Fac/Perm/Co ID #	Date	Doc ID#
20-02	7,2,15	24658

AMENDMENT TO PERMIT

MUNICIPAL SOLID WASTE LANDFILL FACLITY PHASE 4

RECEIVED
JUL - 2 2015
SOLID WASTE SECTION
ASHEVILLE REGIONAL OFFICE

Permit No.: 2002-MSWLF-1998

Site Location: 10160 US Hwy 19
Marble, NC 28905

Applicant: County of Cherokee

Applicant's Address: Cherokee County Courthouse
75 Peachtree Street
Murphy, NC 28906

NORTH CAROLINA PROFESSIONAL SEAL 31020 ENGINEER STEVEN R. GANDY

7/1/2015

Project Number: G15043

June 2015

Submitted by the Garner Office of:

Municipal Services **Engineering Company, P.A.**
P.O. BOX 97 GARNER, N.C. 27529
(919) 772-5393
P.O. BOX 349 BOONE, N.C. 28607
(828) 262-1767
LICENSE NUMBER: C-0281

AMENDMENT TO PERMIT

MUNICIPAL SOLID WASTE LANDFILL FACLITY PHASE 4

Permit No.: 2002-MSWLF-1998

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SECTION 1.0

ENGINEERING PLAN

1.1 Analysis of the Facility Design and Landfill Capacity

The MSWLF unit is located a minimum of 300' from the property lines, 500' from existing wells, and 100' from any stream, river or lake, and the post settlement subbase elevation was prepared a minimum of four feet above the seasonal high groundwater table and bedrock. The landfill subgrade was adequately free of organic material and consist of *in situ* soils. The base liner system consists of a 60 mil HDPE geomembrane liner which was installed above and in direct uniform contact with a compacted clay liner.

The County will cap their landfill within 180 days after the final receipt of solid waste. The cap system will consist of 12 inches bridging material (temporary cover), 18 inches of soil liner with a permeability no greater than 1.0×10^{-5} cm/sec, 40 mil. Linear Low Density Polyethylene (LLDPE), drainage layer, 24 inches of protective/erosive layer. The cap contains gas venting system consisting of a series of washed stone trenches below the soil liner that will be vented through pipes that penetrate the cap. The cap system will also include the proper seeding and mulching of the erosive layer and other erosion control devices.

Landfill Capacity

The Life Expectancy calculations were calculated for Phases 4 of development. Phases 4 is a vertical expansions on top of the existing Phases 1, 2 and 3. Existing Phases 1and 2 are approximately 10.50 acres in size. Each successive phase will vary in size due to being able to expand onto the previously filled areas.

LIFE EXPECTANCY CALCULATIONS PHASE 4

Given:

Life expectancy based on actual air space used from FY 2014-2015, which was 17,501 cubic yards.

Life expectancy based on using 17,501 cubic yards the first year and the waste stream growing at a 2.1% rate which is the same annual rate the population had grown between 1990 and 2000.

Phase 4 = 86,817 cubic yards available = 4.67 years

Soil requirements for daily cover and final cap for Phases 4 (on top of Existing Phases 1, 2 & 3 - 10.5 ac.)

Soil needed for Daily Cover (5:1,trash:soil)	=	14,470 cubic yards
Soil needed for Closure	=	76,230 cubic yards
Overall Soil Requirements	=	90,700 cubic yards (soil needed for closure, and daily cover)

Note: All air space and soil calculation were determined by AutoCadd Civil 3D-computer program.

The estimate of maximum inventory of wastes ever on-site over the life to date of the landfill facility is 513,898 cubic yards.

Estimated schedule of closure will be approximately 20 years.

1.1.1 Base Liner System Standards

The base liner system consists of a geomembrane liner which is installed above and in direct uniform contact with a compacted clay liner.

1. The site has met the following design requirements for Landfill subgrade.

   The landfill subgrade was adequately free of organic material and consist of *in situ* soils.

2. The site has met the following material requirements for the Base Liner System.

   The soil materials used in construction of the compacted clay liner may consist of on-site sources and possessed adequate native properties . The soil was free of particles greater than 1 ½ inches in any direction.

   The compacted clay liner is 24 inches (0.61 m) thick with a permeability not to exceed 1.0×10^{-7} cm/sec.

