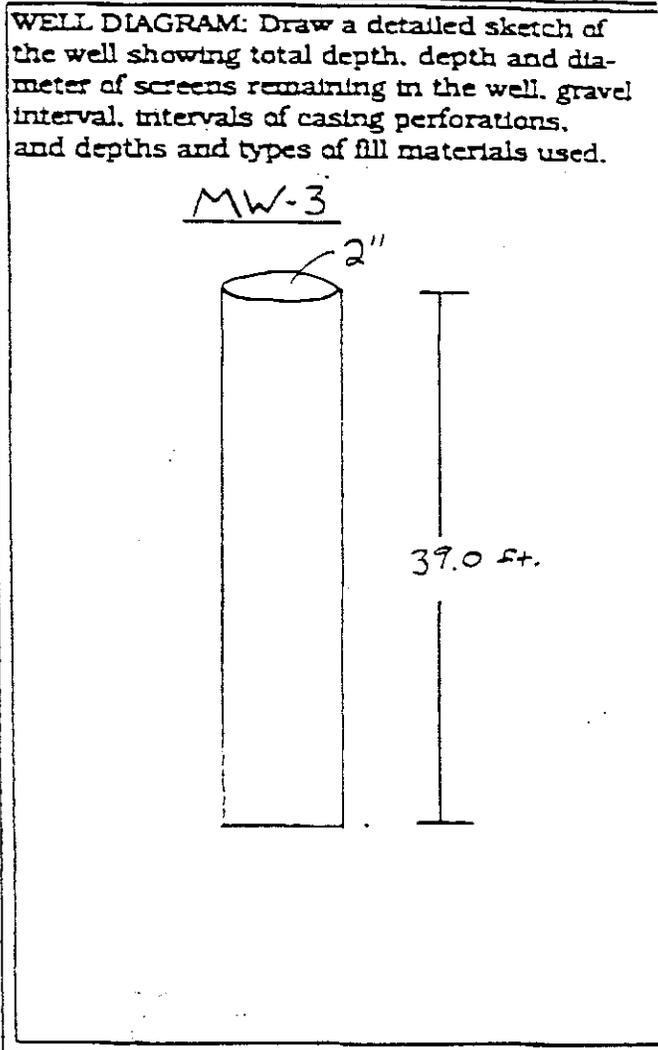
feet	diameter
_____	_____
_____	_____

8. SEALING MATERIAL:

<u>Neat cement</u>	<u>Sand cement</u>
bags of cement _____	bags of cement _____
gals. of water _____	yds. of sand _____
	gals. of water _____

Other
 Type material pumpable grout
 Amount 0.83 cubic feet

9. EXPLAIN METHOD EMPLACEMENT OF MATERIAL.
a grout pump



I do hereby certify that this well abandonment record is true and exact.

Signature of Contractor or Agent Mary Taylor Date 8-3-99

WELL LOCATION: Draw a location sketch on the reverse of this sheet, showing the direction and distance of the well to at least two (2) nearby reference points such as roads, intersections and streams. Identify roads with State Highway road identification numbers.

Submit original to the Division of Environmental Management, one copy to the Driller, and one copy to the owner.

North Carolina
 Department of Natural Resources and Community Development
 Division of Environmental Management
 Groundwater Section
 P.O. Box 27687 - Raleigh, N.C. 27611

WELL ABANDONMENT RECORD

CONTRACTOR Engineering Tectonics, PA

REG. NO. 835

1. WELL LOCATION: (Show a sketch of the location on back of form.)

Nearest Town: Old Salisbury Road Landfill County Forsyth

Old Salisbury Road, Winston-Salem

(Road, Community, Subdivision, Lot No.)

Quadrangle No.

2. OWNER: City of Winston-Salem

3. ADDRESS: _____

4. TOPOGRAPHY : draw, slope, hilltop, valley, flat

5. USE OF WELL: monitoring DATE: 7-9-99

6. TOTAL DEPTH: 59.0' DIAMETER: 2.0"

7. CASING REMOVED:

feet

diameter

8. SEALING MATERIAL:

Neat cement
bags of cement _____

Sand cement
bags of cement _____

gals. of water _____

yds. of sand _____

gals. of water _____

Other

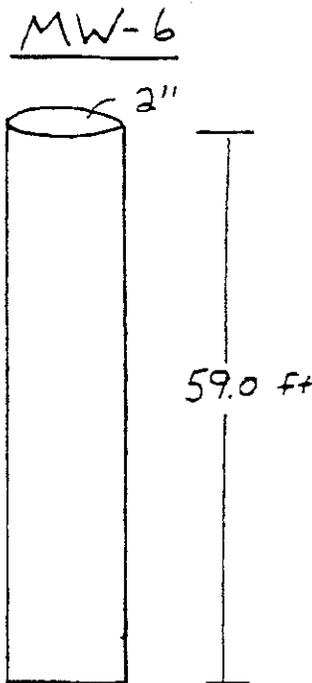
Type material pumpable grout

Amount 1.26 cubic feet

9. EXPLAIN METHOD EMPLACEMENT OF MATERIAL.

a grout pump

WELL DIAGRAM: Draw a detailed sketch of the well showing total depth, depth and diameter of screens remaining in the well, gravel interval, intervals of casing perforations, and depths and types of fill materials used.



I do hereby certify that this well abandonment record is true and exact.

Signature of Contractor or Agent

Mark Taylor

Date

8-3-99

WELL LOCATION: Draw a location sketch on the reverse of this sheet, showing the direction and distance of the well to at least two (2) nearby reference points such as roads, intersections and streams. Identify roads with State Highway road identification numbers.

Submit original to the Division of Environmental Management, one copy to the Driller, and one copy to the owner.

REVISED GROUND-WATER MONITORING PLAN
HDR ENGINEERING, INC. OF NORTH CAROLINA
JANUARY 1996

**WINSTON-SALEM CONSTRUCTION
AND DEMOLITION DEBRIS LANDFILL**

**OLD SALISBURY ROAD (SR 3011)
WINSTON-SALEM, NORTH CAROLINA**

REVISED GROUND-WATER MONITORING PLAN

Conducted for:

**Winston-Salem/Forsyth County Utilities Commission
North Carolina**

Prepared by:

HDR Engineering, Inc. of North Carolina

HDR

Project No. 00162-082-018

January 1996



FORWARD

The existing Ground-water Monitoring Plan for the proposed Winston-Salem Construction and Demolition Debris Landfill (C&D) was prepared by S&ME, Inc. in December, 1994. This document provides the basic foundation of this Revised Ground-Water Monitoring Plan.

An amendment (updated analytical parameters list) to this plan was made by HDR in June of 1995 in response to a memorandum from the Solid Waste Section in Raleigh to the Solid Waste Section in the Winston-Salem Regional Office of the North Carolina Department of Environment, Health and Natural Resources (NCDEHNR). A copy of this memorandum and final amendment has been attached to this document as Appendix A.

In response to a letter dated September 27, 1995 from the Solid Waste Section (Raleigh), additional revisions to the existing Ground-Water Monitoring Plan were warranted as a result of the replacement (and additional installation) of several of the existing on-site detection monitoring wells. Well replacements for existing wells for MW-1, MW-2, MW-4, and MW-5 were installed between December 27 and 29, 1996, in addition to the installation of two new wells (MW-6 and MW-7). Soil boring and monitoring well construction records for each of the newly installed (and existing) monitoring wells for the detection monitoring system have been included as Appendix B. The monitoring wells being replaced were effectively sealed in accordance with state abandonment procedures. In addition, a 24-inch diameter, bored water well was also abandoned. Well abandonment records are included in Appendix C of this document.

Appendix D of this document contains a scaled base map showing the location of the existing detection monitoring well locations along with the water table potentiometric surface contours for the C&D landfill based on water level data collected during the initial "background" sampling of the wells.

GROUNDWATER MONITORING PLAN
PROPOSED CONSTRUCTION AND DEMOLITION DEBRIS LANDFILL
FORSYTH COUNTY, NORTH CAROLINA
S&ME PROJECT NO. 1584-93-143B

Prepared For:

Winston-Salem/Forsyth County Utilities Commission
102 West Third Street, Suite 460
Winston-Salem, North Carolina 27102

Prepared By:

S&ME, Inc.
3718 Old Battleground Road
Greensboro, North Carolina 27410

December 1994



December 2, 1994

Winston-Salem/Forsyth County Utilities Commission
102 West Third Street, Suite 460
Winston-Salem, North Carolina 27102

Attention: Mr. Dan Miles

Reference: **GROUNDWATER MONITORING PLAN**
Proposed Construction and Demolition Debris Landfill
Forsyth County, North Carolina
S&ME Project No. 1584-93-143B

Dear Mr. Miles:

S&ME, Inc. (S&ME) has completed the authorized Groundwater Monitoring Plan (ref. S&ME proposal no. 1584-94-P113) for the proposed construction and demolition debris landfill in Forsyth County. The enclosed Groundwater Monitoring Plan was completed in accordance with North Carolina Solid Waste Management Rules (15A NCAC 13B). If you have any questions regarding the contents of the Groundwater Monitoring Plan or if we may be of further service to you, please call either of the undersigned at (910) 288-7180.

Sincerely,

S&ME, Inc.


Wayne H. Waterson, P.E.
Senior Engineer
N.C. Registration No. 19243


Scott D. Berg
Project Manager

WHW/SDB/mjf

Enclosures

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TABLES

Table 1	Groundwater Elevation Measurements
Table 2	Constituents For Detection Monitoring

1.0 INTRODUCTION

This Groundwater Monitoring Plan is presented to provide a detection monitoring program for a proposed construction and demolition debris (C&D) landfill scheduled to be constructed off Old Salisbury Road in southern Forsyth County, North Carolina.

The Groundwater Monitoring Plan includes the procedures outlined by the North Carolina Department of Environment, Health and Natural Resources, Division of Solid Waste Management (Division) for a groundwater monitoring plan at a newly constructed C&D landfill. The information in this plan is designed to assist the Division, the landfill operations personnel and its agents in the evaluation of future groundwater quality at the landfill cell. Monitor well locations, monitor well construction, monitor well installation procedures, monitor well development, sampling frequency, monitor well sampling procedures, laboratory considerations, evaluation of groundwater monitoring data, and recordkeeping and reporting requirements are included in the Groundwater Monitoring Plan. Monitor well sampling and analytical procedures will be performed in accordance with the Division's rules and policies.

S&ME completed a Geologic and Hydrological Report (S&ME Project No. 1581-93-052) for the proposed C&D landfill in June, 1994. Twenty-six soil borings were performed for the Geologic and Hydrological Report. Permanent groundwater monitor wells were installed at several of the soil boring locations. One of the monitor wells (B-3/MW-1) completed for the Geologic and Hydrological Report has been incorporated into the Groundwater Monitoring Plan and will serve as an upgradient groundwater monitoring point. Four additional groundwater monitor wells will be installed to serve as downgradient groundwater monitoring points.

2.0 PURPOSE

The Groundwater Monitoring Plan is designed for the purpose of detecting a release of hazardous constituents from the C&D landfill into the uppermost aquifer at a relevant point of compliance in order to protect human health and the environment. The Groundwater Monitoring Plan has been completed in accordance with Division policy and includes relevant information presented in Title 15A of the North Carolina Administrative Code (NCAC) Subchapter 13B Section .1604 and Sections .1630 through .1633. The Division policy for groundwater monitoring at C&D landfills as stated by Mr. Bobby Lutfy, Hydrogeologist, Solid Waste Section, requires a minimum of one upgradient and three downgradient groundwater monitoring points. Statistical analyses of groundwater monitoring data is not required.

3.0 GEOLOGIC CHARACTERISTICS

3.1 PHYSIOGRAPHY

The site planned for development of the C&D landfill is comprised of two contiguous tracts, a 29 acre tract and a 108.24 acre tract. The smaller tract is near the intersection of Old Salisbury Road and Friedberg Road. This tract will not be developed with the exception of an access road along its northern limits. Access to the proposed landfill site will be from Old Salisbury Road. In the southern portion of the 108.24 acre tract, a 10.3 acre cell is planned for development.

The southernmost boundary of the cell is parallel to the Forsyth/Davidson County line.

Site elevations generally range from a high of 840 feet above mean sea level in the southeastern portion of the site to a low of 725 feet above mean sea level near the northernmost section of the site. Surface drainage at the subject site is primarily controlled by a north-northwesterly trending ridge within the property. Surface runoff is directed northeast, west and southwest into tributaries of South Fork Muddy Creek. The majority of surface runoff within this site is directed to South Fork Muddy Creek on the north. A small area in the extreme southeasterly section of the site appears to drain south into Miller Creek. Both the South Fork Muddy Creek and Miller Creek flow to the west where they converge with Muddy Creek. Muddy Creek flows to the south and converges with the Yadkin River.

3.2 REGIONAL HYDROLOGY

Ridges and hilltops are generally water-table divides in addition to being surface-water divides. The majority of ridges and hilltops in the region are composed of rocks that were

poorly fractured during the immediate past stage of weathering and erosion. Upland slopes, like the ridges and hilltops, are central recharge areas to the upper aquifer. Draws, or upland topographic lows, are normally underlain by permeable fracture zones and may be discharge areas, where groundwater discharges at the ground surface. Alignment of some draws and surface drainage systems suggest fracture alignment. However, much of the surface drainage pattern is dendritic and not related to rock structures (LeGrand, 1988).

3.3 SITE GEOLOGY AND HYDROGEOLOGY

3.3.1 Site Geology

According to the Geologic Map of North Carolina dated 1985, the subject site is in the Charlotte belt of the Piedmont Physiographic Province. This Province contains metamorphic and igneous plutonic rock which in some areas have been extensively weathered and eroded forming an undulating and well-dissected topography. The area is underlain by intrusive granite rock which is commonly megacrystic to equigranular in texture.

The bedrock is typically fractured and is overlain by highly weathered bedrock called saprolite. The saprolite varies in thickness from a few feet near bedrock outcrops to over 100 feet. The saprolitic material retains some of the original (relict) structural features of the parent rock. The nearer surface residual soils are formed by the in-place physical and chemical weathering of the saprolite and usually do not retain the relict structural features.

Subsurface conditions as indicated by the Geologic and Hydrological Report (S&ME, Inc., 1994) generally consist of a veneer of topsoil underlain by residual soils, saprolite, partially

weathered rock, and fractured rock. There is generally a gradual transition from one material type to the next with varying thickness of each. Generally, the depth to rock in the area of the proposed cell is greater than 35 feet below land surface.

3.3.2 Hydrogeology

In the Piedmont Physiographic Province, groundwater is present within the openings created by fractures and joints within the bedrock and within the pore spaces of the overlying saprolite. The saprolite/bedrock aquifers are primarily recharged by precipitation in the interstream areas which infiltrates through the unsaturated zone to the water table. The depth to ground water is deeper beneath uplands than beneath valleys. The water table is commonly close to the top of bedrock and is more often than not, located within the saprolite. The seasonal fluctuation of the water table generally ranges between 1 foot and 6 feet. Groundwater moves laterally and downward through the saprolite and bedrock toward streams, springs and other surface water bodies (discharge areas) to streams in the adjacent valleys and to bedrock fractures. The water table surface is generally a subdued reflection of the surface topography.

3.3.2.1 Hydraulic Conductivity

Soil permeability values were determined for the Geologic and Hydrological Report from field testing using a rising head (slug) test. The results of rising head field permeability tests performed in the rock indicated hydraulic conductivities in the range of 9.41×10^{-5} cm/sec. to 1.92×10^{-4} cm/sec. The field rising head permeability tests performed in partially weathered rock indicated hydraulic conductivity values ranging between 2.19×10^{-4} and 7.5×10^{-4} cm/sec.

3.3.2.2 Hydraulic Gradient

The horizontal hydraulic gradient in the area of the proposed landfill cell ranges from 0.033 foot per foot to 0.1 foot per foot (Geologic and Hydrological Report, S&ME, Inc., 1994). Based on the hydraulic conductivity values of the partially weathered rock and an assumed effective porosity of 0.20, the groundwater flow rate at the site ranges from 0.10 to 1.1 feet per day (37 to 390 feet per year).

4.0 GROUNDWATER MONITOR PLAN

4.1 MONITOR WELL LOCATIONS

At a minimum, one upgradient and three downgradient groundwater monitor wells are required in a Groundwater Monitoring Plan for a C&D landfill. However, the plan must include a sufficient number of wells to adequately measure groundwater quality upgradient of the landfill cell and at a relevant point of compliance downgradient of the landfill cell. Monitor wells should not be placed greater than 250 feet from the landfill cell boundary or within 50 feet of a property boundary.

Monitor well locations for the Groundwater Monitoring Plan are based on review of the Potentiometric Map completed for the Geologic and Hydrological Report.

Based on data contained in the Geologic and Hydrological Report, the area east of the proposed landfill cell is upgradient. The general direction of groundwater flow from the landfill cell is to the north toward an unnamed tributary of South Fork Muddy Creek and to the south and west to an unnamed intermittent tributary of South Fork Muddy Creek.

Groundwater elevations were measured in October, 1994 to verify that seasonal change in groundwater flow direction were not encountered (see Table 1).

One upgradient monitor well (B-3/MW-1) has been installed during the acquisition of data for the Geologic and Hydrological Report. Four downgradient monitor wells (MW-2, MW-3, MW-4 and MW-5) will also be installed. These four monitor well locations were selected to determine groundwater quality downgradient from the landfill cell and are each located within 200 feet of the cell boundary.

4.2 MONITOR WELL CONSTRUCTION

The four downgradient monitor wells will be constructed of 2-inch PVC schedule 40 flush-joint threaded casing and 0.010-inch slotted screen. All joints will be water-tight. Well construction materials will be shipped in factory sealed containers. The four monitor wells to be constructed for the Groundwater Monitoring Plan will be constructed and installed according to the requirements of Title 15A NCAC 2C. Generalized details for the construction of monitor wells are shown on the Well Schematic included in the Appendix. The four additional monitor wells will have a screened interval of at least 10 feet. A Well Log for monitor well B-3/MW-1 is included in the Appendix.

A geologist/engineer will be present during the installation of the new monitor wells to record the lithology and document well construction details. The screen interval at each well will be set at a depth which intersects the water table throughout the seasonal fluctuations of water levels.

4.3 MONITOR WELL INSTALLATION PROCEDURES

Boreholes drilled for well installation and the monitor well construction will be performed by a licensed drilling contractor. All equipment used for drilling and completion of the wells will be properly cleaned before and after monitor well installation utilizing high pressure steam. Boreholes will be advanced using hollow-stem rotary augers. Once the boreholes are drilled, the monitor well construction will be completed using the following criteria.

1. The four additional monitor wells will be located at the site by a licensed surveyor.

2. The well screen and casing will be lowered through the hollow-stem augers. The annular space between the borehole wall and the well screen will be backfilled with clean, washed sand. The sand will consist of clean sand properly sized to formation material. The sand pack will extend at least 1 foot but no more than 2 feet above the well screen. The hollow-stem augers will be incrementally withdrawn while the filter pack is placed. The sand pack level will be frequently sounded and kept at the base of the augers until the desired length of sand pack is in place.
3. A 2-foot pelletized bentonite seal will be placed above the sand pack and allowed to hydrate. The augers will be withdrawn to above the top of the bentonite pellets prior to allowing the bentonite pellet seal to hydrate. Adequate time shall be provided for the hydration of the bentonite seal prior to grouting the annular space of the wells.
4. The remainder of the annular space will be filled with a neat cement grout from the top of the bentonite seal to the ground surface. The grout will be slowly pumped into a tremmie pipe at a constant rate to fill the annular space. The tremmie pipe will be slowly raised along with the augers to allow for an evenly distributed placement. After grouting, no work will be performed at the wells for a minimum of 24 hours to allow the grout to set.
5. A 6-inch diameter, steel protective casing with a locking cap will be placed over the well's riser pipe and into the grout seal. The protective casing will extend from about 2 feet below the ground surface to slightly above the well casing top. The protective casing will be primed, painted, and provided with a permanently affixed name plate.

6. A 6-inch thick concrete pad, which slopes away from the well in all directions, will be constructed to serve as anchorage and will prevent surface water from migrating along the wall of the casing.
7. The location, installation method and construction details of the four additional wells may be modified, according to site specific conditions. The modifications must be approved by the Division prior to the construction of any monitor well by techniques other than those described herein.