   The geomembrane liner material is high density polyethylene geomembrane with a thickness of 60 mils., which has a demonstrated water vapor transmission rate of not more than 0.03 gm/m^2-day. The liner and seaming materials have chemical and physical resistance not adversely affected by environmental exposure, waste placement and leachate generation.

3. The site has met the following design requirements for the Leachate Collection System.

   The Leachate Collection System is designed with stone filled trenches, collection pipes and 0.6 cm double bonded drainage net that allows less than one foot of head on the liner.

   The impingement rate on the drainage layer is at least equal to the peak monthly precipitation rate.

   The geometry of the landfill controls and contains the volume of leachate generated by the 24-hour, 25-year storm.

The Leachate Collection System includes a pipe network with clean-outs and geotextile and filter fabrics.

The Leachate Collection Piping has a minimum nominal diameter of six inches.

The chemical properties of the pipe and all materials used in installation shall not be adversely affected by waste placement or leachate generated by the landfill.

The pipe provides adequate structural strength to support the maximum static and dynamic loads and stresses imposed by the overlying materials and any equipment used in construction and operation of the landfill.

The Geosynthetic filter materials have adequate permeability and soil particle retention, and chemical and physical resistance which is not adversely affected by waste placement, and overlying material or leachate generated by the landfill.

All calculations for Sliding Block Stability Analysis, Foundation Settlement Calculations, Leachate Quantity Projects, Leachate Collection System Pipe Spacing Calculations, Leachate Collection System Pipe Sizing Calculations were included in the original submittal in 1998 and permit amendments in 2004, 2005 and 2010.

1.1.2 Horizontal Separation Requirements

1. The MSWLF units are located a minimum of 300' from the property lines.
2. The MSWLF units are located a minimum of 500' from existing residences/wells.
3. The MSWLF units are located a minimum of 100' from any stream, river, or lake.

1.1.3 Vertical Separation Requirements

The MSWLF units were constructed so that post settlement bottom elevation of the base liner system is a minimum of four feet above the seasonal high ground-water table and bedrock.

1.1.4 Location Coordinates and Survey Control

Survey control coordinates are shown on the drawings and any additional information will be furnished upon request.

1.1.5 Sedimentation and Erosion Control Plan

The Sedimentation and Erosion control plan was completed for the 24-hour, 25-year storm.

1.1.6 Cap System Standards

The County will cap their landfill within 180 days after the final receipt of solid waste. The cap system will consist of 12 inches bridging material (temporary cover), 18 inches of soil liner with a permeability no greater than 1.0×10^{-5} cm/sec, 40 mil. Linear Low Density Polyethylene (LLDPE), drainage layer, 24 inches of protective/erosive layer. The cap contains a gas venting system that consists of a series of washed stone trenches below the soil liner that will be vented through pipes that penetrate the cap. The cap system will also include the proper seeding and mulching of the erosive layer and other erosion control devices.

Prior to beginning closure, the County will notify the Division of Solid Waste that a notice of the intent to close the unit has been placed in the operating record. The County will begin closure activities no later than thirty (30) days after the date on which the landfill receives the final wastes or if the landfill has remaining capacity and there is a reasonable likelihood that the landfill will receive additional wastes, no later than one year after the most recent receipt of wastes. Extensions beyond the one-year deadline for beginning closure may be granted by the Division of Solid Waste if the County demonstrates that the

landfill has the capacity to receive additional waste and the County has taken and will continue to take all steps necessary to prevent threats to human health and the environment from the closed landfill.

The County will complete closure activities in accordance with the closure plan within 180 days following the final receipt of waste. Extensions of the closure period may be granted by the Division of Solid Waste if the County demonstrates that closure will, of necessity, take longer than one hundred eighty (180) days and the County has taken and will continue to take all steps to prevent threats of human health and environment from the enclosed landfill.

Following closure of the landfill, the County will record a notation on the deed to the landfill property and notify the Division of Solid Waste that the notation has been recorded and a copy has been placed in the operating record. The notation on the deed will in perpetuity notify any potential purchaser of the property that the land has been used as a landfill and its use is restricted under the closure plan approved by the Division of Solid Waste. The County may request permission from the Division to remove the notation from the deed if all waste is removed from the landfill.

1.1.7 Leachate Storage Requirements

The County's leachate lagoon was designed with a minimum of two feet of freeboard. Odor and vector controls are practiced when necessary. A groundwater monitoring system was installed. The lagoon will be protected from external damage by an 8' high chain link fence.