Monitor well elevations will be surveyed by a licensed surveyor after installation. The top of casing and ground surface elevation of each monitor well will be recorded.

4.4 MONITOR WELL DEVELOPMENT

The four downgradient monitor wells will be developed in order to remove clay, silt, sand and other fines that may have been introduced into the well or sand pack during drilling and well installation. Monitor well B-3/MW-1 will also be developed. Well development will be continued until the suspended solids are removed from the well and turbidity is minimized. The wells will be developed by removing water from the well with a decontaminated Teflon bailer or a pneumatic purge pump to facilitate hydraulic communication with the aquifer.

4.5 SAMPLING FREQUENCY

Each monitor well included in the Groundwater Monitoring Plan will be sampled semi-annually. The first semi-annual sampling event will be performed after construction of the landfill cell and prior to its use to establish background groundwater quality.

4.6 MONITOR WELL SAMPLING

The primary concern during the collection of groundwater samples is to obtain a representative groundwater sample from the near surface aquifer. Decontaminated Teflon bailers will be used for monitor well purging and sampling. One equipment blank will be collected during each sampling event by filling a decontaminated bailer with deionized water. The water will then be transferred to laboratory prepared containers labeled for the corresponding laboratory analysis to be performed. After filling, the containers will be placed into a precleaned cooler containing ice.

4.6.1 Groundwater Measurements

Prior to monitor well sampling, the depth to water and the total well depth will be measured in each monitor well from the top of the PVC casing to calculate the amount of water within the well casing. The depth to water will be measured with a decontaminated electronic water level indicator. The measurements will be made to the nearest 0.01 foot. The volume of water in the well will then be calculated and recorded, along with the static water level.

4.6.2 Monitor Well Purging

Five well casing volumes of water will be purged from the monitor wells prior to sampling, unless the wells are purged to dryness. The monitor wells will be purged utilizing laboratory decontaminated Teflon bailers. Field measurements of pH, specific conductance and temperature will be recorded after purging to evaluate the removal of the stagnant water from the monitor well.

4.6.3 Sample Collection

After purging, a groundwater sample will be collected from each monitor well by slowly lowering the Teflon bailer into the well to minimize the potential for volatilization. Samples will be collected from the upper portion of the water column. Samples will be transferred to laboratory prepared containers labeled for the corresponding laboratory analyses. Samples to be analyzed for organic constituents will be collected first followed by samples to be analyzed for inorganic constituents. Preservatives will be added as necessary (in accordance with EPA Method SW-846 protocol) to the sample bottles prior to field operations or by the laboratory prior to shipment. Care will be taken to prevent the bailer from contacting the sample bottle during sample collection. After filling, the sample bottles will be securely placed into a precleaned cooler containing ice. A chain of custody form will be initiated. The Chain of Custody will include the sample number, the sample collector's signature, the date and time of sample collection, the sample type, the number of containers, signature of person(s) in the chain of possession, inclusive dates of possession, and temperature of shipping container upon opening in the laboratory. Each monitor well will be secured after sample collection.

Samples will be shipped to the lab within 1 day of sample collection by courier. Samples will be shipped in a cooler containing ice to maintain a sample temperature at or below 4 degrees celsius. The Chain of Custody form will accompany sample shipment inside the cooler.

4.7 LABORATORY CONSIDERATIONS

4.7.1 Laboratory Qualifications

Sample analyses will be performed by a North Carolina certified/qualified laboratory using EPA methods acceptable to the Division.

4.7.2 Laboratory Procedures

Each groundwater sample will be analyzed for the constituents listed in 40 CFR Part 258 Appendix I (see Table 2) using EPA methods acceptable to the Division. The laboratory reports will contain the referenced methodologies, the constituent concentrations, the method detection limits, QA/QC data, and corresponding Chain of Custody forms.

4.8 EVALUATION OF GROUNDWATER MONITORING DATA

The laboratory analyses included in the Groundwater Monitoring Plan are based on the Detection Monitoring Program requirements outlined in Title 15A NCAC Subchapter 13B Section .1633. Background groundwater quality will be established in the surficial aquifer by performing one sampling event prior to placement of waste into the landfill cell. Semi-annual monitoring will subsequently be used to evaluate the quality of groundwater at the C&D landfill cell. The evaluation of groundwater quality will be based on the North Carolina Groundwater Classifications and Standards as defined in Title 15A NCAC Subchapter 2L Section .0202 and on the results of the initial (background) sampling event which will be completed before the placement of materials into the landfill cell.

4.9 RECORDKEEPING AND REPORTING REQUIREMENTS

All field and laboratory data will be maintained on file during the active life of the landfill and during the post-closure period. The sample collector will maintain a field log to record all pertinent information regarding the purging and sampling of the monitor wells. The information to be recorded will include the following.

1. Collectors name, date and time,
2. Site name and location,
3. Well identification,
4. Well depth,
5. Depth to water measured from top of casing,
6. Well casing inside diameter,
7. Well volume (the amount of water occupying the casing prior to purging),
8. Time that purging was initiated and completed,
9. Reason for sampling,
10. Sample pH, temperatures and specific conductivity,
11. Sample volume, containers, preservatives,
12. Sample observations, color, turbidity,
13. Analyses to be performed on each sample,
14. Weather conditions at the time of sampling,
15. Additional comments.

A report will be submitted to the Division within 30 days of receipt of the results of the laboratory analyses. The report will include an outline of the field procedures used, the results of the laboratory analyses, QA/QC documentation, chain of custody, analytical methods, and groundwater analyte concentrations. If the laboratory test data reports an analyte concentration above the background concentration, the Division will be notified in writing by the operator within 14 days of receipt of the results of the laboratory analyses.

TABLE 1
GROUNDWATER ELEVATION MEASUREMENTS
PROPOSED C&D LANDFILL
FORSYTH COUNTY, NORTH CAROLINA
S&ME PROJECT NO. 1584-93-143B

Boring Number	Date Drilled	Elevation Ground Surface	Elevation Bottom of Boring	Groundwater Elevation 04/14/94	Groundwater Elevation 05/04/94	Groundwater Elevation 10/06/94
B-1	12/29	841.25	794.15	NM	NM	Dry
B-2	12/30	838.66	787.46	NM	NM	Dry
B-3	03/23	833.67	783.77	796.90	797.02	796.55
B-4	04/04	822.85	774.25	Dry	Dry	Dry
B-5	03/30	818.45	769.45	777.12	777.21	776.67
B-6	03/24	824.46	774.46	777.46	777.42	777.12
B-7	03/30	814.61	764.61	773.50	773.69	772.97
B-8	03/31	791.64	742.84	761.59	761.60	759.76
B-9	03/31	820.98	772.08	774.10	774.15	773.59
B-12	03/31	826.93	778.33	780.46	780.56	780.07
B-13	03/31	814.05	779.05	783.95	784.12	783.08
B-14	04/04	804.22	755.62	787.59	787.70	787.60
B-15A	03/24	780.93	735.93	772.13	772.19	771.35
B-16A	03/28	762.17	717.17	751.42	751.17	749.13
B-16B	03/28	761.07	732.07	752.34	751.70	750.95
B-17	04/11	762.19	713.49	756.99	756.99	754.12
B-22	03/30	817.34	768.74	Dry	Dry	Dry
B-23	04/07	811.68	763.08	777.59	777.94	777.21

NM - Not Measured

See Figure 2 for boring locations

TABLE 2
 CONSTITUENTS FOR DETECTION MONITORING
 PROPOSED C&D LANDFILL
 FORSYTH COUNTY, NORTH CAROLINA
 S&ME PROJECT NO. 1584-93-143B

Inorganic Constituents:

Antimony
 Arsenic
 Barium
 Beryllium
 Cadmium
 Chromium
 Cobalt
 Copper

Lead
 Mercury
 Nickel
 Selenium
 Silver
 Thallium
 Vanadium
 Zinc

Organic Constituents:

Acetone
 Acrylonitrile
 Benzene
 Bromochloromethane
 Bromodichloromethane
 Bromoform
 Carbon disulfide
 Carbon tetrachloride
 Chlorobenzene
 Chloroethane
 Chloroform
 Dibromochloromethane
 1,2-Dibromo-3-chloropropane
 1,2-Dibromoethane
 o-Dichlorobenzene
 p-Dichlorobenzene
 trans-1,4-Dichloro-2-butene
 1,1-Dichloroethane
 1,2-Dichloroethane
 1,1-Dichloroethylene
 cis-1,2-Dichloroethylene
 trans-1,2-Dichloroethylene
 1,2-Dichloroethylene
 cis-1,3-Dichloropropene

trans-1,3-Dichloropropene
 Ethylbenzene
 2-Hexanone
 Methyl bromide
 Methyl chloride
 Methylene bromide
 Methylene chloride
 Methyl ethyl ketone
 Methyl iodide
 4-Methyl-2-pentanone
 Styrene
 1,1,1,2-Tetrachloroethane
 1,1,2,2-Tetrachloroethane
 Tetrachloroethylene
 Toluene
 1,1,1-Trichloroethane
 1,1,2-Trichloroethane
 Trichloroethylene
 Trichlorofluoromethane
 1,2,3-Trichloropropane
 Vinyl acetate
 Vinyl chloride
 Xylenes

APPENDIX A

INITIAL AMENDMENT TO GROUND-WATER MONITORING PLAN

June 26, 1995

HDR

Ms. Jan McHargue, P.E.
NCDEHNR
Solid Waste Section
585 Waughtown Street
Winston-Salem, NC 27107-2241

Re: - Proposed Construction and Demolition Landfill
Winston-Salem, North Carolina
Response to Comments from Jim Bateson, dated April 27, 1995
HDR-Project No. 00162-082-018

Dear Ms. McHargue:

This letter is provided in response to the memorandum to you from Jim Bateson, dated April 27, 1995. The comments have been retyped in *italics*, with the responses following. Per our previous discussions, please insert this response letter behind the tab entitled "Exhibit 4 - Review Comments and Responses." Some of the information attached herewith should replace previously submitted material. These items are referenced in the responses below.

NCDEHNR April 27, 1995. Comments

1. *Section .0504(1)(a) of 15A NCAC 13B requires two versions of the quarter-mile map: one, a photographic version similar to the one already submitted, and another blueline version with topographic contours. The current photographic version was printed with the mylar reversed left to right. On both versions, the following need to be specifically marked:*

A corrected and updated aerial photograph is included herewith. Take out the existing aerial photograph and replace with the attached aerial photograph. Also, a topographic version of the quarter-mile map has been prepared and is included herewith.

ii) *land use and zoning*

Land use and zoning classifications have been shown or noted on both versions of the quarter-mile map.

HDR Engineering, Inc.
of North Carolina
of North Carolina

Suite 1400
128 S. Tryon Street
Charlotte, North Carolina
28202-5001

Telephone
704 338-1800
Fax
704 338-6760

- iii) *utilities; power lines and the public water supply lines need to be shown and labeled.*

Utilities, power lines, and public water lines have been located and shown or noted on both versions.

- iv) *Location of all wells within the quarter-mile radius. For those areas substantially further than 500 feet away from the proposed waste boundaries, a note in the margin of the map, stating that residences may have private wells, will suffice. For those lots adjacent to the site, the exact location of all wells needs to be shown on the map. If private wells are located on the back parts of any of those lots, the 500-foot buffer needs to be measured from the wells, and not the residences. The waste boundaries may then require adjustment. If the operators or their consultants do not wish to locate all of the nearby wells, they have the option of locating the waste boundaries 500 feet from the edges of the adjacent residential properties.*

The City has recently sent letters to all area residences requesting that information regarding private drinking water wells be returned to the Utility Department. While all responses have not been received, two residents located on June Lane (Little, 5635 June Lane; and Bertini, 5665 June Lane) have indicated that they do have residential wells. Both residents are connected to public water supply, and city staff has verified that the well at 5665 June Lane is inactive. City staff will follow up as other responses are received from the area residents.

The 500-foot buffer line adjacent to June Lane has been relocated based on the location of the two known drinking water wells. This shift was approximately 40 feet. Based on the minimal number of homes which could influence the 500-foot buffer line by the existence of a drinking water well, it is anticipated that no future adjustment to the buffer line will be required. When all responses have been received from the area residents, further correspondence will be transmitted to the section.

- v) *margins of flood plains.*

From an obtained flood insurance map, pertinent floodplains are shown on both versions of the quarter-mile map.

2. *On the two-mile map, if none of the items (i) through (iv) occur within the radius, then this needs to be noted specifically for each in the margin of the map.*

The two-mile radius map has been updated and is included herewith. Remove the existing two-mile map and replace it with the conformed two-mile map attached.

Items (i) through (iv) have been researched and noted on the conformed two-mile map.

3. *In section 8.8 of the Site Plan Report, the reference to a 100-foot buffer between disposal areas and property lines needs to be changed to 200 feet.*

Remove pages eleven and twelve which include section 8.8 and replace with the revised pages attached.

The 100-foot buffer was modified in the text.

4. *Grading limits will need to be raised in the easternmost part of the proposed footprint, near soil boring B-3. Base grades needs to be at least four feet above long-term seasonable high ground water levels, estimated by S&ME to be six feet above the February 1995 levels contoured in the recently submitted potentiometric surface map. Although the February 1995 readings were lower, in some cases, than previous readings; and therefore, do not represent the seasonable high, the Section feels that the six feet of additional vertical separation meant to account for long-term variation of the seasonable high is generous enough to account, as well, for some uncertainty in the seasonal high for this year.*

Base grade changes will be redesigned, as necessary, and the updated design will be submitted in the Construction Plan Application.

5. *In the monitoring plan, the list of constituents to be analyzed needs to be changed. Sampling and Analysis Requirements for Construction and Demolition Landfills, recently revised by the Solid Waste Section, is attached.*

Remove Table 2 in the monitoring plan of Exhibit 3 and replace with revised list of constituents attached.

Table 2 - list of constituents was revised with the new list obtained from the Solid Waste Section.

6. *The Solid Waste Section issues permits for landfill units designed to contain a maximum of five years of projected fill. The monitoring system needs to be designed to monitor the first five-year cell. If Phase I of the proposed landfill is intended to accommodate five years of fill, then volume estimates for that period need to be included in the application.*

Phase I is intended to accommodate approximately five years of fill. Two of the groundwater monitoring wells currently in place may conflict with the revised base grade

plan prepared for the Construction Plan Application. The revisions proposed for the groundwater monitoring plan will be further addressed in the Construction Plan.

7. *The proposed monitoring plan needs to be revised to reflect the currently proposed footprint, rather than the rectangular conceptual footprint shown on S&ME's plan sheets. Proposed waste boundaries need to be clearly marked on the monitoring plan. The revised version of the monitoring plan may be submitted with the construction plan application.*

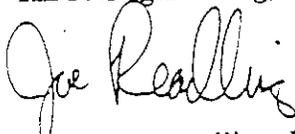
The revised groundwater monitoring plan will be submitted with the Construction Plan Application.

Other Attached Information

1. The City of Winston-Salem has created a response to all C & D written comments received as of June 8, 1995. The attached response should be placed in Exhibit 4 of the Site Plan Application.
2. S & ME of Greensboro has compiled a temporary monitor well abandonment report for the C & D Site (per comment No. 5 by Jim Bateson in December 19, 1994, memorandum to Jan McHargue). The attached report should be placed in Exhibit 4 of the Site Plan Application.

Sincerely,

HDR Engineering, Inc. of North Carolina



Joseph C. Readling, P.E.
Project Manager

JCR/nct

List of Attachments: Revised 1/4-Mile Aerial Photograph
New 1/4-Mile Topographic Map
Revised 2-Mile Regional Map
Revised Pages 11 and 12 of Site Plan Report
Revised List of Monitoring Plan Constituents
New City of Winston-Salem Response
New Temporary Well Abandonment Report

TABLE 2
 CONSTITUENTS FOR DETECTION MONITORING
 PROPOSED C&D LANDFILL
 FORSYTH COUNTY, NORTH CAROLINA
 S&ME PROJECT NO. 1584-93-143B

Inorganic Constituents:

Antimony	Lead
Arsenic	Mercury
Barium	Nickel
Beryllium	Selenium
Cadmium	Silver
Chromium	Thallium
Cobalt	Vanadium
Copper	Zinc

Organic Constituents:

Acetone	trans-1,3-Dichloropropene
Acrylonitrile	Ethylbenzene
Benzene	2-Hexanone
Bromochloromethane	Methyl bromide
Bromodichloromethane	Methyl chloride
Bromoform	Methylene bromide
Carbon disulfide	Methylene chloride
Carbon tetrachloride	Methyl ethyl ketone
Chlorobenzene	Methyl iodide
Chloroethane	4-Methyl-2-pentanone
Chloroform	Styrene
Dibromochloromethane	1,1,1,2-Tetrachloroethane
1,2-Dibromo-3-chloropropane	1,1,2,2-Tetrachloroethane
1,2-Dibromoethane	Tetrachloroethylene
o-Dichlorobenzene	Toluene
p-Dichlorobenzene	1,1,1-Trichloroethane
trans-1,4-Dichloro-2-butene	1,1,2-Trichloroethane
1,1-Dichloroethane	Trichloroethylene
1,2-Dichloroethane	Trichlorofluoromethane
1,1-Dichloroethylene	1,2,3-Trichloropropane
cis-1,2-Dichloroethylene	Vinyl acetate
trans-1,2-Dichloroethylene	Vinyl chloride
1,2-Dichloroethylene	Xylenes
cis-1,3-Dichloropropene	

APPENDIX B

EXISTING DETECTION MONITORING WELL CONSTRUCTION AND SOIL
BORING RECORDS

LOCATION: OLD SALISBURY ROAD

BORING NUMBER: MW-1R

PAGE: 1 OF 2

BORING LOG

DATE: 12/27/95

NUMBER	DEPTH	SPT	T	WL	SI	DESCRIPTION (USCS)	COMMENTS
	4'					REDDISH-BROWN TO TAN, FIRM SANDY CLAY (CL), SLIGHTLY PLASTIC, RELICT GRANITIC TEXTURE, QUARTZ, FELDSPAR, BIOTITE, IRON OXIDATION, DRY	GRANITIC SAPROLITE
SS-1		7	SS				
	8'						
SS-2		NA	SS				
	12'						
SS-3		NA	SS				
	20'						
SS-4		NA	SS			SAME AS ABOVE, SLIGHT MOISTURE IN PLACES, SOFT, MANGANESE OXIDE STAINING	
	24'						
SS-5		NA	SS			SIMILAR TO ABOVE, MOIST CLAYEY ZONES, LARGE QUARTZ/FELDSPAR FRAGMENTS, SOFT, GRANITIC TEXTURE	
	28'						
SS-6		NA	SS			LIGHT BROWN TO TAN CLAYEY SAND (SC), SLIGHTLY STICKY, MEDIUM TO COARSE GRAINED, IRON OXIDES, VERY MOIST, QUARTZ/FELDSPAR RICH	
	32'						
SS-7		NA	SS			LIGHT BROWN TO TAN SANDY SILTY CLAY, (CL), MOIST, SOFT, SLIGHTLY PLASTIC, LESS RELICT GRANITIC TEXTURE, FINER GRAINED	
	36'						
	40'						



BOREHOLE COMPLETION: 60 FT. BELOW LAND SURFACE

WATER DEPTH: 38.77 FT. BELOW TOC

DATE: 1/3/96

DRILLING METHOD: 4 1/4-INCH HOLLOW STEM AUGER

LOGGED BY: J. ISHAM

- KEY:**
- SI - SCREEN
 - SS - SPLITSPOON
 - SPT - SOIL PENETRATION TEST-N NUMBER
 - ST - SHELBY TUBE
 - T - TYPE
 - WL - WATER LEVEL



LOCATION: OLD SALISBURY ROAD

BORING NUMBER: MW-1R

PAGE: 2 OF 2

BORING LOG

DATE: 12/27/95

NUMBER	DEPTH	SPT	T	WL	SI	DESCRIPTION (USCS)	COMMENTS
SS-8		NA	SS			SAME AS ABOVE, VERY MOIST, LAST 2" IS WHITE MOTTLED WEATHERED GRANITIC SAPROLITE WITH VERY PREDOMINANT TEXTURE	GRANITIC SAPROLITE
	44'						
	48'						
	52'						
	56'						
	60'					TD = 60 FT.	
	64'						
	68'						
	72'						
	76'						
	80'						