The management of leachate is a major daily operational task. The generation of leachate should always be kept to a minimum. The leachate that is generated will be pumped to the Town of Andrews Waste Water Treatment Plant. The leachate that is pumped to the treatment plant will be tested according to the Pretreatment Agreement with the Town of Andrews. The reason for this testing is to assure the Town that the leachate will not harm the biological processes in their treatment facility. The County will also record rainfall events as they occur and leachate generation to track the effect rainfall amounts have on the amount of leachate that is generated.

The leachate is collected in the double lined lagoon which will hold approximately 450,446 gallons at 10 feet deep. The Lagoon is 12 feet deep which allows for 2 feet of free board. In the event that the lagoon fills up faster than it can be recirculated or pumped, the pump can be turned off at the landfill which will allow the lagoon to be drained. Once the leachate levels have been lowered, the pump can be started. Leachate will be a management problem from the time the garbage is placed in the landfill until long after closure has taken place. Consequently, it is imperative that stormwater be diverted away from any solid waste and managed properly.

All stormwater falling outside of the existing lined areas will be diverted away from the lined section through the use of diversion berms and ditches. Stormwater that falls within the lined area but does not come in contact with solid waste can be diverted to the perimeter areas of the landfill.

The County will close the leachate lagoon within 180 days after liquid collection has ceased.

All solid waste is removed from the leachate lagoon, connecting sewer lines, and manholes. All solid waste removed is properly handled and disposed of according to Federal and State requirements. All connecting lines will be disconnected and securely capped or plugged.

All waste residues, contaminated system components (composite liner system), contaminated subsoils, structures and equipment contaminated with waste will be removed and appropriately disposed. If the groundwater surrounding the impoundment is contaminated, other corrective actions to remediate a contaminant plume may be required by the Department. If the groundwater surrounding the lagoon is found not to be contaminated, the liner system may remain in place if drained and cleaned to remove all traces of waste, and both liners punctured so that drainage is allowed. The lagoon is to be backfilled and re-graded to the surrounding topography.

1.1.8 Foundation, Settlement, and Slope Stability Analysis

All calculations for Sliding Block Stability Analysis, Foundation Settlement Calculations were submitted and approved with previous submittals and can be found in Section 1.3 of this submittal.

1.1.9 Applicable Location Restriction Demonstrations

All location restrictions were handled in the site study.

1.2 Summary of the Facility Design

Several factors were looked at in the design and stability of the landfill. The first is earthwork calculations to see if the facility will need to borrow material from another source. 14,470 cubic yards of soil will be needed for daily cover and an additional 76,230 cubic yards will be needed for closure.

HELP Model Summary

A Model, "Hydrologic Evaluation of Landfill Performance" (HELP) has been performed to simulate precipitation and leachate generation under certain conditions. The analysis was done through the landfill with 8 ft. of solid waste with no runoff for the 1st year of operation and with 25 ft. of solid waste with no runoff for the 1st through the 5th year of operation. Simulation was also done on a closed landfill. The peak daily head on the liner of 0.532 inches occurs after 1 year of operation with 8 ft. of solid waste and no surface runoff. The peak daily head on the liner for the 1st five years is 0.421 inches. The drainage layer (layer 5) is a double bonded 250 mil thick drainage net.

Leachate Collection System Calculations Summary

The leachate collection system consists of a 250 mil double bonded drainage net that is the drainage layer, stone filled trenches and collection pipes.

Calculations were performed for the Leachate Collection Pipes. The calculation used Manning's equation and the orifice equation to determine the adequacy of the leachate piping system to drain the leachate. The system adequately drains the 24hr 25yr storm.

Strength of the HDPE leachate pipe calculations have been done. The SDR 17 HDPE pipe can handle the loads created by up to 250' of waste.

Liner System Calculation Summary

Several calculations were done for the stress during construction on the textured flexible geomembrane liner. The thermal stress on the liner created by the temperature changing 100°F is 0.67% which was well within the 13% elongation yield limit. The self-weight stress on the textured flexible geomembrane liner shows that on a 3:1 slope the total length of slope allowed far exceeds the longest slope design.

The Anchor trench was analyzed and the design depth of the Anchor trench is 4.0 ft. which allows pullout just prior to liner failure. An analysis of the drainage net for anchor trench requirements was analyzed and no anchor trench was required; however, the drainage net will be placed in the same anchor trench as the flexible membrane liner.