BOREHOLE COMPLETION: 60 FT. BELOW LAND SURFACE

WATER DEPTH: 38.77 FT. BELOW TOC

DATE: 1/3/96

DRILLING METHOD: 4 1/4-INCH HOLLOW STEM AUGER

LOGGED BY: J. ISHAM

KEY:

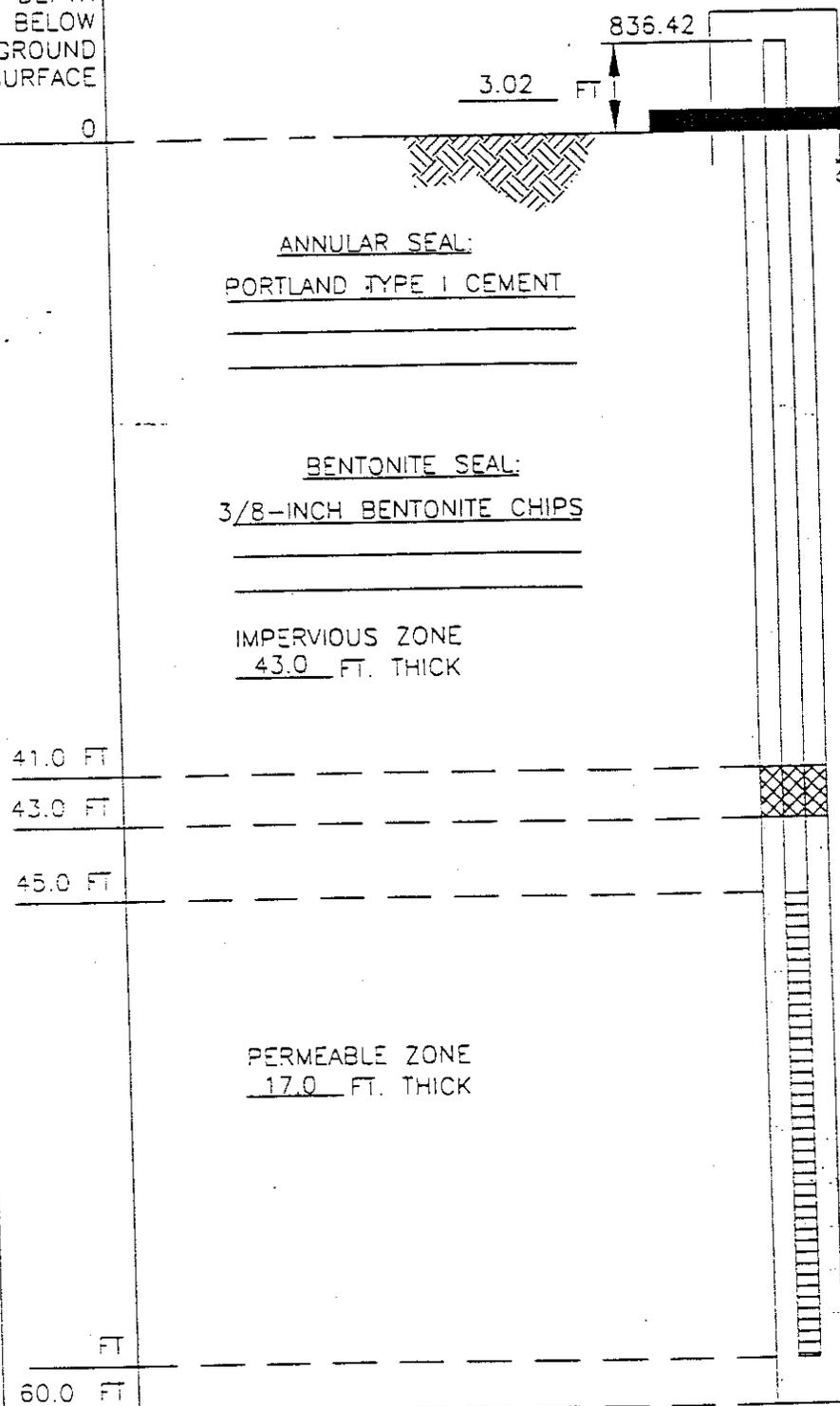
- SI - SCREEN
- SS - SPLITSPOON
- SPT - SOIL PENETRATION TEST-N NUMBER
- ST - SHELBY TUBE
- T - TYPE
- WL - WATER LEVEL



MONITORING WELL INSTALLATION DIAGRAM

LOCATION: WINSTON-SALEM C&D
 WELL NO.: MW-1R
 BORING NO.: _____
 JOB NO.: 00162-082-018
 PREPARED BY: J. ISHAM
 CHECKED BY: _____
 DATE: 12/27/95

DEPTH
BELOW
GROUND
SURFACE



EL. 833.4 FT.
 TOP OF GROUND
 SURFACE

ANNULAR SEAL:
PORTLAND TYPE 1 CEMENT

BENTONITE SEAL:
3/8-INCH BENTONITE CHIPS

IMPERVIOUS ZONE
43.0 FT. THICK

PERMEABLE ZONE
17.0 FT. THICK

PROTECTIVE METAL CASING
4-INCH SQUARE SILVER
STEEL BOX WITH LOCKING
LID

RISER PIPE: SCHEDULE 40
 ID: 2" OD: _____
 COUPLINGS: THREADED
 PIPE IN 10.0 FT. LENGTHS
 PIPE 1-8.0 FT
 PIPE 4-10.0 FT
 SCREEN 15.0 FT
 SLOT SIZE 0.010 IN

TOTAL: 63.0 FT

THICKNESS OF
UPPER SEAL 2.0 FT

LENGTH OF SCREEN 15.0 FT

SAND 17.0 FT

BOTTOM OF BORING

FT
 60.0 FT

REMARKS: ALL MEASUREMENTS TO THE NEAREST 0.1 FT.

HDR

HDR Engineering, Inc.

FILE NAME: MONITOR

FOR OFFICE USE ONLY	
QUAD. NO. _____	SERIAL NO. _____
Lat. _____ Long. _____	RO _____
Minor Basin _____	
Basin Code _____	
Header Ent. _____	GW-1 Ent. _____

WELL CONSTRUCTION RECORD

LING CONTRACTOR: Geologic Exploration, Inc.

DRILLER REGISTRATION NUMBER: 1175 STATE WELL CONSTRUCTION PERMIT NUMBER: _____

1. WELL LOCATION: (Show sketch of the location below)

Nearest Town: Winston Salem County: Forsyth

Friedberg Lane

(Road, Community, or Subdivision and Lot No.)

2. OWNER City of Winston Salem Utilities Division

ADDRESS PO Box 2511

(Street or Route No.)

Winston Salem

NC

27102

City or Town

State

Zip Code

3. DATE DRILLED 12-27-95 USE OF WELL monitor

4. TOTAL DEPTH 60.0' ft.

5. CUTTINGS COLLECTED YES NO

6. DOES WELL REPLACE EXISTING WELL? YES NO

7. STATIC WATER LEVEL Below Top of Casing: 3.0 FT.

(Use "-" if Above Top of Casing)

8. TOP OF CASING IS 3.0 FT. Above Land Surface*

* Casing Terminated at/or below land surface is illegal unless a variance is issued in accordance with 15A NCAC 2C .0118

9. YIELD (gpm): N/A METHOD OF TEST N/A

10. WATER ZONES (depth): N/A

CHLORINATION: Type N/A Amount N/A

If additional space is needed use back of form

CASING:

LOCATION SKETCH

(Show direction and distance from at least two State Roads, or other map reference points)

Depth	Diameter	Wall Thickness or Weight/Ft	Material
From <u>0.0</u> To <u>45.0</u> Ft.	<u>2 inch</u>	<u>Sch. 40</u>	<u>PVC</u>
From _____ To _____ Ft.	_____	_____	_____
From _____ To _____ Ft.	_____	_____	_____

13. GROUT:

Depth	Material	Method
From <u>0.0</u> To <u>41.0</u> Ft.	<u>Portland Bentonite Slurry</u>	_____
From _____ To _____ Ft.	_____	_____

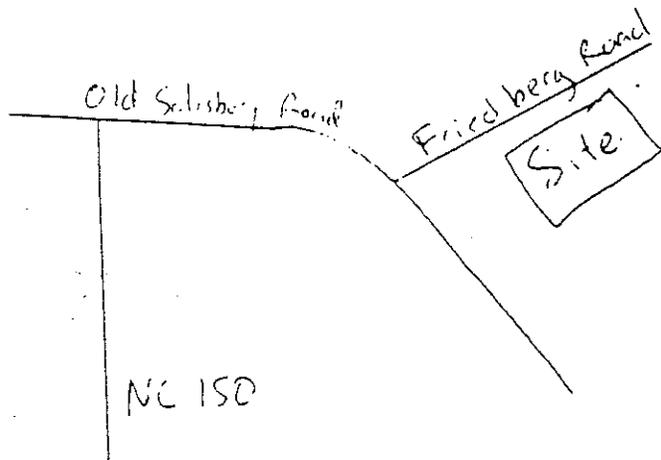
14. SCREEN:

Depth	Diameter	Slot Size	Material
From <u>45.0</u> To <u>60.0</u> Ft.	<u>2</u> in.	<u>.010</u> in.	<u>PVC</u>
From _____ To _____ Ft.	_____ in.	_____ in.	_____
From _____ To _____ Ft.	_____ in.	_____ in.	_____

15. SAND/GRAVEL PACK:

Depth	Size	Material
From <u>43.0</u> To <u>60.0</u> Ft.	<u>20-40</u>	<u>Fine Silica Sand</u>
From _____ To _____ Ft.	_____	_____

16. REMARKS: MW-1R Bentonite seal from 41.0 to 43.0 feet.



I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C. WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Alan J. J.

12-28-95

SIGNATURE OF CONTRACTOR OR AGENT

DATE

LOCATION: OLD SALISBURY ROAD

BORING NUMBER: MW-2R

PAGE: 1 OF 1

BORING LOG

DATE: 12/29/95

NUMBER	DEPTH	SPT	T	WL	SI	DESCRIPTION (USCS)	COMMENTS
						RED, VERY SOFT, MICACEOUS CLAY (CL) WITH SAND, PLASTIC, VERY MOIST	FILL MATERIAL
SS-1	4'	2	SS			LIGHT BROWN TO TAN, VERY LOOSE, SLIGHTLY CLAYEY SAND (SC), MEDIUM TO FINE GRAINED QUARTZ, STRUCTURELESS, VERY MOIST, ORGANIC MATTER	ALLUVIAL DEPOSITS (?)
	8'					LIGHT GRAY TO DARK BROWN/BLACK, VERY DENSE, SILTY SAND (SM) MEDIUM TO FINE GRAINED, HEAVY IRON AND MANGANESE OXIDE STAINING, MICACEOUS, QUARTZ, FELDSPAR, BRITTLE, DRY	GRANITIC SAPROLITE
SS-2	12'	50+	SS			PARTIALLY WEATHERED ROCK AND SAPROLITE (SILTY SAND), QUARTZ, FELDSPAR, BIOTITE, BRITTLE, HARD, DRY	
SS-3	16'	50+	SS			PARTIALLY WEATHERED ROCK	AUGAR REFUSAL
	20'						
	24'					TD = 23 FT.	
	28'						
	32'						
	36'						
	40'						



BOREHOLE COMPLETION: 23 FT. BELOW LAND SURFACE

WATER DEPTH: 11.41 FT. BELOW TOC

DATE: 1/3/96

DRILLING METHOD: 4 1/4-INCH HOLLOW STEM AUGER

LOGGED BY: J. ISHAM

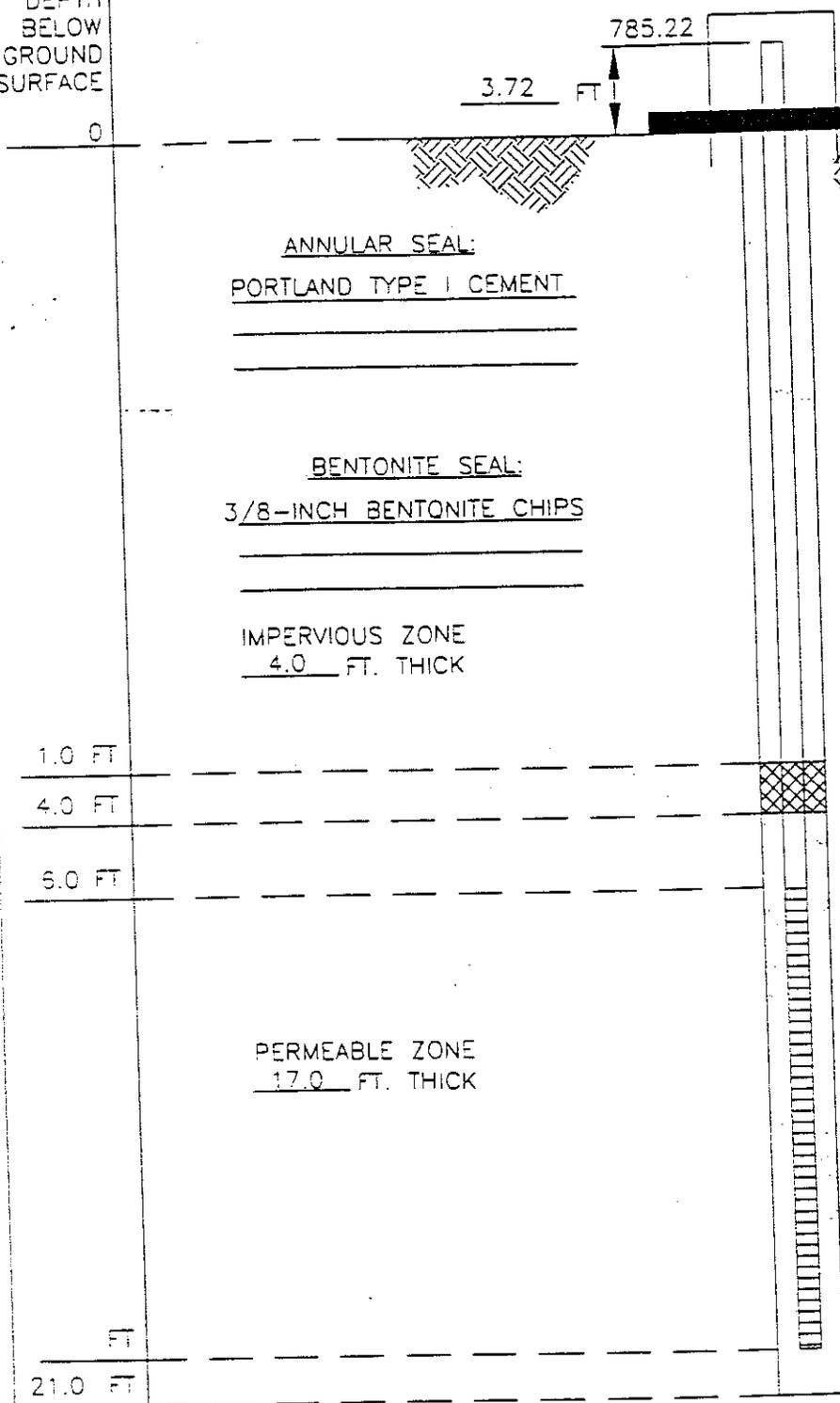
- KEY:
- SI - SCREEN
 - SS - SPLITSPOON
 - SPT - SOIL PENETRATION TEST-NUMBER
 - ST - SHELBY TUBE
 - T - TYPE
 - WL - WATER LEVEL



MONITORING WELL INSTALLATION DIAGRAM

LOCATION: WINSTON-SALEM C&O
 WELL NO.: MW-2R
 BORING NO.: _____
 JOB NO.: 00162-082-018
 PREPARED BY: J. ISHAM
 CHECKED BY: _____
 DATE: 12/29/95

DEPTH
BELOW
GROUND
SURFACE



EL 781.50 FT.
TOP OF GROUND
SURFACE

ANNULAR SEAL:
PORTLAND TYPE I CEMENT

BENTONITE SEAL:
3/8-INCH BENTONITE CHIPS

IMPERVIOUS ZONE
4.0 FT. THICK

PERMEABLE ZONE
17.0 FT. THICK

PROTECTIVE METAL CASING
4-INCH SQUARE BLACK
STEEL BOX WITH LOCKING
LID

RISER PIPE: SCHEDULE 40
 ID: 2 OD: _____
 COUPLINGS: THREADED
 PIPE IN 10.0 FT. LENGTHS
 PIPE _____ FT
 PIPE 1-9.0 FT
 SCREEN 15.0 FT
 SLOT SIZE 0.010 IN
 TOTAL: 24.0 FT

THICKNESS OF
UPPER SEAL 3.0 FT

LENGTH OF SCREEN 15.0 FT

SAND 17.0 FT

BOTTOM OF BORING

1.0 FT

4.0 FT

6.0 FT

21.0 FT

REMARKS: ALL MEASUREMENTS TO THE NEAREST 0.1 FT.

HDR

HDR Engineering, Inc.

FILE NAME: MONITOR

PROJECT: Construction & Demolition Debris Landfill Forsyth County		WELL LOG		MW-3
PROJECT NO.: 1584-93-1430	ELEVATION: 807.0	NOTES:		
LOGGED BY: Butler	BORING DEPTH: 43.5 FEET			
DATE DRILLED: 02/10/95	WATER LEVEL: 38.1			
DRILLING METHOD: 4 1/4" HSA	DRILL RIG: B-59 ATV			

DEPTH (ft)	GRAPHIC LOG	Description & Remarks	SAMPLE NUMBER	SAMPLE	QVM (ppm)	SPR	ELEV.	WELL DIAGRAM
5		Residuum-Firm orange brown slightly micaceous medium to fine SANDY SILT				6.0	802.0	<p>2" PVC Schedule 40 Casing</p> <p>2" PVC Schedule 40 Screen, 0.010" Slot</p> <p>Cement Grout</p> <p>Bentonite Seal</p> <p>Fine Filter Sand</p>
10		Stiff orange, white gray micaceous coarse to fine SANDY SILT				10.0	797.0	
15		Stiff to hard white gray coarse to fine very SANDY SILT				14.0	792.0	
20						21.0	787.0	
25						39.0	782.0	
30		PARTIALLY WEATHERED ROCK sampled as white gray coarse to fine very sandy silt with small rock fragments.				50/2	777.0	
35		PARTIALLY WEATHERED ROCK sampled as white gray silty coarse to fine sand				50/4	772.0	
40						50/4	787.0	
45		Boring Terminated					782.0	

Quad. No. _____ Serial No. _____
 Lat. _____ Long. _____ Pc _____
 Minor Basin _____
 Basin Code _____
 Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD

MW-3

CONTRACTOR Groundwater Protection, Inc.
 REGISTERED NUMBER 1105

STATE WELL CONSTRUCTION PERMIT NUMBER: NA

WELL LOCATION (Show sketch of the location below)
 Nearest Town Winston-Salem, North Carolina
Friedburg Road
 Road, Community, or Subdivision and LDI No.)
 OWNER Winston-Salem/Forsyth County Utilities Comm.
 ADDRESS 102 West Third Street, Suite 460
Winston-Salem, North Carolina 27102
(Street or Route No.)
 City or Town State Zip Code

County: Forsyth

DATE DRILLED February 10, 1995 USE OF WELL MONITOR
 TOTAL DEPTH 43.5 CUTTINGS COLLECTED Yes No
 DOES WELL REPLACE EXISTING WELL? Yes No
 STATIC WATER LEVEL: 36.1 FT. above TOP OF CASING.
 below
 TOP OF CASING IS 3.1 FT. ABOVE LAND SURFACE.
 TDS (ppm) NA METHOD OF TEST _____
 WATER ZONES (depth) NA
 CONTAMINATION: Type NA Amount _____

Depth		DRILLING LOG
From	To	Formation Description
0-6		Orange Brown Slightly Micaceous Medium To Fine Sandy Silt
6-13		Orange, White Gray Micaceous Coarse to Fine Sandy Silt
13-27		White Gray Coarse To Fine Very Sandy Silt
27-32		Partially Weathered Rock As White Gray Coarse To Fine Very Sandy Silt with Small Rock Fragments
32-43.5		Partially Weathered Rock As White Gray Silty Coarse To Fine Sand

If additional space is needed use back of form.

CASING

From	To	Depth	Diameter	Wall Thickness or Weight/Ft.	Material
0	31.5	31.5	2"	SCH 40	PVC
31.5	41.5	41.5	2"	SCH 40	PVC

GROUT

From	To	Depth	Material	Method
0	25.5	25.5	PORTLAND	TREMMIE

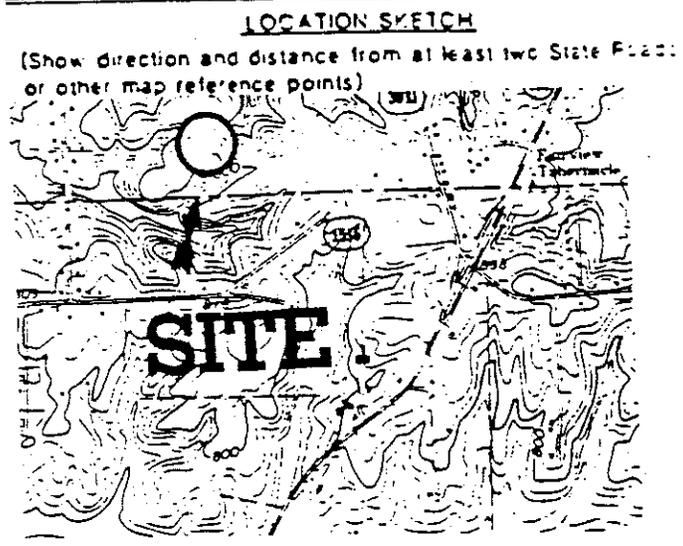
SCREEN

From	To	Depth	Diameter	Slot Size	Material
31.5	41.0	41.0	2"	.010 in.	PVC

GRAVEL PACK

From	To	Depth	Size	Material
27.5	43.5	43.5	FINE FILTER SAND	SAND

ARMS Bentonite Seal From 25.5 to 27.5 Feet Below Ground Surface



I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C. WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CONTRACTOR OR AGENT [Signature] DATE 04-03-95

PROJECT: WINSTON-SALEM C & D LANDFILL

PROJECT NO: 00162-082-018

LOCATION: OLD SALISBURY ROAD

BORING NUMBER: MW-4R

PAGE: 1 OF 1

BORING LOG

DATE: 12/28/95

NUMBER	DEPTH	SPT	T	WL	SI	DESCRIPTION (USCS)	COMMENTS
							
SS-1	4'	9	SS			GRAY, LOOSE, CLAYEY SAND (SC), MEDIUM TO COARSE GRAINED, SOFT, PLASTIC, IRON OXIDE STAINING, TRACE OF ORGANIC MATTER, WET	ALLUVIAL DEPOSITS (?)
	8'					LT. TAN, MEDIUM DENSE CLAYEY SAND (SC), WET, SOFT, MINOR IRON OXIDATION, MEDIUM TO COARSE QUARTZ SAND	
SS-2		12	SS				GRANITIC SAPROLITE
	12'						
SS-3		50+	SS			LIGHT GRAY TO WHITE, VERY DENSE CLAYEY SILTY SAND (SM), MEDIUM TO FINE GRAINED, QUARTZ, FELDSPAR, BIOTITE MICA, MOIST, BRITTLE, IRON OXIDATION	
	16'						
	20'						
	24'						
	28'						
	32'						
	36'						
	40'						
						TD = 20 FT.	



BOREHOLE COMPLETION: 20 FT. BELOW LAND SURFACE

WATER DEPTH: 10.06 FT. BELOW TOC

DATE: 1/3/96

DRILLING METHOD: 4 1/4-INCH HOLLOW STEM AUGER

LOGGED BY: J. ISHAM

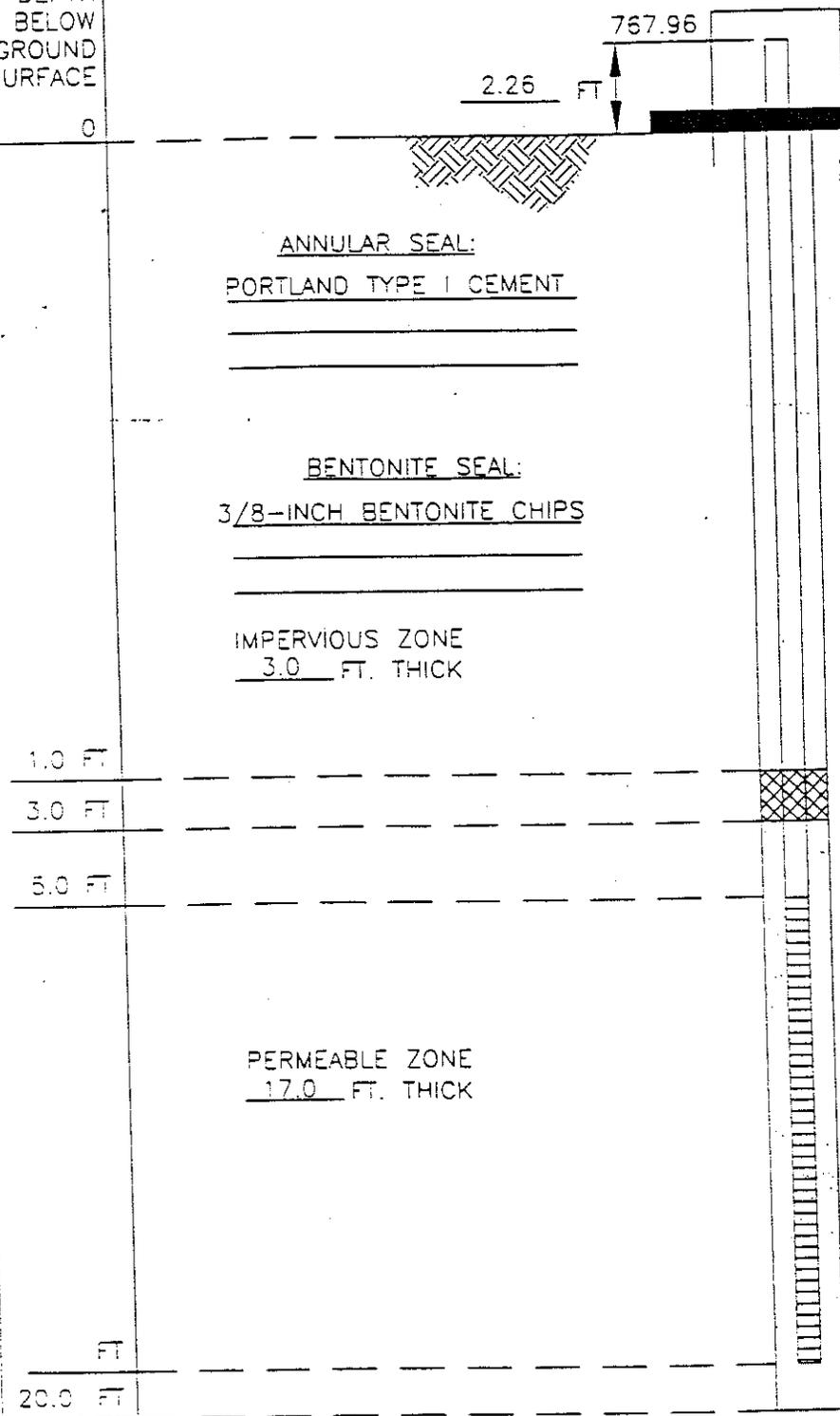
- KEY:
- SI - SCREEN
 - SS - SPLITSPOON
 - SPT - SOIL PENETRATION TEST-NUMBER
 - ST - SHELBY TUBE
 - T - TYPE
 - WL - WATER LEVEL



MONITORING WELL INSTALLATION DIAGRAM

LOCATION: WINSTON-SALEM C&D
 WELL NO.: MW-4R
 BORING NO.: _____
 JOB NO.: 00162-082-018
 PREPARED BY: J. ISHAM
 CHECKED BY: _____
 DATE: 12/28/95

DEPTH
BELOW
GROUND
SURFACE



EL. 765.70 FT.
 TOP OF GROUND
 SURFACE

ANNULAR SEAL:
PORTLAND TYPE I CEMENT

BENTONITE SEAL:
3/8-INCH BENTONITE CHIPS

IMPERVIOUS ZONE
3.0 FT. THICK

PERMEABLE ZONE
17.0 FT. THICK

PROTECTIVE METAL CASING
4-INCH SQUARE BLACK
STEEL BOX WITH LOCKING
LID

RISER PIPE: SCHEDULE 40
 ID: 2" OD: _____
 COUPLINGS: THREADED
 PIPE IN 10.0 FT. LENGTHS
 PIPE 1-7.5 FT
 PIPE _____ FT
 SCREEN 15.0 FT
 SLOT SIZE 0.010 IN

TOTAL: 22.5 FT

THICKNESS OF
 UPPER SEAL 2.0 FT

LENGTH OF SCREEN 15.0 FT

SAND 17.0 FT

BOTTOM OF BORING

1.0 FT
 3.0 FT
 5.0 FT
 _____ FT
 20.0 FT

REMARKS: ALL MEASUREMENTS TO THE NEAREST 0.1 FT.

HDR

HDR Engineering, Inc.

FILE NAME: MONITOR

BORING LOG

DATE: 12/29/95

NUMBER	DEPTH	SPT	T	WL	SI	DESCRIPTION (USCS)	COMMENTS
						LIGHT BROWN TO REDDISH-TAN, FIRM SANDY CLAY (CL), SLIGHTLY PLASTIC, MOIST, ABUNDANT IRON OXIDATION, ORGANIC MATTER, QUARTZ AND FELDSPAR GRAINS (MEDIUM TO FINE GRAINED)	ALLUVIAL DEPOSITS(?)
SS-1	4'	8	SS				
	8'					TAN TO BROWN AND WHITE, VERY DENSE SILTY SAND (SM), GRANITIC SAPROLITE, MEDIUM TO COARSE GRAINED, FELDSPAR-RICH, ABUNDANT QUARTZ, DRY, IRON OXIDATION BANDING, BRITTLE	GRANITIC SAPROLITE
SS-2	8'	50+	SS				
	12'					REDDISH-BROWN TO TAN, VERY DENSE CLAYEY SAND (SC), MEDIUM TO COARSE GRAINED, HEAVY IRON OXIDATION, MOTTUNG, QUARTZ, FELDSPAR, MOIST	
SS-3	12'	50+	SS				
	16'						
SS-4	20'	50+	SS			SAME AS ABOVE, DRY	
	24'						
SS-5	24'	50+	SS			SAME AS ABOVE, WET	
	28'						
	32'					TD = 30 FT.	
	36'						 AT DRILLING  24 HR
	40'						

BOREHOLE COMPLETION: 30 FT. BELOW LAND SURFACE

WATER DEPTH: 12.39 FT. BELOW TOC

DATE: 1/3/96

DRILLING METHOD: 4 1/4-INCH HOLLOW STEM AUGER

LOGGED BY: J. ISHAM

KEY:
SI - SCREEN
SS - SPLITSPOON
SPT - SOIL PENETRATION TEST - NUMBER
ST - SHELBY TUBE
T - TYPE
WL - WATER LEVEL



MONITORING WELL INSTALLATION DIAGRAM

LOCATION: WINSTON-SALEM C&D
 WELL NO.: MW-5R
 BORING NO.: _____
 JOB NO.: 0C162-082-C1S
 PREPARED BY: J. ISHAM
 CHECKED BY: _____
 DATE: 12/29/95

DEPTH
BELOW
GROUND
SURFACE
0

784.36

2.06 FT

EL. 782.30 FT.
TOP OF GROUND
SURFACE

ANNULAR SEAL:
PORTLAND TYPE I CEMENT

PROTECTIVE METAL CASING
4-INCH SQUARE BLACK
STEEL BOX WITH LOCKING
LID

BENTONITE SEAL:
3/8-INCH BENTONITE CHIPS

RISER PIPE: SCHEDULE 40
ID: 2" OD: _____
COUPLINGS: THREADED
PIPE IN 10.0 FT. LENGTHS
PIPE 1-7.5 FT
PIPE 1-10.0 FT
SCREEN 15.0 FT
SLOT SIZE 0.010 IN

IMPERVIOUS ZONE
13.0 FT. THICK

TOTAL: 32.5 FT

11.0 FT

13.0 FT

15.0 FT

THICKNESS OF
UPPER SEAL 2.0 FT

LENGTH OF SCREEN 15.0 FT

PERMEABLE ZONE
17.0 FT. THICK

SAND 17.0 FT

FT

30.0 FT

BOTTOM OF BORING

HDR

REMARKS: ALL MEASUREMENTS TO THE NEAREST 0.1 FT.

HDR Engineering, Inc.

FILE NAME: MONITOR

LOCATION: OLD SALISBURY ROAD

BORING NUMBER: MW-6

PAGE: 1 OF 2

BORING LOG

DATE: 12/27/95

NUMBER	DEPTH	SPT	T	WL	SI	DESCRIPTION (USCS)	COMMENTS
	4'					RED, MICACEOUS, FIRM CLAY (CL) WITH MINOR SAND, PLASTIC, MOIST, NO RELICT STRUCTURES	CLAY SOIL HORIZON
SS-1		9	SS				
	8'					LIGHT YELLOW-BROWN TO WHITE SILTY SAND (SM), FINE TO COARSE GRAINED, DRY, GRANITIC TEXTURE SAME AS ABOVE, MANGANESE OXIDE STAINING, DRY, BRITTLE, QUARTZ, BIOTITE, FELDSPAR GRAINS, MEDIUM TO FINE GRAINED LIGHT BROWN TO TAN, MEDIUM DENSE SILTY SAND (SM), SOFT, DRY, MICACEOUS, IRON OXIDE STAINING, MEDIUM TO FINE GRAINED LIGHT BROWN TO MOTTLED WHITE, MEDIUM DENSE SILTY SAND (SM), ABUNDANT FELDSPAR, DRY, IRON AND MANGANESE OXIDE STAINING, MEDIUM TO FINE GRAINED LIGHT BROWN TO TAN, MEDIUM DENSE SILTY SAND (SM), MICACEOUS, SOFT, BIOTITE, QUARTZ, FELDSPAR GRAINS, DRY SAME AS ABOVE, DRY	GRANITIC SAPROLITE
SS-2		11	SS				
	12'						
SS-3		10	SS				
	20'						
SS-4		13	SS				
	24'						
SS-5		15	SS				
	28'						
SS-6		13	SS				
	32'						
SS-7		12	SS				
	40'						



BOREHOLE COMPLETION: 60 FT. BELOW LAND SURFACE

WATER DEPTH: 49.90 FT. BELOW TOC

DATE: 1/3/96

DRILLING METHOD: 4 1/4-INCH HOLLOW STEM AUGER

LOGGED BY: J. ISHAM

- KEY:**
- SI - SCREEN
 - SS - SPLITSPOON
 - SPT - SOIL PENETRATION TEST-NUMBER
 - ST - SHELBY TUBE
 - T - TYPE
 - WL - WATER LEVEL



LOCATION: OLD SALISBURY ROAD

BORING NUMBER: MW-6

PAGE: 2 OF 2

BORING LOG

DATE: 12/27/95

NUMBER	DEPTH	SPT	T	WL	SI	DESCRIPTION (USCS)	COMMENTS		
SS-8	44'	10	SS			LIGHT BROWN TO TAN, LOOSE SILTY SAND (SM), MOIST, MEDIUM TO COARSE GRAINED, QUARTZ, BIOTITE, FELDSPAR ABUNDANT, STICKY, SOFT	GRANITIC SAPROLITE		
SS-9	48'	8	SS			SAME AS ABOVE, WET, SOFT			
SS-10	52'	9	SS			SAME AS ABOVE, WET, SOFT			
SS-11	56'	9	SS			SAME AS ABOVE, WET, SOFT, PRONOUNCED GRANITIC (PHANERITIC) TEXTURE			
	60'								TD = 60 FT.
	64'								
	68'								
	72'								
	76'								
	80'								



BOREHOLE COMPLETION: 60 FT. BELOW LAND SURFACE

WATER DEPTH: 49.90 FT. BELOW TOC

DATE: 1/3/96

DRILLING METHOD: 4 1/4-INCH HOLLOW STEM AUGER

LOGGED BY: J. ISHAM

- KEY:**
- SI - SCREEN
 - SS - SPLITSPOON
 - SPT - SOIL PENETRATION TEST-NUMBER
 - ST - SHELBY TUBE
 - T - TYPE
 - WL - WATER LEVEL



MONITORING WELL INSTALLATION DIAGRAM

LOCATION: WINSTON-SALEM C&D
 WELL NO.: MW-6
 BORING NO.: _____
 JOB NO.: 00162-082-018
 PREPARED BY: J. ISHAM
 CHECKED BY: _____
 DATE: 12/27/95

DEPTH
BELOW
GROUND
SURFACE

0

2.54 FT 825.24

EL 822.70 FT.
TOP OF GROUND
SURFACE

ANNULAR SEAL:
PORTLAND TYPE I CEMENT

PROTECTIVE METAL CASING
4-INCH SQUARE BLACK
STEEL BOX WITH LOCKING
LID

BENTONITE SEAL:
3/8-INCH BENTONITE CHIPS

RISER PIPE: SCHEDULE 40
ID: 2" OD: _____
COUPLINGS: THREADED
PIPE IN 10.0 FT. LENGTHS
PIPE 1-8.0 FT
PIPE 4-10.0 FT
SCREEN 15.0 FT
SLOT SIZE 0.010 IN

IMPERVIOUS ZONE
43.0 FT. THICK

TOTAL: 63.0 FT

41.0 FT

43.0 FT

45.0 FT

THICKNESS OF
UPPER SEAL 2.0 FT

PERMEABLE ZONE
17.0 FT. THICK

LENGTH OF SCREEN 15.0 FT

SAND 17.0 FT

FT
60.0 FT

BOTTOM OF BORING



REMARKS: ALL MEASUREMENTS TO THE NEAREST 0.1 FT.

HDR Engineering, Inc.

FILE NO. OF MONITOR



WELL CONSTRUCTION RECORD

CONTRACTOR: Geologic Exploration, Inc.

DRILLER REGISTRATION NUMBER: 1175

STATE WELL CONSTRUCTION PERMIT NUMBER: _____

1. WELL LOCATION: (Show sketch of the location below)

Nearest Town: Winston Salem County: Forsyth

Friedberg Lane

(Road, Community, or Subdivision and Lot No.)

2. OWNER City of Winston Salem Utilities Division
 ADDRESS PO Box 2511

Winston Salem NC 27102
 City or Town State Zip Code

3. DATE DRILLED 12-27-95 USE OF WELL monitor

4. TOTAL DEPTH 60.0' ft

5. CUTTINGS COLLECTED YES NO

6. DOES WELL REPLACE EXISTING WELL? YES NO

7. STATIC WATER LEVEL Below Top of Casing: 3.0 FT.

(Use "+" if Above Top of Casing)

8. TOP OF CASING IS 3.0 FT. Above Land Surface*

* Casing Terminated at or below land surface is illegal unless a variance is issued in accordance with 15A NCAC 2C .0118

9. YIELD (gpm): N/A METHOD OF TEST N/A

10. WATER ZONES (depth): N/A

CHLORINATION: Type N/A Amount N/A

If additional space is needed use back of form

CASING:

Depth	Diameter	Wall Thickness or Weight/Ft.	Material
From <u>0.0</u> To <u>45.0</u> Ft.	<u>2 inch</u>	<u>Sch 40</u>	<u>PVC</u>
From _____ To _____ Ft.	_____	_____	_____
From _____ To _____ Ft.	_____	_____	_____

13. GROUT:

Depth	Material	Method
From <u>0.0</u> To <u>41.0</u> Ft.	<u>Portland Bentonite Slurry</u>	_____
From _____ To _____ Ft.	_____	_____

14. SCREEN:

Depth	Diameter	Slot Size	Material
From <u>45.0</u> To <u>60.0</u> Ft.	<u>2 in.</u>	<u>.010 in.</u>	<u>PVC</u>
From _____ To _____ Ft.	_____ in.	_____ in.	_____
From _____ To _____ Ft.	_____ in.	_____ in.	_____

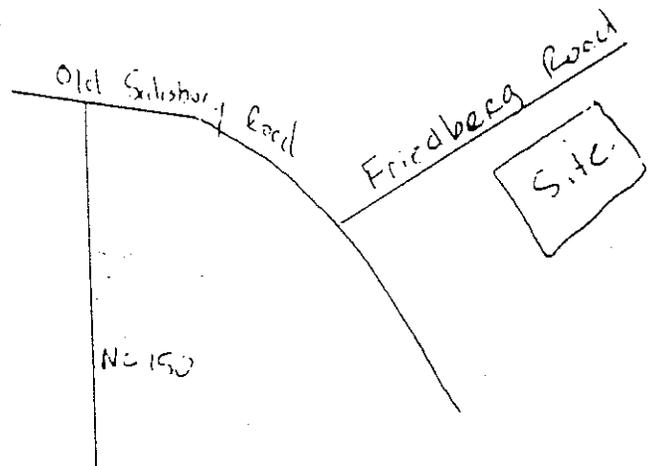
15. SAND/GRAVEL PACK:

Depth	Size	Material
From <u>43.0</u> To <u>60.0</u> Ft.	<u>20-40 Fine Silica Sand</u>	_____
From _____ To _____ Ft.	_____	_____

16. REMARKS: MW-6 Bentonite seal from 41.0 to 43.0 feet.

LOCATION SKETCH

(Show direction and distance from at least two State Roads, or other map reference points)



I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Steve J. J.