The factor of safety for the sliding of the protective soil cover was analyzed showing a factor of safety greater than 1 for the interface between the soil and double bonded drainage net. The stresses due to the placement of protective cover were also analyzed. Soil placed on the 3:1 embankment 50 ft. high does not affect the drainage net or the liner. The soil was buttressed enough at the base to have a negative effect on the slopes.

The geotechnical evaluation report by ECS, LTD. states that the proposed plan is suitable and falls within acceptable safety factors. The report is located in Section 1.3.

1.3 Foundation, Settlement, and Slope Stability Analysis

ECS CAROLINAS, LLP
"Setting the Standard for Service"
Geotechnical • Construction Materials • Environmental • Facilities NC Registered Engineering Firm F-1078

January 12, 2010

Mr. Wayne Sullivan, PLS
Municipal Engineering Services Co. PA
The Corporate Center
1140 Benson Highway, Suite 220
Garner, NC 27529

RE: Report of Geotechnical Engineering Services
Cherokee County Municipal Landfill – 3 to 1 Fill Slope Evaluation
US Highway 19/74/129
Marble, North Carolina
ECS Report Number: 06.16804

Dear Mr. Sullivan:

ECS Carolinas, LLP (ECS) has completed the geotechnical slope stability analysis for the proposed updated maximum fill slopes for Cherokee County Landfill as requested by Municipal Engineering Services Company, PA (MESCO). The proposed landfill slopes are at 3 horizontal to 1 vertical (3H:1V), compared to the original design of 4H:1V.

Project Information

Based on the proposed finished grades and the section provided by MESCO we understand that the maximum waste height will be approximately 100 feet. The permanent side slopes for the cap will have an inclination of 3H:1V.

ECS has been provided with boring logs performed by others. Selected boring logs are included in Appendix A, along with Figure 1 showing the site location and Figure 2 showing the approximate boring locations and slope stability sections. The Cherokee County Landfill lies in the Murphy Belt of North Carolina, and the soils generally consist of medium dense to very dense silty SANDS and sandy SILTS, overlying metamorphic rock. Groundwater was encountered within most of the borings ranging from approximately 13 to 103 feet below the prevailing ground surface.

Engineering Analyses

Analyses were performed to determine global slope stability of the landfill. These analyses were based on the design drawings provided by MESCO. Shear strength and compressibility of the soil were estimated based on the soil descriptions on the provided boring logs and our previous experience. The analyses were performed by engineers specializing in geotechnical engineering and copies of the slope stability analyses are attached in Appendix B.

The waste fill and perimeter embankment were evaluated for slope stability analysis using circular potential failure mechanism. Two sections were selected for the stability analysis, which is considered representative of the most unfavorable conditions. The locations of the analyzed sections are shown on the Slope Stability Location Diagram in Appendix A. The slope stability analysis was performed using the proprietary Slide 5.0 computer program. The modeled slope configuration was based on the topographic information and site grading plan provided to us by MESCO, while the soil strata information, index properties and engineering properties used in these analyses were estimated based on the soil descriptions on the provided preliminary boring logs and our previous experience. For the pseudostatic analysis of the slope, we used an earthquake ground motion having a 2-percent probability of exceedance within a 50-year period (2,475 year return period).

The factors of safety were determined for both static and seismic loading, using the pseudo-static method. According to the USGS Map, Oct 2002, the seismic acceleration at the bed rock level based on the probabilistic earthquake (2,475 year return period) for this site is 0.26g. The seismic coefficient, k_s, for the site is 0.13g.

The resulting factors of safety were computed to exceed 1.5 for permanent slopes under static loading conditions and more than 1.1 for seismic conditions. The results of the slope stability analyses are presented in Appendix B.

In conclusion, the results of the geotechnical analysis indicate that the 3H: 1V (permanent) slope configuration will be stable and provide an adequate factor of safety.

This report has been prepared in order to aid in the evaluation of this property and to assist the architect and/or engineer in the design of this project. The scope is limited to the specific project and locations described herein and our description of the project represents our understanding of the significant aspects relative to soil and foundation characteristics. In the event that any changes in the nature or location of the proposed construction outlined in this report are planned, we should be informed so that the changes can be reviewed and the conclusions of this report modified or approved in writing by the geotechnical engineer. It is recommended that all construction operations dealing with earthwork and foundations be reviewed by an experienced geotechnical engineer to provide information as to whether the design requirements are fulfilled in the actual construction. If you wish, we would welcome the opportunity to provide field construction services for you during construction.

The data submitted in this report are based upon the information obtained from the soil borings and tests performed by others at the locations as indicated on the information referenced in this report. This report does not reflect any variations which may occur between the borings. In the performance of the subsurface exploration, specific information is obtained at specific locations at specific times. However, it is a well known fact that variations in soil conditions exist on most sites between boring locations and also such situations as groundwater levels vary from time to time. The nature and extent of variations may not become evident until the course of construction. If site conditions vary from those identified during the explorations, the recommendations contained in this report may require revision.

Thank you for the opportunity to work with you on this project. Should you have any questions or if we could be of further assistance, please do not hesitate to contact us.

Respectfully,

ECS CAROLINAS, LLP represented by:
Firm License No. F-1078

Heather A. Hickerson, PE
Geotechnical Project Manager
NC PE License No. 035100

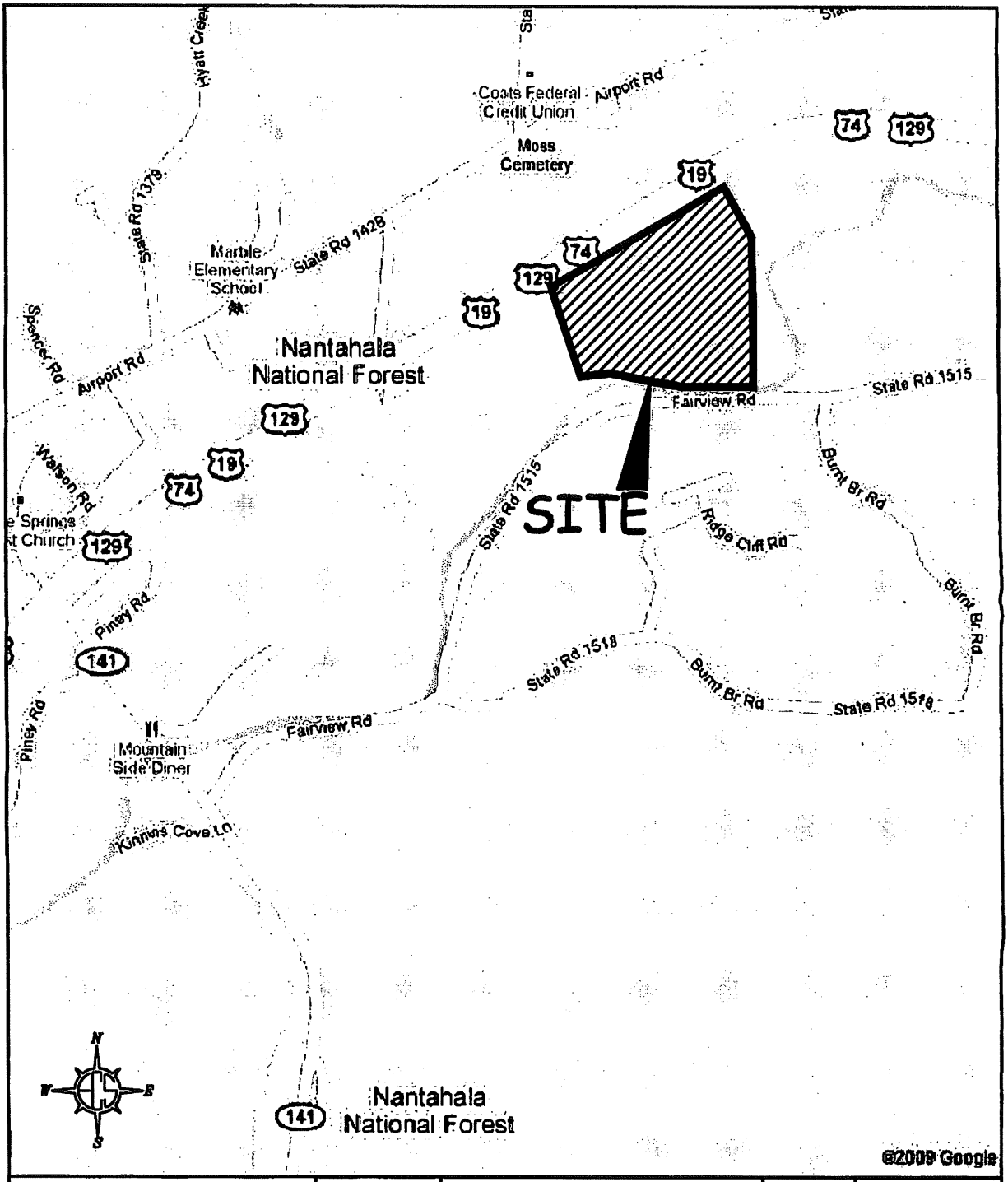
C. (Nathan) Nallainathan, PE
Principal Engineer
NC PE License No. 019937