SIGNATURE OF CONTRACTOR OR AGENT

12-28-95

DATE

LOCATION: OLD SALISBURY ROAD

BORING NUMBER: MW-7

PAGE: 1 OF 2

BORING LOG

DATE: 12/28/95

NUMBER	DEPTH	SPT	T	WL	SI	DESCRIPTION (USCS)	COMMENTS
	4'						
SS-1	8'	36	SS			LIGHT BROWN TO TAN, DENSE, CLAYEY SILTY SAND (SM), MEDIUM TO FINE GRAINED, BRITTLE, VERY DRY, QUARTZ, FELDSPAR, BIOTITE	GRANITIC SAPROLITE
	12'						
SS-2	16'	34	SS			YELLOW-BROWN TO TAN, DENSE, CLAYEY SILTY SAND (SM), MEDIUM TO FINE GRAINED, MANGANESE OXIDE STAINING, VERY DRY, BRITTLE	
	20'						
SS-3	24'	34	SS			LIGHT TAN TO WHITE, DENSE, SILTY SAND (SM) AND PARTIALLY WEATHERED ROCK FRAGMENTS, ABUNDANT FELDSPAR, BRITTLE, SLIGHT MOISTURE, QUARTZ, BIOTITE ABUNDANT, IRON OXIDE STAINING	
	28'						
SS-4	32'	31	SS			SAME AS ABOVE, WHITE, MEDIUM TO COARSE GRAINED, BRITTLE, DRY	
	36'						
SS-5	40'	50+	SS			LIGHT GRAY TO WHITE, VERY DENSE, SILTY SAND (SM), WEATHERED GRANITE, BRITTLE, DRY, MEDIUM GRAINED, IRON OXIDE STAINING, QUARTZ, FELDSPAR, BIOTITE	
SS-6		50+	SS			SAME AS ABOVE, MOIST, SOFT	



▽ AT DRILLING

▽ 24 HR

BOREHOLE COMPLETION: 48 FT. BELOW LAND SURFACE

WATER DEPTH: 35.86 FT. BELOW TOC

DATE: 1/3/96

DRILLING METHOD: 4 1/4-INCH HOLLOW STEM AUGER

LOGGED BY: J. ISHAM

- KEY:
- SI - SCREEN
 - SS - SPLITSPOON
 - SPT - SOIL PENETRATION TEST-N NUMBER
 - ST - SHELBY TUBE
 - T - TYPE
 - WL - WATER LEVEL



PROJECT: WINSTON-SALEM C & D LANDFILL

PROJECT NO: 00162-082-018

LOCATION: OLD SALISBURY ROAD

BORING NUMBER: MW-7

PAGE: 2 OF 2

BORING LOG

DATE: 12/28/95

NUMBER	DEPTH	SPT	T	WL	SI	DESCRIPTION (USCS)	COMMENTS
	44'					HARD, SLOW DRILLING	GRANITIC SAPROLITE
	48'						
	52'					TD. = 48 FT.	
	56'						
	60'						
	64'						
	68'						
	72'						
	76'						
	80'						

BOREHOLE COMPLETION: 48 FT. BELOW LAND SURFACE

WATER DEPTH: 35.86 FT. BELOW TOC

DATE: 1/3/96

DRILLING METHOD: 4 1/4-INCH HOLLOW STEM AUGER

LOGGED BY: J. ISHAM

KEY:

- SI - SCREEN
- SS - SPLITSPOON
- SPT - SOIL PENETRATION TEST-NUMBER
- ST - SHELBY TUBE
- T - TYPE
- WL - WATER LEVEL



MONITORING WELL INSTALLATION DIAGRAM

LOCATION: WINSTON-SALEM C&O
 WELL NO.: MW-7
 BORING NO.:
 JOB NO.: 00162-082-018
 PREPARED BY: J. ISHAM
 CHECKED BY:
 DATE: 12/28/95

DEPTH
BELOW
GROUND
SURFACE
0

803.66

1.56 FT

EL 802.10 FT.
TOP OF GROUND
SURFACE

ANNULAR SEAL:
PORTLAND TYPE I CEMENT

PROTECTIVE METAL CASING
4-INCH SQUARE BLACK
STEEL BOX WITH LOCKING
LID

BENTONITE SEAL:
3/8-INCH BENTONITE CHIPS

RISER PIPE: SCHEDULE 40
 ID: 2" OD:
 COUPLINGS: THREADED
 PIPE IN 10.0 FT. LENGTHS
 PIPE 1-5.0 FT
 PIPE 3-10.0 FT
 SCREEN 15.0 FT
 SLOT SIZE 0.010 IN
 TOTAL: 50.0 FT

IMPERVIOUS ZONE
31.0 FT. THICK

THICKNESS OF
UPPER SEAL 3.0 FT

28.0 FT

31.0 FT

33.0 FT

LENGTH OF SCREEN 15.0 FT

PERMEABLE ZONE
17.0 FT. THICK

SAND 17.0 FT

FT
48.0 FT

BOTTOM OF BORING

REMARKS: ALL MEASUREMENTS TO THE NEAREST 0.1 FT.

HDR

HDR Engineering, Inc.

FILENAME: MONITOR

APPENDIX C

GROUND-WATER MONITORING AND BORED WELL ABANDONMENT
RECORDS

Department of Natural Resources and Community Development
 Division of Environmental Management
 Groundwater Section
 P.O. Box 27687 - Raleigh, N.C. 27611

WELL ABANDONMENT RECORD

CONTRACTOR Geologic Exploration REG. NO. 1175

1. WELL LOCATION: (Show a sketch of the location on back of form.)
 Nearest Town: Winston Salem County Forsyth
Friedburg Lane
 (Road, Community, Subdivision, Lot No.) Quadrangle No.

2. OWNER: City of Winston Salem Utilities Div.

3. ADDRESS: PO Box 2511 Winston Salem, NC

4. TOPOGRAPHY: draw, slope, hilltop, valley, flat

5. USE OF WELL: monitor DATE: 12/28/95

6. TOTAL DEPTH: 50.0 ft DIAMETER: 2 inch

7. CASING REMOVED:

<u>feet</u>	<u>diameter</u>
<u>N/A</u>	<u>N/A</u>

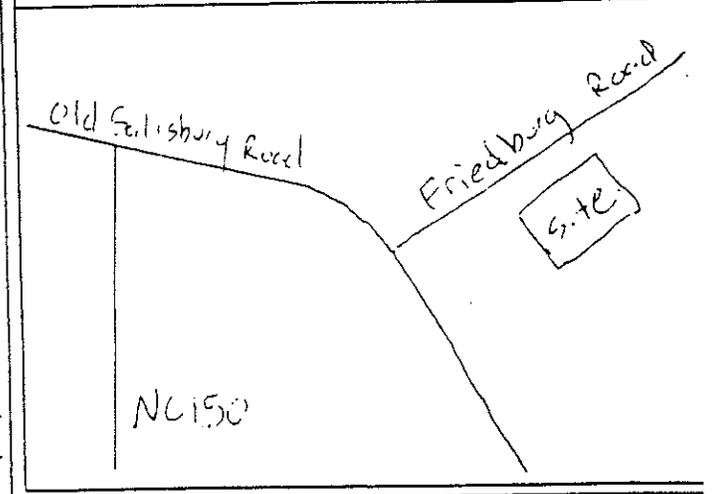
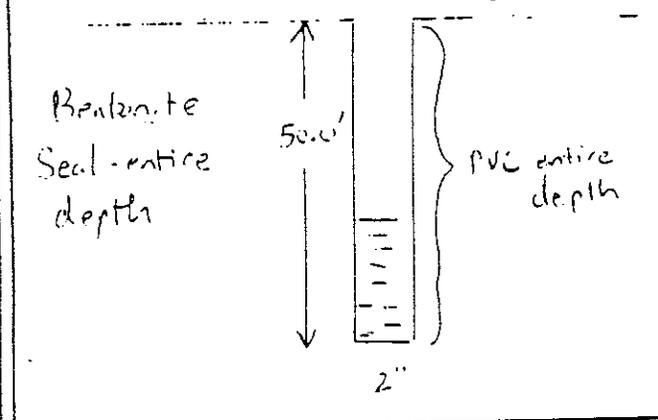
8. SEALING MATERIAL:

<u>Neat cement</u>	<u>Sand cement</u>
bags of cement _____	bags of cement _____
gals. of water _____	yds. of sand _____
	gals. of water _____

Other
 Type material Bentonite Holeplug
 Amount 8 gallons

9. EXPLAIN METHOD EMPLACEMENT OF MATERIAL.
pour/wet
 MW-1

WELL DIAGRAM: Draw a detailed sketch of the well showing total depth, depth and diameter of screens remaining in the well, gravel interval, intervals of casing perforations, and depths and types of fill materials used.



I do hereby certify that this well abandonment record is true and exact.

Signature of Contractor or Agent *Steve Poff* Date 1-4-96

WELL LOCATION: Draw a location sketch on the reverse of this sheet, showing the direction and distance of the well to at least two (2) nearby reference points such as roads, intersections and streams. Identify roads with State Highway road identification numbers.

Submit original to the Division of Environmental Management, one copy to the Driller, and one copy to the owner.

Department of Natural Resources and Community Development
 Division of Environmental Management
 Groundwater Section
 P.O. Box 27687 - Raleigh, N.C. 27611

WELL ABANDONMENT RECORD

CONTRACTOR Geologic Exploration REG. NO. 1175

1. WELL LOCATION: (Show a sketch of the location on back of form.)
 Nearest Town: Winston Salem County Forsyth
Friedburg Lane
 (Road, Community, Subdivision, Lot No.) Quadrangle No.

2. OWNER: City of Winston Salem Utilities Div.

3. ADDRESS: PO Box 2511 Winston Salem, NC

4. TOPOGRAPHY: draw, slope, hilltop, valley, flat

5. USE OF WELL: monitor DATE: 12/28/95

6. TOTAL DEPTH: 16.0 ft DIAMETER: 2 inch

7. CASING REMOVED:

feet	diameter
N/A	N/A
_____	_____
_____	_____

8. SEALING MATERIAL:

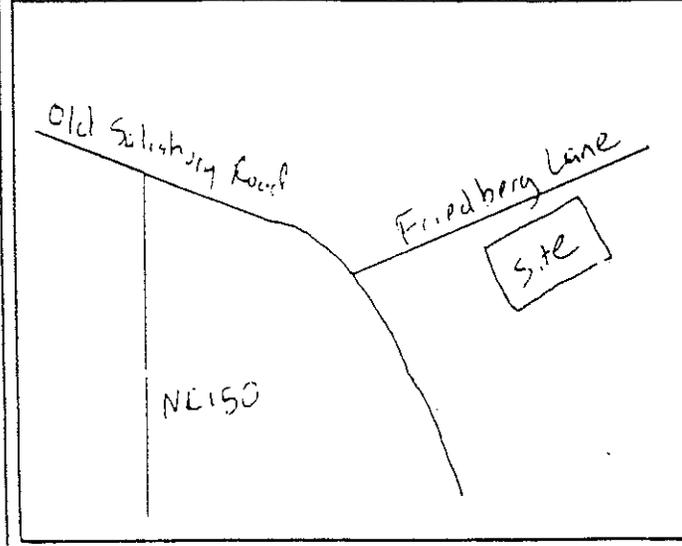
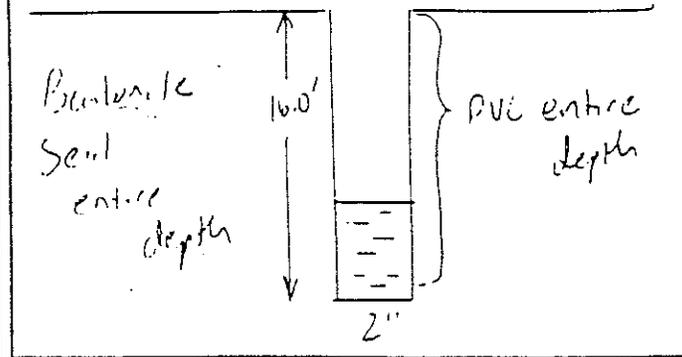
<u>Neat cement</u>	<u>Sand cement</u>
bags of cement _____	bags of cement _____
gals. of water _____	yds. of sand _____
	gals. of water _____

Other
 Type material Bentonite Holeplug
 Amount 3 gallon

9. EXPLAIN METHOD EMPLACEMENT OF MATERIAL.
pour/wet

MW-2

WELL DIAGRAM: Draw a detailed sketch of the well showing total depth, depth and diameter of screens remaining in the well, gravel interval, intervals of casing perforations, and depths and types of fill materials used.



I do hereby certify that this well abandonment record is true and exact.

Signature of Contractor or Agent Alex Zyl Date 1-4-96

WELL LOCATION: Draw a location sketch on the reverse of this sheet, showing the direction and distance of the well to at least two (2) nearby reference points such as roads, intersections and streams. Identify roads with State Highway road identification numbers.

submit original to the Division of Environmental Management, one copy to the Driller, and one copy to the owner.

Quad. No. _____ Serial No. _____
 Lat. _____ Long. _____ Pc _____
 Minor Basin _____
 Basin Code _____
 Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD

MW-2

CONTRACTOR Groundwater Protection, Inc.
 REGISTERED NUMBER 1105

STATE WELL CONSTRUCTION PERMIT NUMBER: NA

WELL LOCATION (Show sketch of the location below)
 Nearest Town Winston-Salem, North Carolina
Friedburg Road

Address Winston-Salem/Forsyth County Utilities Comm.
102 West Third Street, Suite 460
Winston-Salem, North Carolina 27102

DATE DRILLED February 13, 1995 USE OF WELL MONITOR

TOTAL DEPTH 16.0 CUTTINGS COLLECTED Yes No

DESIGN TO REPLACE EXISTING WELL? Yes No
 STATIC WATER LEVEL: 14.8 FT. above TOP OF CASING.
 below

TOP OF CASING IS 2.7 FT. ABOVE LAND SURFACE.
 YIELD (gpm): NA METHOD OF TEST _____
 WATER ZONES (depth): NA

CONTAMINATION: Type NA Amount _____

From	To	Depth	Diameter	Wall Thickness	Material
From <u>+ 2.7</u>	To <u>5.5</u>	Fl. <u>2"</u>	<u>SCH 40</u>	<u>PVC</u>	
From <u>15.0</u>	To <u>15.5</u>	Fl. <u>2"</u>	<u>SCH 40</u>	<u>PVC</u>	

From	To	Depth	Material	Method
From <u>0</u>	To <u>3.0</u>	Fl. <u>PORTLAND</u>	<u>HAND</u>	

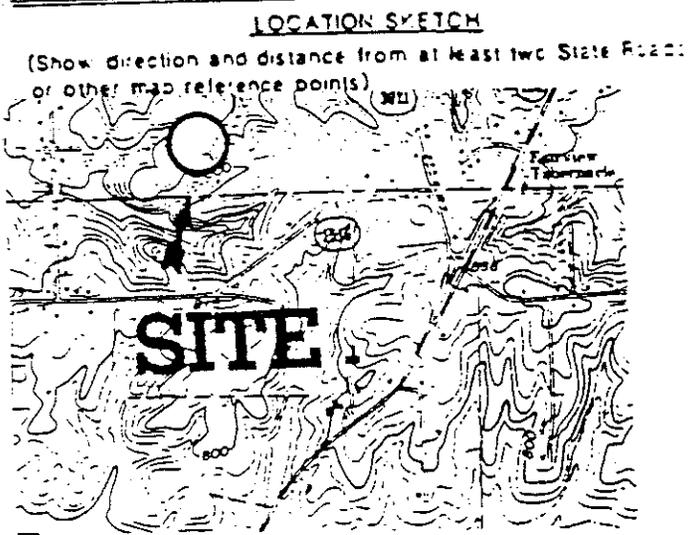
From	To	Depth	Diameter	Slot Size	Material
From <u>5.5</u>	To <u>15.0</u>	Fl. <u>2"</u>	<u>.010</u>	<u>PVC</u>	

From	To	Depth	Size	Material
From <u>4.0</u>	To <u>16.0</u>	Fl. <u>FINE FILTER SAND</u>	<u>SAND</u>	

GRAVEL PACK: _____
 BENTONITE SEAL FROM 3.0 TO 4.0 FEET BELOW GROUND SURFACE

Depth	DRILLING LOG	
From	To	Formation Description
<u>0-2</u>		<u>Tan and Brown Coarse To Fine Sandy Silt</u>
<u>2-7</u>		<u>Partially Weathered Rock Sampled As Orange, Tan and Brown Micaceous Coarse To Fine Very Sandy Silt</u>
<u>7-16</u>		<u>Rock, Cuttings Sampled As White to Light Gray Very Coarse Sand</u>

If additional space is needed use back of form.



I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C. WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CONTRACTOR OR AGENT [Signature] DATE 04-03-95

NORTH CAROLINA
 Department of Natural Resources and Community Development
 Division of Environmental Management
 Groundwater Section
 P.O. Box 27687 - Raleigh, N.C. 27611

WELL ABANDONMENT RECORD

CONTRACTOR Geologic Exploration REG. NO. 1175

1. WELL LOCATION: (Show a sketch of the location on back of form.)
 Nearest Town: Winston Salem County Forsyth
Friedburg Lane
 (Road, Community, Subdivision, Lot No.) Quadrangle No.

2. OWNER: City of Winston Salem Utilities Div.

3. ADDRESS: PO Box 2511 Winston Salem, NC

4. TOPOGRAPHY: draw, slope, hilltop, valley, flat

5. USE OF WELL: monitor DATE: 12/28/95

6. TOTAL DEPTH: 25.0 ft DIAMETER: 2 inch

7. CASING REMOVED:
 feet diameter
N/A N/A

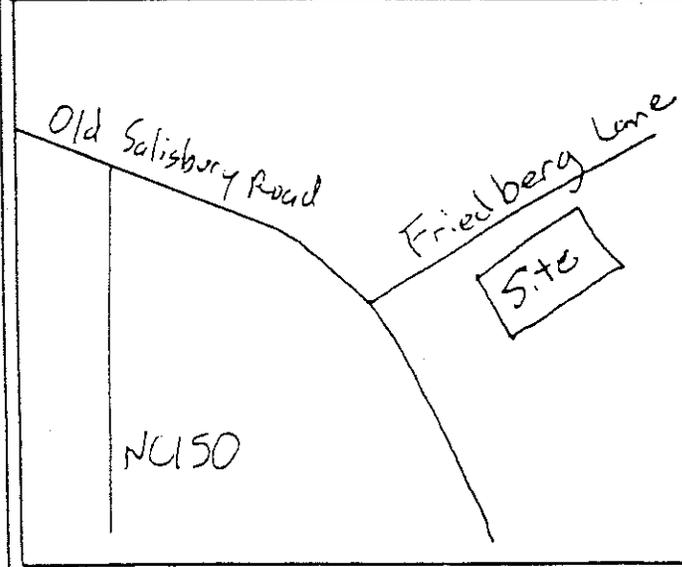
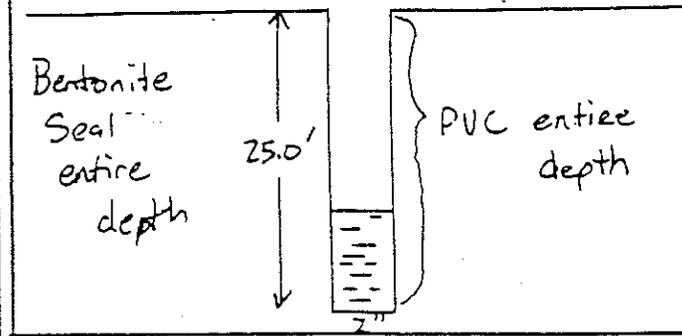
8. SEALING MATERIAL:
Neat cement | Sand cement
 bags of cement _____ bags of cement _____
 gals. of water _____ yds. of sand _____
 gals. of water _____

Other
 Type material Bentonite Holeplug
 Amount 4 gallons

9. EXPLAIN METHOD EMPLACEMENT OF MATERIAL.
pour/wet

MW-4

WELL DIAGRAM: Draw a detailed sketch of the well showing total depth, depth and diameter of screens remaining in the well, gravel interval, intervals of casing perforations, and depths and types of fill materials used.



I do hereby certify that this well abandonment record is true and exact.

Signature of Contractor or Agent Steve J... Date 1-4-96

WELL LOCATION: Draw a location sketch on the reverse of this sheet, showing the direction and distance of the well to at least two (2) nearby reference points such as roads, intersections and streams. Identify roads with State Highway road identification numbers.

Submit original to the Division of Environmental Management, one copy to the Driller, and one copy to the owner.

Quadr. No. _____ Serial No. _____
 Lat. _____ Long. _____ Pc _____
 Minor Basin _____
 Basin Code _____
 Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD

MW-4

DRILLING CONTRACTOR Groundwater Protection, Inc.
 REGISTERED NUMBER 1105

STATE WELL CONSTRUCTION PERMIT NUMBER: NA

WELL LOCATION (Show sketch of the location below)
 Nearest Town Winston-Salem, North Carolina
Friedburg Road
 Road, Community, or Subdivision and Lot No.)
 OWNER Winston-Salem/Forsyth County Utilities Comm.
 ADDRESS 102 West Third Street, Suite 460
Winston-Salem, North Carolina 27102
 City or Town State Zip Code
 DATE DRILLED February 13, 1995 USE OF WELL MONITOR
 TOTAL DEPTH 37-0 CUTTINGS COLLECTED Yes No
 DOES WELL REPLACE EXISTING WELL? Yes No
 STATIC WATER LEVEL: 26.1 FT. above TOP OF CASING.
 below
 TOP OF CASING IS 2.6 FT. ABOVE LAND SURFACE.
 GROUNDWATER QUALITY (ppm): NA METHOD OF TEST _____
 WATER ZONES (depth): NA
 CONTAMINANTS: Type NA Amount _____

County: Forsyth

Depth		DRILLING LOG
From	To	Formation Description
0-5		Medium To Fine Sandy Silt
5-16		Partially Weathered Rock As Coarse to Fine Very Sandy Sil To Silty Coarse To Fine Sand
16-37		Partially Weathered Rock As Silty Coarse To Fine Sand

If additional space is needed use back of form.

CASING

From	To	Depth	Diameter	Wall Thickness or Weight/FT.	Material
From 2.6	To 19.75	Fl.	2"	SCH 40	PVC
From 34.25	To 34.75	Fl.	2"	SCH 40	PVC

PROJECT

From	To	Depth	Material	Method
From 0	To 15.25	Fl.	PORTLAND	HAND

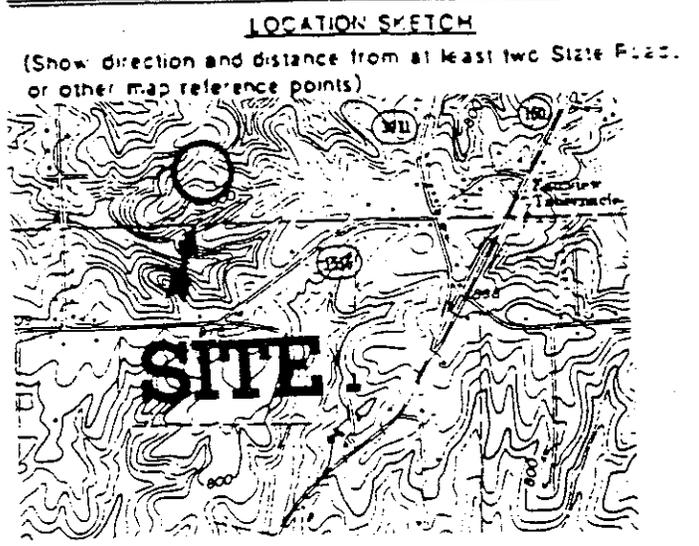
SCREEN

From	To	Depth	Diameter	Slot Size	Material
From 19.75	To 34.25	Fl.	2"	.010 in	PVC

GRAVEL PACK

From	To	Depth	Size	Material
From 17.75	To 37.0	Fl.	FINE FILTER SAND	SAND

Gr.S Bentonite Seal From 15.25 To 17.75 Feet Below Ground Surface



I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C. WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CONTRACTOR OR AGENT [Signature] DATE 04-03-95

Department of Natural Resources and Community Development
 Division of Environmental Management
 Groundwater Section
 P.O. Box 27687 - Raleigh, N.C. 27611

WELL ABANDONMENT RECORD

CONTRACTOR Geologic Exploration

REG. NO. _____

1175

1. WELL LOCATION: (Show a sketch of the location on back of form.)

Nearest Town: Winston Salem

County Forsyth

Friedberg Lane

(Road, Community, Subdivision, Lot No.)

Quadrangle No. _____

2. OWNER: City of Winston Salem Utilities Div.

3. ADDRESS: PO Box 2511 Winston Salem, NC

4. TOPOGRAPHY: draw, slope, hilltop, valley, flat

5. USE OF WELL: monitor DATE: 12/28/95

6. TOTAL DEPTH: 35.0 ft DIAMETER: 2 inch

7. CASING REMOVED:

<u>feet</u>	<u>diameter</u>
N/A	N/A
_____	_____
_____	_____

8. SEALING MATERIAL:

<u>Neat cement</u>	<u>Sand cement</u>
bags of cement _____	bags of cement _____
gals. of water _____	yds. of sand _____
	gals. of water _____

Other

Type material Bentonite Holeplug

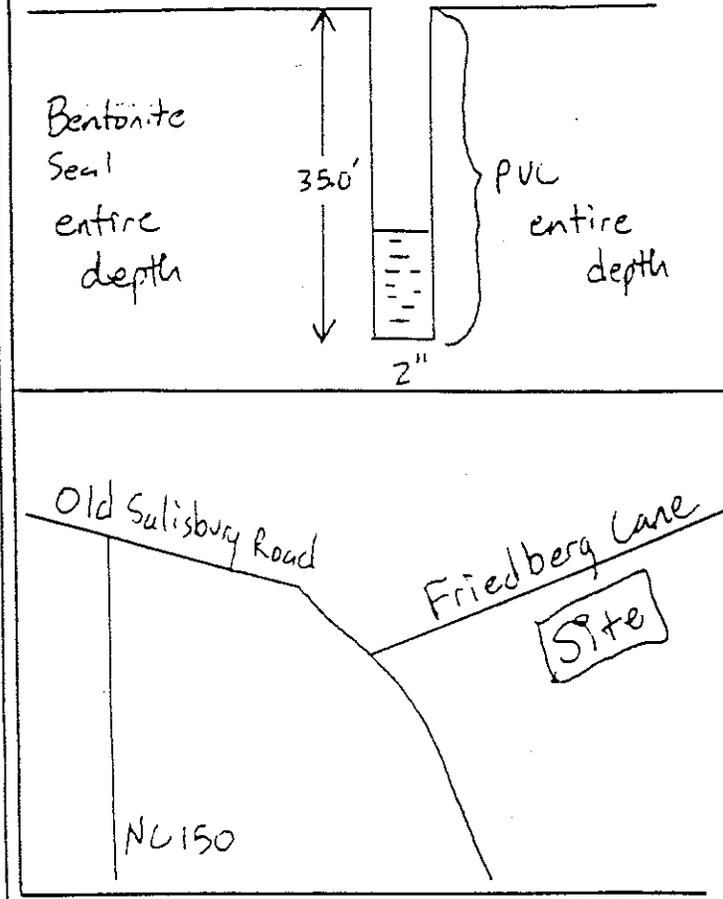
Amount 5.5 gallons

9. EXPLAIN METHOD EMPLACEMENT OF MATERIAL.

pour/wet

MW-5

WELL DIAGRAM: Draw a detailed sketch of the well showing total depth, depth and diameter of screens remaining in the well, gravel interval, intervals of casing perforations, and depths and types of fill materials used.



I do hereby certify that this well abandonment record is true and exact.

Signature of Contractor or Agent Steve Taylor

Date 1-4-96

WELL LOCATION: Draw a location sketch on the reverse of this sheet, showing the direction and distance of the well to at least two (2) nearby reference points such as roads, intersections and streams. Identify roads with State Highway road identification numbers.

Submit original to the Division of Environmental Management, one copy to the Driller, and one copy to the owner.

Quad No. _____ Serial No. _____
 Lat. _____ Long. _____ Pc _____
 Minor Basin _____
 Basin Code _____
 Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD

MF-5

INSTALLING CONTRACTOR Groundwater Protection, Inc.
 PERMITS REGISTRATION NUMBER 1105

STATE WELL CONSTRUCTION PERMIT NUMBER: RA

WELL LOCATION (Show sketch of the location below)

Nearest Town Winston-Salem, North Carolina
Friedburg Road

Map, Community, or Subdivision and Lot No.)

OWNER Winston-Salem/Forsyth County Utilities Comm.

ADDRESS 102 West Third Street, Suite 460
Winston-Salem, North Carolina 27102
(Street or Route No.)

DATE DRILLED February 11, 1995 State _____ Zip Code _____
 USE OF WELL MONITOR

TOTAL DEPTH 25.0 CUTTINGS COLLECTED Yes No

DOES WELL REPLACE EXISTING WELL? Yes No

STATIC WATER LEVEL: 14.0 FT. above TOP OF CASING.

TOP OF CASING IS 2.4 FT. ABOVE LAND SURFACE. below

YIELD (gpm) NA METHOD OF TEST _____

WATER ZONES (depth): NA

CONTAMINATION. Type NA Amount _____

CASING

From	Depth	To	Diameter	Wall Thickness or Weight/Ft.	Material
From <u>2.4</u>	To <u>10.0</u>	Ft. <u>2"</u>	<u>SCH 40</u>	<u>PVC</u>	
From <u>24.5</u>	To <u>25.0</u>	Ft. <u>2"</u>	<u>SCH 40</u>	<u>PVC</u>	
From _____	To _____	Ft. _____	_____	_____	

GROUT

From	Depth	To	Material	Method
From <u>0</u>	To <u>6.0</u>	Ft. <u>PORTLAND</u>	<u>BAND</u>	
From _____	To _____	Ft. _____	_____	

SCREEN

From	Depth	To	Diameter	Slot Size	Material
From <u>10.0</u>	To <u>24.5</u>	Ft. <u>2"</u>	<u>.010</u>	<u>PVC</u>	
From _____	To _____	Ft. _____	_____	_____	
From _____	To _____	Ft. _____	_____	_____	

GRAVEL PACK

From	Depth	To	Size	Material
From <u>8.0</u>	To <u>25.0</u>	Ft. <u>FINE FILTER SAND</u>	<u>SAND</u>	
From _____	To _____	Ft. _____	_____	

PAKS Bentonite Seal From 6.0 to 8.0 Feet Below Ground Surface

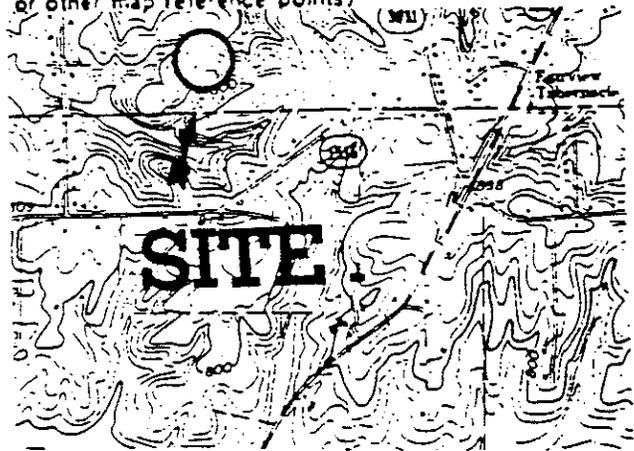
County: Forsyth

Depth	DRILLING LOG	
From	To	Formation Description
<u>0-10</u>		<u>Coarse To Fine Sandy Silt</u>
<u>10-25.7</u>		<u>Partially Weathered Rock As Silty Coarse To Fine Sand</u>
_____		_____
_____		_____
_____		_____
_____		_____
_____		_____
_____		_____
_____		_____
_____		_____
_____		_____

If additional space is needed use back of form.

LOCATION SKETCH

(Show direction and distance from at least two State Plane or other map reference points)



I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C. WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CONTRACTOR OR AGENT [Signature] DATE 02-03-95

Department of Natural Resources and Community Development
 Division of Environmental Management
 Groundwater Section
 P.O. Box 27687 - Raleigh, N.C. 27611

WELL ABANDONMENT RECORD

CONTRACTOR Geologic Exploration, Inc. REG. NO. 1175

1. WELL LOCATION: (Show a sketch of the location on back of form.)
 Nearest Town: Winston Salem County Forsyth
Friedberg Lane
 (Road, Community, Subdivision, Lot No.) Quadrangle No. _____

2. OWNER: City of Winston Salem Utilities Div.

3. ADDRESS: PO Box 2511 Winston Salem, NC 27102

4. TOPOGRAPHY: draw, slope, hilltop, valley, flat

5. USE OF WELL: drinking water DATE: 12-28-95

6. TOTAL DEPTH: 65.0 ft DIAMETER: 24 inch

7. CASING REMOVED:

feet	diameter
<u>N/A</u>	<u>N/A</u>

8. SEALING MATERIAL:

<u>Neat cement</u> bags of cement _____	<u>Sand cement</u> bags of cement _____
<u>gals. of water</u> _____	<u>yds. of sand</u> _____
	<u>gals. of water</u> _____

Other

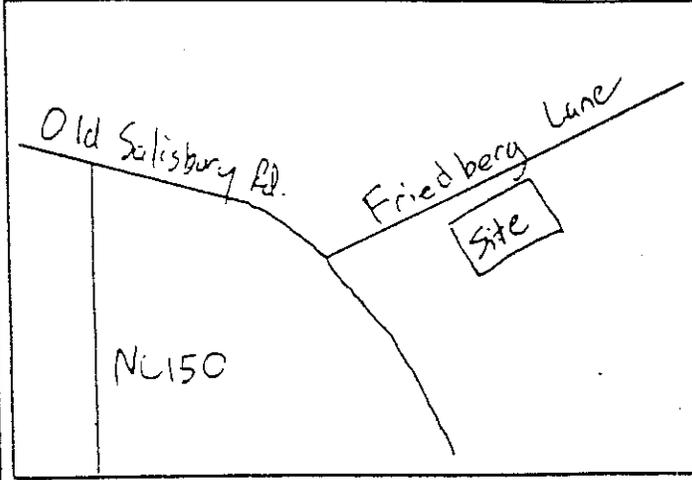
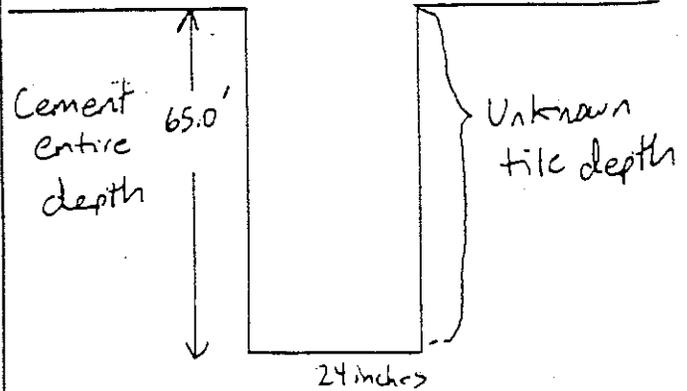
Type material Portland Cement

Amount 8.5 yards

9. EXPLAIN METHOD EMPLACEMENT OF MATERIAL.

poured/dumped

WELL DIAGRAM: Draw a detailed sketch of the well showing total depth, depth and diameter of screens remaining in the well, gravel interval, intervals of casing perforations, and depths and types of fill materials used.



I do hereby certify that this well abandonment record is true and exact.

Signature of Contractor or Agent Steve Taylor Date 01-04-96

WELL LOCATION: Draw a location sketch on the reverse of this sheet, showing the direction and distance of the well to at least two (2) nearby reference points such as roads, intersections and streams. Identify roads with State Highway road identification numbers.

Submit original to the Division of Environmental Management, one copy to the Driller, and one copy to the owner.

APPENDIX F

CLOSURE/POST-CLOSURE PLAN

CLOSURE & POST-CLOSURE PLANS

OLD SALISBURY ROAD C&D LANDFILL WINSTON-SALEM, NORTH CAROLINA

JUNE 2008



Prepared for

**City/County Utility Commission
City of Winston-Salem
P.O. Box 2511
Winston-Salem, NC 27102**

Prepared by

HDR

**HDR Engineering, Inc. of the Carolinas
128 S. Tryon St., Suite 1400
Charlotte, NC 28202**

HDR Project No. 00162-13625-018

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SECTION 1.0 CLOSURE PLAN

1.1 Cap System Background

In compliance with the State Solid Waste Management Rule 0.543, the Old Salisbury Road (OSR) Landfill will place a final cap system over all waste placed in the approximately 26 acre footprint of Phases IV, V, and VI of the landfill. The layers of the cap system will be designed and constructed with a low permeable layer under an erosion layer. It is estimated that the total landfill volume for Phases IV, V, and VI at completion will be **2,251,000 CY** (gross capacity) or **2,236,000 CY** (C&D waste, weekly cover and intermediate cover). The maximum area requiring a cap at any one time shall be **26.4** acres.

1.2 Cap System Design

Compacted soil liners will be incorporated in the cap system design to provide protection throughout the 30-year post-closure period. The system will consist of two layers (bottom up): the compacted soil liner and the erosion layer. The compacted soil liner forms a composite barrier designed to reduce infiltration into the Landfill, thus minimizing leachate and the potential for groundwater contamination. The erosion layer is designed to provide vegetation and minimize erosion.

The Landfill may use on- or off-site borrow material for the compacted soil layer and erosion layer. The compacted soil liner will consist of no less than **18 inches** of soil having permeability equal to or less than **1 x 10⁻⁵ cm/sec**. In order to assure that the material meets the permeability criteria, the soil will be tested prior to use and during placement. It is anticipated that the upper **12 inches** of the intermediate cover will be suitable for compaction and incorporation into the compacted soil layer. Construction methods for the compacted soil liner shall be based upon the type and quality of the borrow source and shall be verified in the field by constructing test pad(s). A professional engineer shall certify that the compacted soil liner installation conforms with the plans approved by the NCDENR Division of Solid Waste Management.

The erosion layer will consist of no less than **18 inches** of earthen material capable of sustaining native plant growth. It is anticipated that this layer will consist of 18 inches of suitable on-site or off-site borrow material.

The materials of the erosion layer will be selected considering soil type, nutrient levels, pH, erodibility, sideslope drainage, and other factors. The vegetation will be selected based upon the following characteristics.

- Species of grasses which are locally adapted and resistant to drought or temperature extremes.
- Having roots which will not disrupt the low permeability layer.
- Ability to thrive in low nutrient soil and develop a good stand to resist erosion.
- Survive and function with little or no maintenance.

All cover material will be free of putrescible material, solid waste, vegetation, rocks, construction debris, frozen soil, and other deleterious materials.

1.3 Final Contour Requirements

The final contour requirements for closure are shown on the **Drawing C-01**. These contours represent the top of the erosion layer and have been established to reflect all C&D waste expected to be received, intermediate cover material, and the final cover system (representing a total of **3** feet).

The Landfill is designed to have top slopes of eight percent and side slopes of 3H:1V. Final contours have been established to allow the Landfill's surface water to drain off the final cover while limiting erosion potential and maintaining post settlement slopes greater than five percent. A system of sideslope diversion channels, slope drains, and perimeter channels are designed to convey the runoff to one of seven adjacent sedimentation basins.