APPENDICES

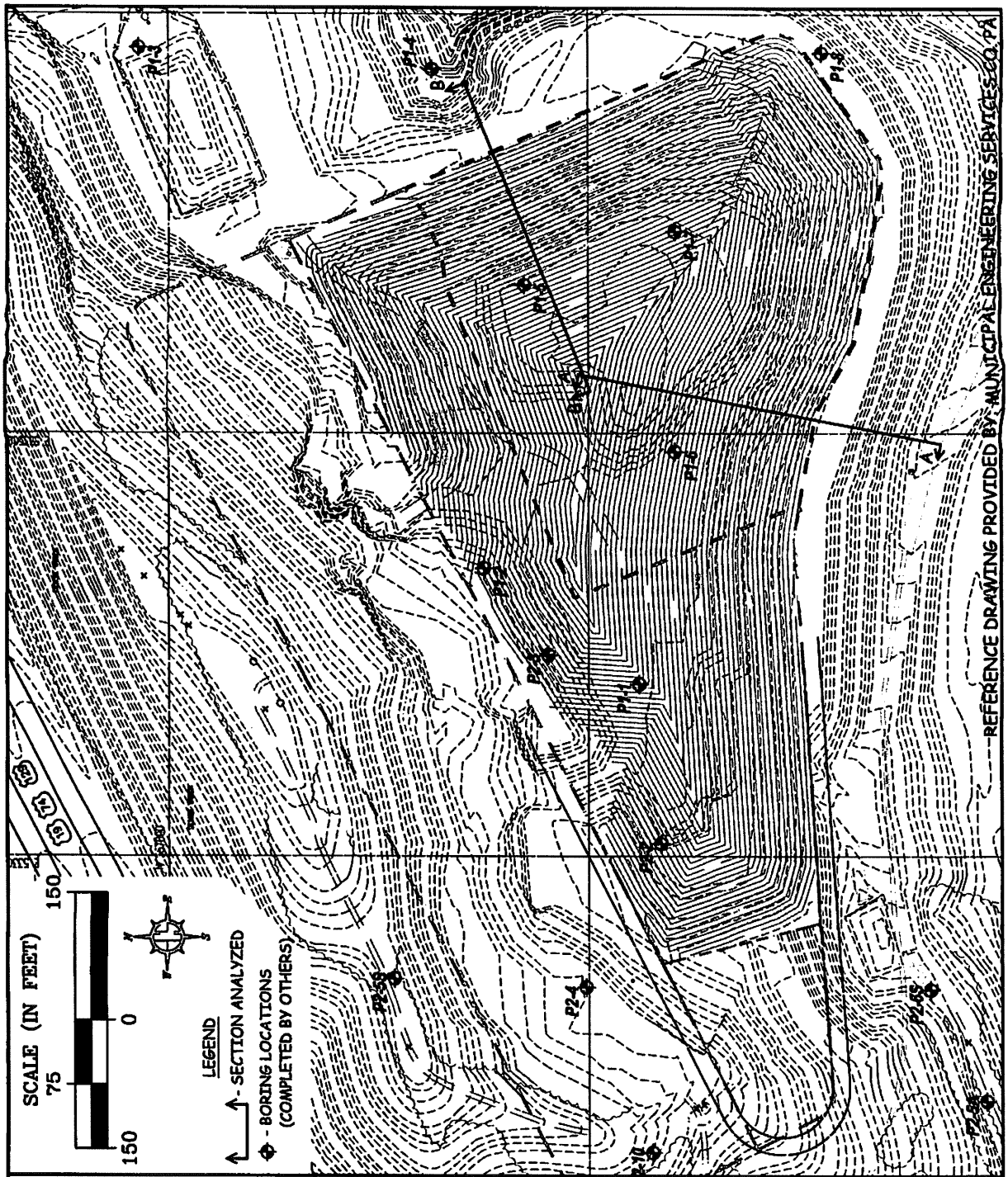
APPENDIX A

FIGURES &

SELECTED BORING LOGS



VICINITY MAP	ECS LLP CAROLINAS SETTING THE STANDARD FOR SERVICE	**CHEROKEE COUNTY MUNICIPAL LANDFILL**	ENGINEER HAH	SCALE NTS
		U.S. HIGHWAY 19/74/129	DRAFTSMAN DAH	PROJECT NO. 06:16804
MUNICIPAL ENGINEERING SERVICES CO.		**MARBLE, NORTH CAROLINA**	REVISIONS	SHEET FIGURE 1
				DATE 1-11-10


REFERENCE DRAWING PROVIDED BY: MUNICIPAL ENGINEERING SERVICES CO. PA
SCALE (IN FEET)
150
75
0
150
LEGEND
A - SECTION ANALYZED
- BORING LOCATIONS (COMPLETED BY OTHERS)
APPROXIMATE SLOPE STABILITY
LOCATION DIAGRAM
MUNICIPAL ENGINEERING SERVICES CO.
ECS LLP
CAROLINAS
SETTING THE STANDARD FOR SERVICE
CHEROKEE COUNTY MUNICIPAL LANDFILL
U.S. HIGHWAY 19/74/129
MARBLE, NORTH CAROLINA
ENGINEER HAH
DRAFTSMAN DAH
REVISIONS
SCALE 1"=150'
PROJECT NO. 06:16804
SHEET FIGURE 2
DATE 1-11-10

LOG OF BORING NO. P1-1

PROJECT : Cherokee County Lined Landfill
Marble, North Carolina

JOB NO.: 96101.02

TYPE : HSA; SS, NX, RB

LOCATION : see Plan

DEPTH (FT)	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	WATER CONTENT %	LIQUID LIMIT	PLASTIC LIMIT	COHESION LB / SQ FT PENETRO-METER	COHESION LB / SQ FT UNCONFINED COMPRESSION	RECOVERY, %	RQD, %
			1.5 ft of soil removed for drilling platform									
			Topsoil, 2 inches									
			CLAYEY SILT (ML); Tan, moist, firm, with sand, trace gravel and organics	5		21	35	25				
5			SANDY SILT (ML); Tan, moist, medium dense	13								
10			-grades dense	35								
15			-grades very dense	66/9		22	27	27				
20			-grades brown and white, dense	47								
			Auger Refusal at 23 feet									
25			SCHIST; Gray, iron-stained, medium hard to soft, highly weathered and fractured, fine grained, with mica garnet and/or amphibole, some silt and sandy silt zones								75	0
											83	0
30			-fractures 40 degrees									
35											85	0
											20	0
40			-vertical seams									
			Boring continued on next plate									

COMPLETION DEPTH: 45.0 ft

DEPTH TO WATER IN BORING: 36 ft WD; 28.2 ft AD; 34.9 ft 24 hrs AD

DATE: 5-20-96

GAI CONSULTANTS

PLATE A-4

LOG OF BORING NO. P1-1 (cont)

PROJECT : Cherokee County Lined Landfill
Marble, North Carolina

JOB NO.: 96101.02

TYPE : HSA; SS, NX, RB

LOCATION : see Plan

DEPTH (FT)	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	WATER CONTENT %	LIQUID LIMIT	PLASTIC LIMIT	COHESION LB / SQ FT PENETRO-METER	COHESION LB / SQ FT UNCONFINED COMPRESSION	RECOVERY, %	RQD, %
			-fractures 50 to 80 degrees, foliation 80 degrees, grades gneissic, iron-stained, pitted, with coarse megacrysts								60	18
45			End of Boring									
50												
55												
60												
65												
70												
75												
80												

COMPLETION DEPTH: 45.0 ft **DEPTH TO WATER IN BORING:** 36 ft WD; 28.2 ft AD; 34.9 ft 24 hrs AD