1.4 Cap System Material Requirements

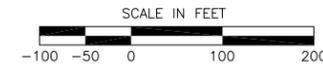
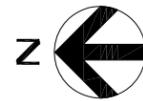
Based on **18 inches** of compacted soil placed over the areas that require final closure of the unit, **63,888 CY** of compacted soil are required for the first layer of the cap system. A minimum of **63,888 CY** is required for the erosion layer.

The following table summarizes the cap system requirements for OSR C&D Landfill.

Cap System Requirements	
18 inch Compacted Soil Liner	63,888 CY
18 inch Erosion Layer	63,888 CY

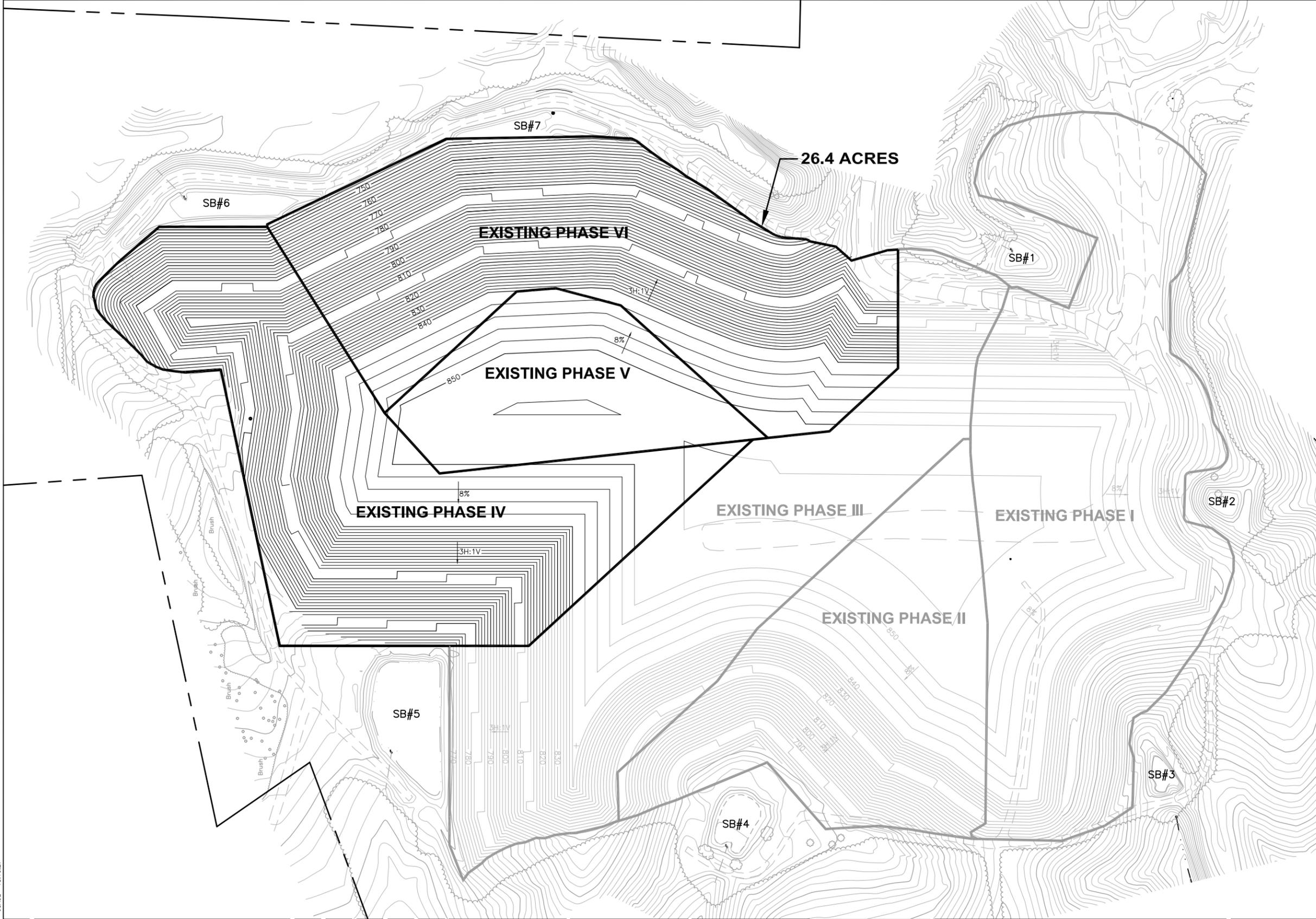
1.5 Erosion Control Measures

The sedimentation basins were designed to control the 24-hour 25-year storm event. The sedimentation basin design calculations may be found in the calculations section of the OSR Phases IV, V, and VI Construction Permit Application.



NOTES

1. PHASE I-IV TOPOGRAPHIC INFORMATION INDICATES PERMITTED CONTOURS.
2. TOPOGRAPHIC INFORMATION OUTSIDE OF PHASES I-VI PROVIDED BY CARTOGRAPHIC AERIAL MAPPING DATED JAN 3, 2008.
3. PROPERTY SURVEY TAKEN FROM DATA SUPPLIED BY BRADY SURVEYING, INC. DATED MARCH 14, 1994.
4. PROPOSED FINAL CAP CONTOURS ARE SHOWN AT THREE HORIZONTAL TO ONE VERTICAL SLOPE WITH A FIFTEEN FOOT WIDE BENCH EVERY THIRTY VERTICAL FEET.
5. THE OVERALL HEIGHT OF THE LANDFILL IS NOT CHANGED FROM THE ORIGINAL PERMITTED CAP.
6. LOCAL GOVERNMENT APPROVAL WAS GRANTED ON NOVEMBER 15, 2002 TO CHANGE THE EXTERIOR SLOPES FROM A FOUR HORIZONTAL: ONE VERTICAL TO A THREE HORIZONTAL: ONE VERTICAL.



LEGEND

- 770 EXISTING CONTOUR
- PHASING LIMITS
- 770 PROPOSED CONTOUR
- PROPERTY LINE

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 12-13-02 JGAUL 15:10:27

Issue No.	Description	Date	Drawn	Chkd.	Resp. Engr.	Proj. Mgr.
A	ISSUED FOR APPROVAL					

HDR
 HDR Engineering, Inc.
 of the Carolinas
 Suite 1400
 128 S. Tryon Street
 Charlotte, NC 28202-5009
 (704) 339-6700

Project Manager	J.C. READLING, P.E.
Designed	M.D. PLUMMER, P.E.
Designed	
Checked	
Drawn	J. GAUL

**OSR C&D LANDFILL
 PHASE IV, V, AND VI**

WINSTON-SALEM NORTH CAROLINA

**PHASES IV, V, AND VI
 PROPOSED FINAL GRADES**

Date	JUNE 2008	Project No.	00162-13625-018	Drawing No.	C-01	Issue	A
Scale	AS SHOWN	File Name					

1.6 Settlement Subsidence and Displacement

Landfill compaction methods, which include the use of steel-wheeled compaction equipment to spread and compact in layers, combined with an adequate number of passes over each layer of waste, will be utilized to reduce voids and minimize differential settlement. Proper placement of daily, intermediate, and final cover will reduce the moisture content of the waste prior to site closure and further reduce settlement. Final slopes of the landfill have been developed to allow for this anticipated subsidence so that long-term positive drainage of the fill will not be hindered.

1.7 Gas Collection/Venting System

It is anticipated that passive gas venting system will be installed to allow movement of gas generated from the completed fill area. The gas collection system will be designed prior to closure.

1.8 Schedule for Closure

Currently the Old Salisbury Road C&D landfill holds a Permit to Construct Phases IV, V, and VI dated October 7, 2005. The next Permit to Construct is a vertical expansion over Phase IV, V, and VI and therefore the City of Winston-Salem will request the closure timeline extension in accordance with Rule .0543(c)(5). The closure activities will begin no later than 30 days after the known final receipt of waste.

Areas at final design grade will be closed within 180 days unless an extension has been requested and received which identified the need for an increase schedule in accordance with Rule .0543(c)(6).

1.9 Notice of Closure and Date of Final Waste Acceptance

A sign indicating the anticipated date of closure and the date of final waste acceptance will be conspicuously posted at the facility at least 30 days in advance. Prior to beginning closure of the unit or portions thereof, the NCDENR Department of Solid Waste Management will be notified that a notice of intent to close has been placed in the operating record.

1.10 Closure Verification

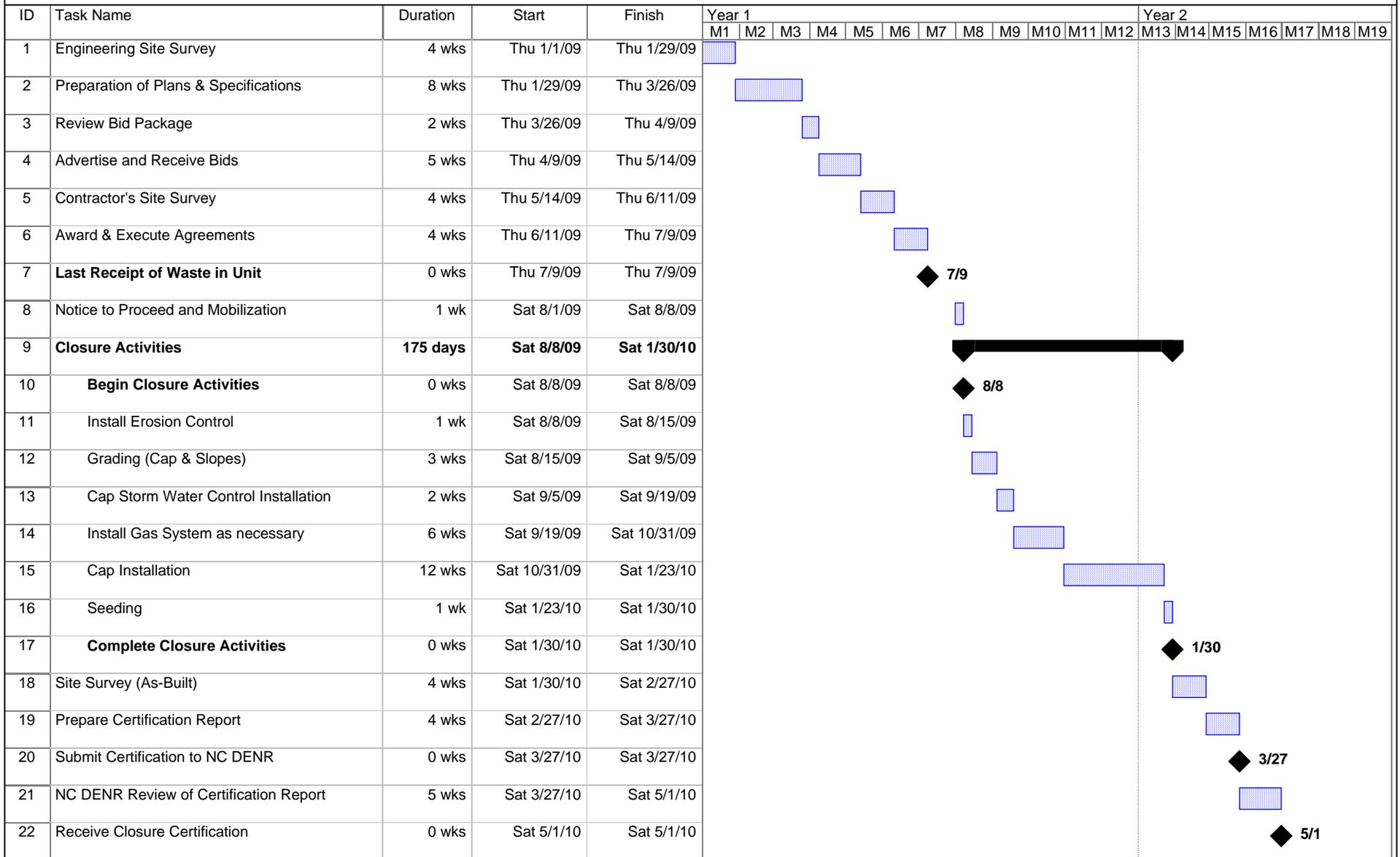
The following procedures will be implemented following closure.

- A CQA report shall be submitted to the NCDENR Division of Solid Waste Management. This CQA report shall describe the observations and tests used before, during, and upon completion of construction to ensure that the construction materials meet the cap design

Old Salisbury Road Landfill Phase IV, V, & VI Closure Schedule

Printed: Wed 6/25/08

Figure 1-1



specifications and the construction and certification requirements. The CQA report shall contain as-built drawings.

- A signed certification from an independent registered professional engineer verifying that closure has been completed in accordance with the closure plan will be submitted to the NCDENR Division of Solid Waste Management and a copy will be placed in the operating record.
- Within 90 days, a survey plat prepared by a professional land surveyor registered by the State, indicating the location and dimensions of landfill disposal areas, will be recorded in the RMC office.
- A notation shall be recorded on the deed notifying any potential purchaser of the property that the land has been used as a solid waste management unit and that future use is restricted under Paragraph (8) of Rule .0543(c). A copy of the deed notation as recorded shall be filed with the operating record.

1.11 Cost Estimate of Closure Activities

The following table gives a cost estimate for closure construction at the OSR Landfill, Phases IV, V, and VI.

**CITY/COUNTY UTILITY COMMISSION OSR LANDFILL
OSR LANDFILL CLOSURE CONSTRUCTION COST
26.4 ACRES (Phases IV through VI) ¹**

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
MOBILIZATION, CQC, PROJECT ADMIN., BONDS	1	LS	4.00%	\$128,800
NUMBER OF ACRES TO CONSTRUCT:	26.4 ²			
SURVEYING AND CONTROL	26.4	ACRE	\$3,000	\$79,200
EROSION AND SEDIMENT CONTROL AND MAINTENANCE	26.4	ACRE	\$5,000	\$132,000
GRADING PREPARATION	26.4	AC	\$5,900	\$155,800
MISCELLANEOUS STRUCTURAL FILL	35,000	CY	\$5.00	\$175,000
CONSTRUCT COMPACTED SOIL LINER (18" THICK)	63,888	CY	\$18.00	\$1,150,000
CONSTRUCT EROSION LAYER (18" THICK)	63,888	CY	\$5.00	\$319,400
CONSTRUCT GAS COLLECTION SYSTEM	26.4	ACRE	\$35,000.00	\$924,000
TOE DRAIN	2,100	LF	\$12.00	\$25,200
CONSTRUCT DRAINAGE BERMS	2,400	LF	\$12.00	\$28,800
PERIMETER RIP-RAP CHANNEL	3,200	TONS	\$45.00	\$144,000
CONSTRUCT DOWNCHUTES	2,000	LF	\$25.00	\$50,000
FURNISH AND INSTALL SEEDING AND MULCHING	26.4	ACRE	\$1,400	\$37,000
Sub Total	-	-	-	\$3,349,200
CONTINGENCY	5%			\$170,800
ENGINEERING	26.4	ACRE	\$2,000	\$52,800
CONSTRUCTION MANAGEMENT	2%	PERCENT	\$3,349,200	\$67,000
CQA	26.4	ACRE	\$5,000	\$132,000
TOTAL COSTS	-	-	-	\$3,828,400
Cost per Acre	-	-	-	\$145,000

Notes:

1. Phases IV, V, and VI are estimated based on the new regulatory cap system.
2. Covers Phases IV, V, and VI (25 Ac) plus a slope factor.
3. Unit prices are estimated in 2007 dollars.
4. Soil Liner is 1 X 10⁻⁵ cm/sec material from off site location within 10 miles.
5. All other soils are from onsite.
6. Gas Collection System has not been fully designed and therefore the estimated is subject to change.

SECTION 2.0 POST-CLOSURE PLAN

2.1 Introduction

This Post-Closure Plan has been developed to outline steps to be taken to ensure the environmental soundness of the Landfill Phases IV, V, and VI during its post-closure care period. The post-closure care period will last at least 30 years after closure completion and at a minimum will consist of the following.

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

No wastes will remain exposed after closure of the unit. Access to the closed site by the public will be restricted. Any proposed use will be evaluated to determine its potential for posing a significant health hazard.

2.2 Post-Closure Contact

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

Solid Waste Administrator
City/County Utility Commission
City of Winston-Salem
PO Box 2511
Winston – Salem, NC 27102
(336) 747-7310

2.3 Description of Use

After the unit is officially closed in accordance with the Closure Plan, the area will be allowed to return to a natural vegetative state. The City will maintain control of the property and prevent public access to it during the post-closure period.

There will be an access road on the cap to allow proper maintenance during post-closure. Final location of the access will be determined as a part of operations and Closure Plan.

2.4 Maintenance

2.4.1 Repair of Security Control Devices

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

2.4.2 Erosion Damage Repair

If erosion of the final cover occurs during post-closure, the affected area will be repaired and re-seeded as necessary. Excessive slopes will be flattened if possible by adding clean fill material. If necessary, erosion control fabrics will be used to expedite rapid revegetation of slopes and to secure topsoil in place. Rough surfaces, which cause isolated erosion areas will be smooth and re-seeded as necessary.

2.4.3 Correction of Settlement, Subsidence, and Displacement

Minimum slopes of five percent will be maintained in order to prevent ponding and allow for proper drainage without infiltration. If vertical or horizontal displacement occurs due to differential settlement, cracks will be filled with appropriate material and final cover will be reestablished.

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

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

2.4.5 Gas Collection/Venting System

The landfill gas collection and venting system will be inspected and maintained. Proper operation of the systems is verified through testing at the landfill gas monitoring wells and probes.

2.4.6 Groundwater Monitoring System

Groundwater wells will be inspected regularly (at the time of sampling) to ensure integrity. Persons inspecting a well should look for signs of well tampering, cracking or degradation, and determine whether the well needs to be replaced. If the decision is

made to replace and abandon a well, the replacement well should be installed 5 to 10 feet from the abandoned well in accordance with previous well specifications. Well abandonment should be accomplished by pulling the casing out and grouting the hole.

2.5 Monitoring Plan

The closed unit shall be monitored for 30 years. A series of inspections shall be scheduled to ensure the integrity and effectiveness of the cap system, storm water control system, groundwater monitoring system, gas collection system, and to protect human health and the environment.

2.5.1 Inspection Frequencies

Inspections to be conducted during the post-closure care period will occur regularly as follows:

Table 2.5-1 Post-Closure Inspection Frequencies		
Inspection Activity	Years 1-3	Years 4-30
Security Control Devices	Quarterly	Quarterly
Cover Drainage System Functioning	Quarterly	Semiannually
Gas Collection/Venting System	Quarterly	Semiannually
Groundwater Monitoring System	Semiannually	Semiannually
Erosion Damage	Quarterly	Semiannually
Cover Settlement, Subsidence, and Displacement	Quarterly	Semiannually
Vegetative Cover Condition	Quarterly	Semiannually
Stormwater Control System	Quarterly	Semiannually
Benchmark Integrity	Annually	Annually

A copy of the Post-Closure Inspection Checklist is included as Figure 2-1 on the following page.

**FIGURE 2-1
POST-CLOSURE INSPECTION CHECKLIST**

Location: _____

Date: _____

Time: _____

Weather: _____

Completed By: _____

	<u>Yes</u>	<u>No</u>
I. Security Control Devices		
Are security control devices in place and functioning?	<input type="checkbox"/>	<input type="checkbox"/>
Are all warning signs prominent and legible?	<input type="checkbox"/>	<input type="checkbox"/>
Are there any signs of unauthorized entry on the site?	<input type="checkbox"/>	<input type="checkbox"/>
Are there signs of illegal dumping on site?	<input type="checkbox"/>	<input type="checkbox"/>
II. Final Cover System		
Is the final cover free of erosion and depressions?	<input type="checkbox"/>	<input type="checkbox"/>
Is there leachate seeping from the final cover? (If yes, make note of location in comment section below).	<input type="checkbox"/>	<input type="checkbox"/>
Is the vegetative cover continuous and in good condition, free of bare spots?	<input type="checkbox"/>	<input type="checkbox"/>
Does the site require mowing? (If yes, mow grass and note in comment section below).	<input type="checkbox"/>	<input type="checkbox"/>
Is there ponding of water on final cover system?	<input type="checkbox"/>	<input type="checkbox"/>
III. Groundwater Monitoring Wells		
Is the casing upright and unobstructed?	<input type="checkbox"/>	<input type="checkbox"/>
Is the outer casing secure and locked?	<input type="checkbox"/>	<input type="checkbox"/>
Is the ID tag present and legible?	<input type="checkbox"/>	<input type="checkbox"/>
IV. Miscellaneous		
Are all benchmarks visible and intact?	<input type="checkbox"/>	<input type="checkbox"/>
Are all ditches free of debris and litter?	<input type="checkbox"/>	<input type="checkbox"/>
Are any odors present which may indicate landfill gas migration?	<input type="checkbox"/>	<input type="checkbox"/>

2.5.2 Quarterly Inspections

Quarterly inspections of the closed site will include examination of the security control devices for signs of deterioration or vandalism to ensure access to the site is limited to authorized persons.

2.5.3 Semiannual Inspections

Semiannual inspections of the site during the post-closure period will be conducted by the Owner or Owner's representative with attention paid to the integrity of the final cover system. This includes inspection for erosion damage, a good stand of vegetative cover, and cover settlement, subsidence, and displacement. Drainage ditches will be cleared of litter and debris, benchmark integrity will be noted and maintained as well as the integrity of the groundwater and gas monitoring systems.

Groundwater monitoring will continue on a regular basis throughout the post-closure care period. The parameters chosen for analysis will be no less than the requirements of regulatory agencies. Groundwater monitoring wells will be inspected in accordance with the post-closure inspection protocol. A report of findings will be made to the responsible party via the Post-Closure Inspection Checklist, including any recommendations for actions necessary to ensure the site continues to meet the closure performance standard. The engineer will also receive copies of the quarterly inspection reports and respond to any comments that demand immediate attention.

2.6 Engineering Certification

Based on the monitoring reports and semiannual site visits, annual certifications by the owner or owner's representative will be placed in the operating record. They will certify that the post closure plan is being followed, noting discrepancies along with the corrective actions undertaken. At the end of the post-closure period, the individual certifications will be compiled into a final document and forwarded to NCDENR.

2.7 Cost Estimate of Post Closure Care Activities

Table 2.7-2 gives a cost estimate of the Post Closure Care activities.

**Table 2.7-2
CITY/COUNTY UTILITY COMMISSION OSR LANDFILL
ENGINEERING OPINION OF PROBABLE POST-CLOSURE COST
56 ACRES, 30-YEAR TERM**

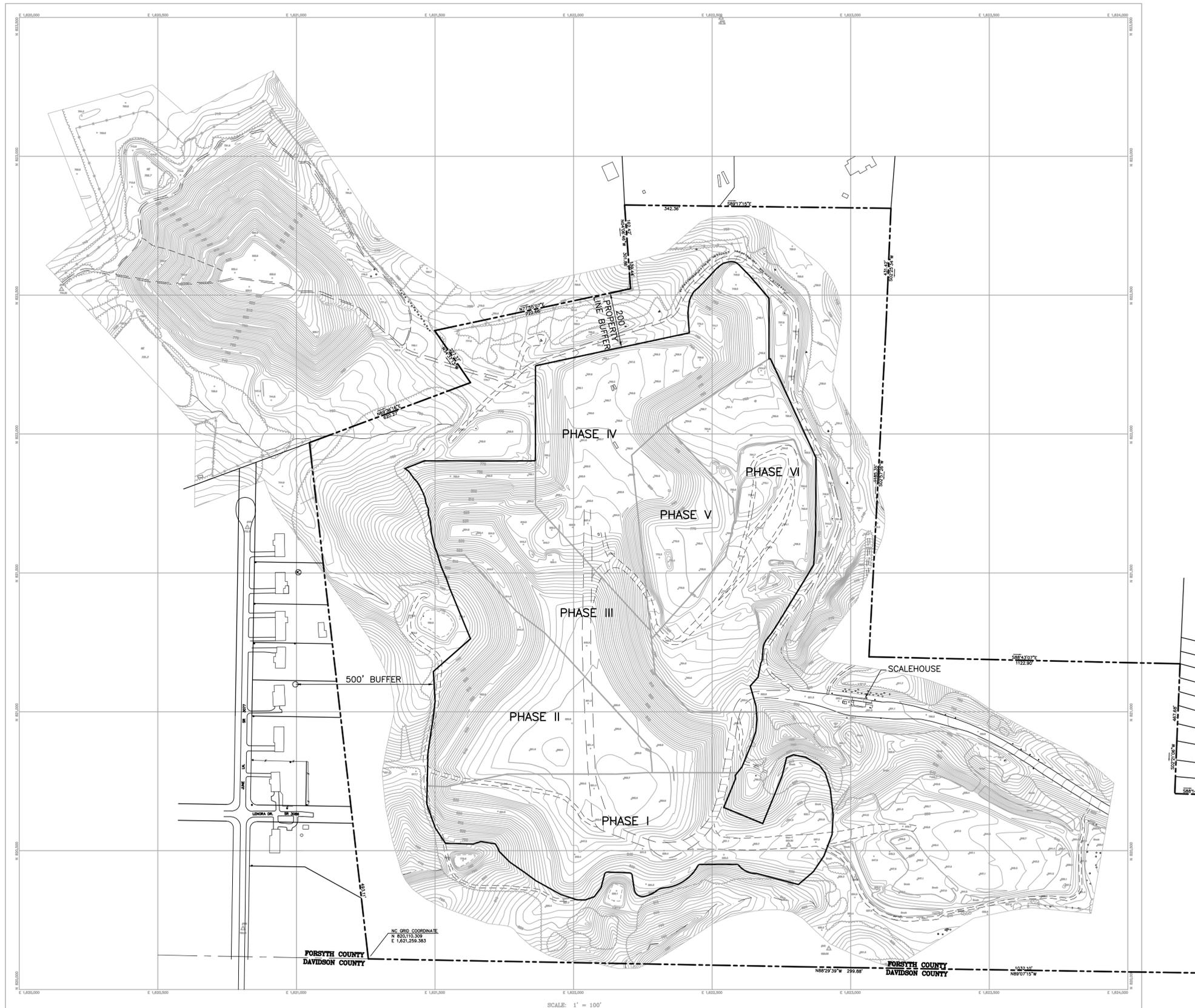
ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
SECURITY FENCE REPAIR	30	YEAR	\$2,000	\$60,000
EROSION, SETTLEMENT REPAIR & REVEGETATION				
YEARS 0-5	5	YEAR	\$40,000	\$200,000
YEARS 6-10	5	YEAR	\$20,000	\$100,000
YEARS 11-30	20	YEAR	\$5,000	\$100,000
SEDIMENT BASIN CLEANOUT (20 hours/basin, 9 basins, cleaned once/5 years)	900	HOURS	\$100	\$90,000
SEEDING (2 acres/year for 30 years)	60	ACRE	\$2,000	\$120,000
MOWING (2 times/year over 56 acres for 30 years)	3,360	ACRE	\$40	\$134,400
GAS MONITORING	60	Semiannually	\$5,000	\$300,000
GROUNDWATER & SURFACE WATER MONITORING	60	Semiannually	\$15,000	\$900,000
SITE INSPECTIONS				
YEARS 0-5	20	Quarterly	\$2,000	\$40,000
YEARS 6-30	50	Semiannually	\$2,000	\$100,000
ELECTRICITY/LIGHTING	30	YEAR	\$4,000	\$120,000
POST CLOSURE CERTIFICATION (at year 30)	1	EACH	\$25,000	\$25,000
Sub Total	-	-	-	\$2,323,800
			30-YEAR TOTAL COST :	\$2,323,800
			AVERAGE ANNUAL COST	\$77,500
			Phase 1,2,3 PC Cost:	\$1,285,757
			Phase 4,5,6 PC Cost:	\$1,038,043

DRAWINGS



NOTES

1. SITE TOPOGRAPHIC INFORMATION PROVIDED BY CARTOGRAPHIC AERIAL MAPPING, INC. DATED JAN. 01, 2009.
2. PROPERTY SURVEY TAKEN FROM DATA SUPPLIED BY BRADY SURVEYING, INC. DATED MARCH 14, 1994.



NC GRID COORDINATE
 N 820110.309
 E 1,621,258.383

SCALE: 1" = 100'

HDR
 HDR Engineering, Inc.
 of the Carolinas
 License Number: F-0116
 128 S Tryon Street, Suite 1400 | Charlotte, NC 28202

ISSUE	DATE	DESCRIPTION
		ISSUED FOR APPROVAL

PROJECT MANAGER	E.L. SHUFFLER, P.E. M.D. PLUMMER, P.E. S. FUTRELL, E.I. J. GAUL
PROJECT NUMBER	13625-007-018



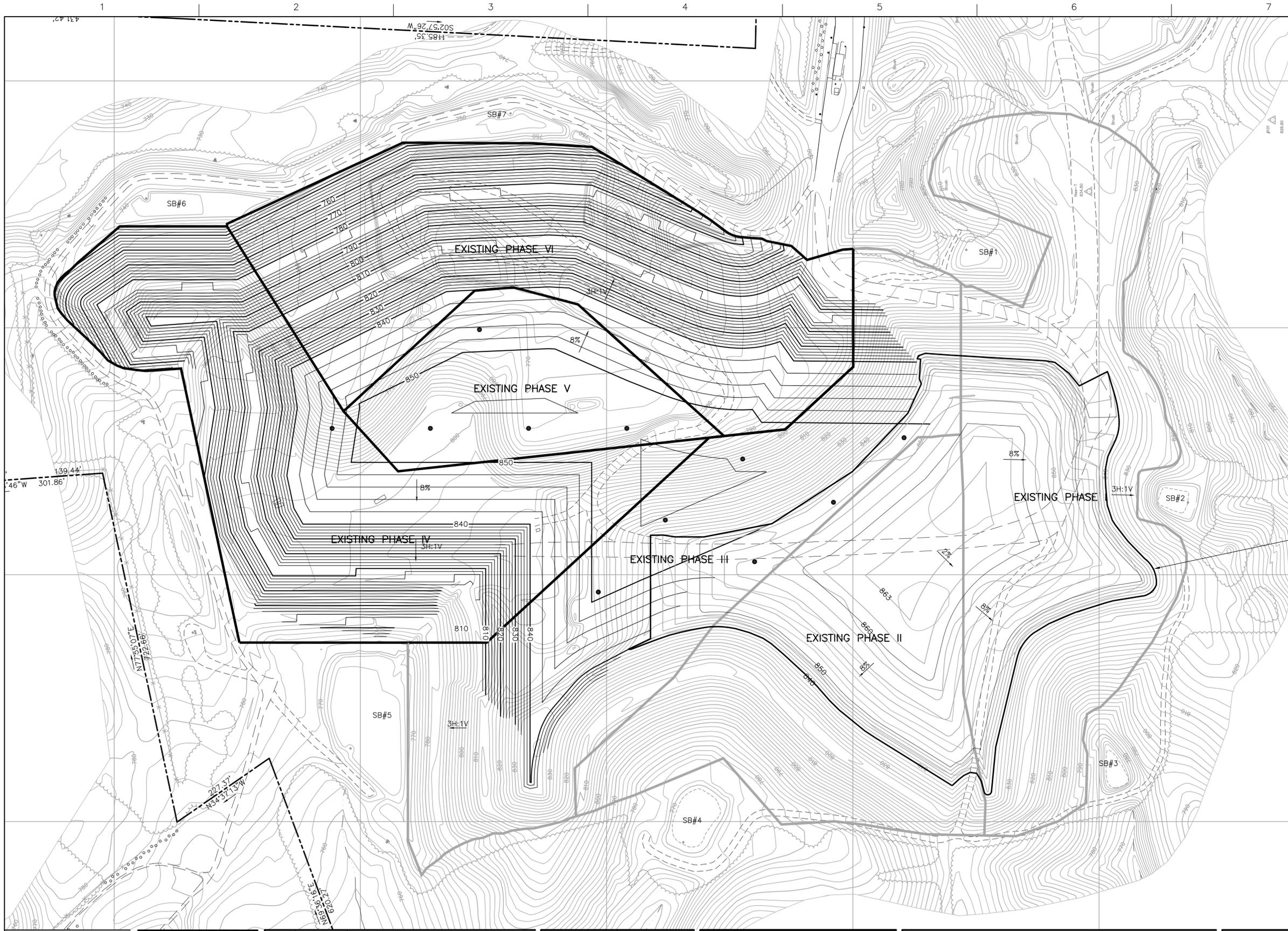
**PERMIT AMENDMENT
 OSR C&D LANDFILL**

WINSTON-SALEM NORTH CAROLINA

OVERALL SITE PLAN

FILENAME: 04C-01.dwg
 SCALE: 1"=200'

SHEET
04C-01



NOTES

1. SITE TOPOGRAPHIC INFORMATION PROVIDED BY CARTOGRAPHIC AERIAL MAPPING, INC. DATED JAN. 01, 2009.
2. PROPERTY SURVEY TAKEN FROM DATA SUPPLIED BY BRADY SURVEYING, INC. DATED MARCH 14, 1994.
3. LOCAL GOVERNMENT APPROVAL WAS GRANTED ON NOVEMBER 15, 2002 TO CHANGE THE EXTERIOR SLOPES FROM A FOUR HORIZONTAL: ONE VERTICAL TO A THREE HORIZONTAL: ONE VERTICAL.
4. PROPOSED FINAL GRADES ARE SHOWN TO TIE INTO EXISTING GRADES WHERE EXISTING GRADES WILL REMAIN PERMANENT.
5. ACTUAL LOCATION AND FREQUENCY OF PROPOSED GAS VENT WELLS TO BE DESIGNED AT THE TIME OF CLOSURE.

STOCKPILE CONTOURS

LEGEND

- EXISTING GRADE
- 840 PROPOSED FINAL GRADES
- PHASING LIMITS
- VERTICAL EXPANSION BOUNDARY
- PROPOSED GAS WELL VENT

HDR Engineering, Inc.
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128 S Tryon Street, Suite 1400 | Charlotte, NC 28202

ISSUE	DATE	DESCRIPTION
		ISSUED FOR APPROVAL

PROJECT MANAGER	E.L. SHUFFLER, P.E. M.D. PLUMMER, P.E. S. FUTRELL, E.I. J. GAUL
PROJECT NUMBER	13625-007-018



**PERMIT AMENDMENT
OSR C&D LANDFILL**

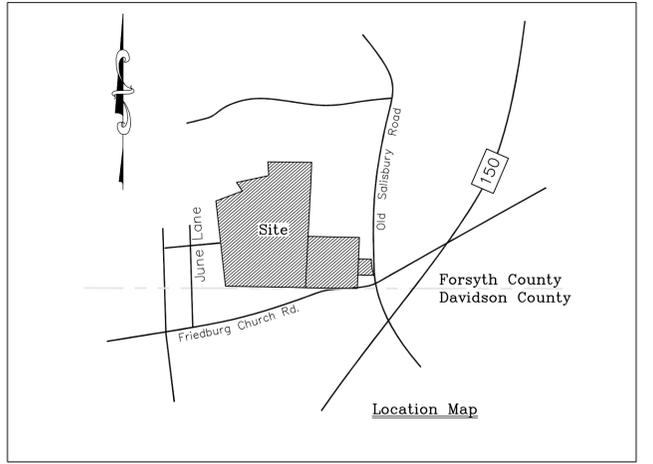
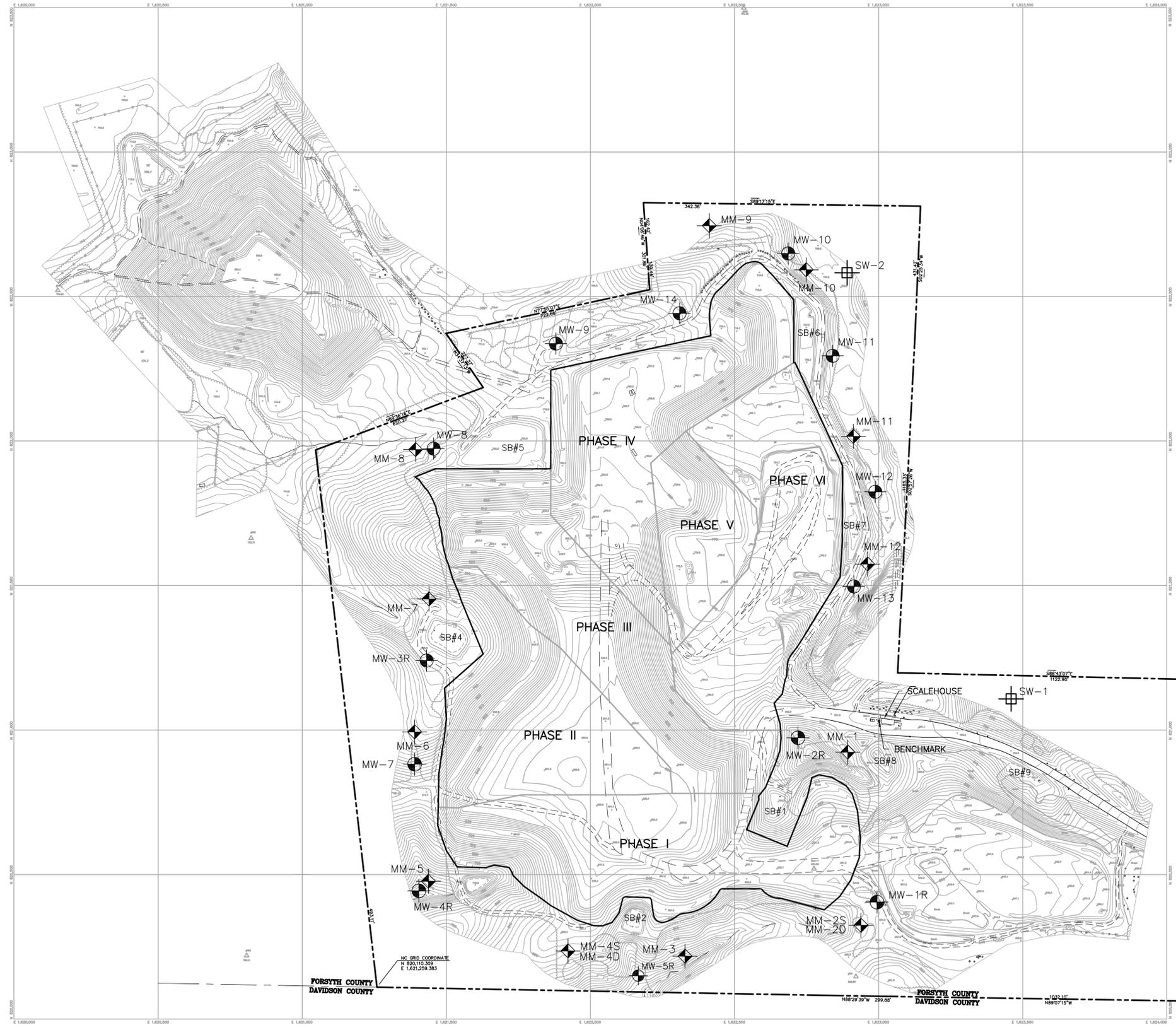
WINSTON-SALEM NORTH CAROLINA

PROPOSED FINAL CONTOURS

0 1" 2"

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SCALE 1"=100' **04C-02**

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LEGEND

	EXISTING CONTOURS
	PROPERTY BOUNDARY
	COUNTY LINE
	PROPOSED PHASING BOUNDARY
	SWAMP/STANDING WATER
	STREAM
	GROUND-WATER MONITORING WELL (EXISTING)
	SEDIMENTATION BASIN
	METHANE MONITORING PROBE (EXISTING)
	SURFACE WATER SAMPLING LOCATION

- NOTES**
- SITE TOPOGRAPHIC INFORMATION PROVIDED BY CARTOGRAPHIC AERIAL MAPPING, INC. DATED JAN. 01, 2009.
 - PROPERTY SURVEY TAKEN FROM DATA SUPPLIED BY BRADY SURVEYING, INC. DATED MARCH 14, 1994.

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HDR Engineering, Inc.
of the Carolinas

License Number: F-0116
128 S Tryon Street, Suite 1400 | Charlotte, NC 28202

ISSUE	DATE	DESCRIPTION
		ISSUED FOR APPROVAL

PROJECT MANAGER	E.L. SHUFFLER, P.E. M.D. PLUMMER, P.E. S. FUTRELL, E.I. J. GAUL
PROJECT NUMBER	-



**PERMIT AMENDMENT
OSR C&D LANDFILL**

WINSTON-SALEM NORTH CAROLINA

**EXISTING
GROUNDWATER AND METHANE
MONITORING WELL LOCATIONS**

0 1" 2"

FILENAME	O4C-03.dwg	SHEET
SCALE	1"=200'	04C-03