DATE: 5-20-96

GAI CONSULTANTS

PLATE A-5

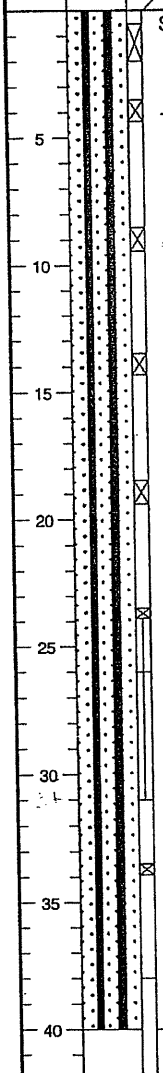
LOG OF BORING NO. P1-2

PROJECT: Cherokee County Lined Landfill
Marble, North Carolina

JOB NO.: 96101.02

TYPE: HSA; SS, NX, DB

LOCATION: see Plan



DEPTH (FT)	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	WATER CONTENT %	LIQUID LIMIT	PLASTIC LIMIT	COHESION LB / SQ FT PENETRO-METER	COHESION LB / SQ FT UNCONFINED COMPRESSION	RECOVERY, %	RQD, %
	SANDY SILT (ML); Tan, moist, dense	47		19						
5	-grades very dense	50/4								
10	-grades trace gravel	50/5		16						
15	-grades brown	50/4								
20		50/5		15						
25	Auger Refusal at 23.9 feet -grades brown and gray, with rock fragments	Ref/5							30 20	0 0
30	-drilled with drag bit below 31 feet									
35	-grades dark brown	Ref/5								
40		Ref/0								
	Boring continued on next plate									

COMPLETION DEPTH: 68.0 ft **DEPTH TO WATER IN BORING:** 59.2 ft WD; 42.6 ft AD; 45.1 ft 24 hrs AD

DATE: 5-14-96

GAI CONSULTANTS

PLATE A-6

LOG OF BORING NO. P1-2 (cont)

PROJECT : Cherokee County Lined Landfill
Marble, North Carolina

JOB NO.: 96101.02

TYPE : HSA; SS, NX, DB

LOCATION : see Plan

DEPTH (FT)	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	WATER CONTENT %	LIQUID LIMIT	PLASTIC LIMIT	COHESION LB / SQ FT PENETRO-METER	COHESION LB / SQ FT UNCONFINED COMPRESSION	RECOVERY, %	RQD, %
			Drag Bit Refusal at 43 feet									
45			SCHIST; Gray, iron-stained, medium hard, weathered and highly fractured, fine grained, with mica, garnet and/or amphibole, pyrite -fractures 0 to 40 degrees								48	0
											100	28
											100	34
50												
			-fractures 0 to 60 degrees								100	59
55			-fractures 0 to 40 degrees								80	43
											100	58
60			-fractures 0 to 30 degrees								100	20
											91	76
65												
			End of Boring									
70												
75												
80												

COMPLETION DEPTH: 68.0 ft

DEPTH TO WATER IN BORING: 59.2 ft WD; 42.6 ft AD; 45.1 ft 24 hrs AD

DATE: 5-14-96

GAI CONSULTANTS

PLATE A-7

LOG OF BORING NO. P1-3

PROJECT : Cherokee County Lined Landfill
Marble, North Carolina

JOB NO.: 96101.02

TYPE : HSA; SS, ST, DB

LOCATION : see Plan

DEPTH (FT)	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	WATER CONTENT %	LIQUID LIMIT	PLASTIC LIMIT	COHESION LB / SQ FT PENETRO-METER	COHESION LB / SQ FT UNCONFINED COMPRESSION	RECOVERY, %	RQD, %
			Topsoil, 6 inches									
			CLAYEY SILT (ML-MH); Red, moist, stiff, trace gravel	12		27						
5			-grades very stiff	20								
					97	29						
10			-grades less gravel	19		29						
			SANDY SILT (ML); Brown tan, moist, medium dense, coarse, with gravel and rock fragments	17								
20			-grades brown and black, very dense	90/11		21	35	35				
25				66								
30			-grades tan, wet, fine, less gravel	75/11		12						
35				53								
40			-grades saturated	1		28						
			Boring continued on next plate									

COMPLETION DEPTH: 52.0 ft **DEPTH TO WATER IN BORING:** 39.5 ft WD; 34.5 ft AD; 35.3 ft 24 hrs AD

DATE: 4-25-96

GAI CONSULTANTS

PLATE A-8

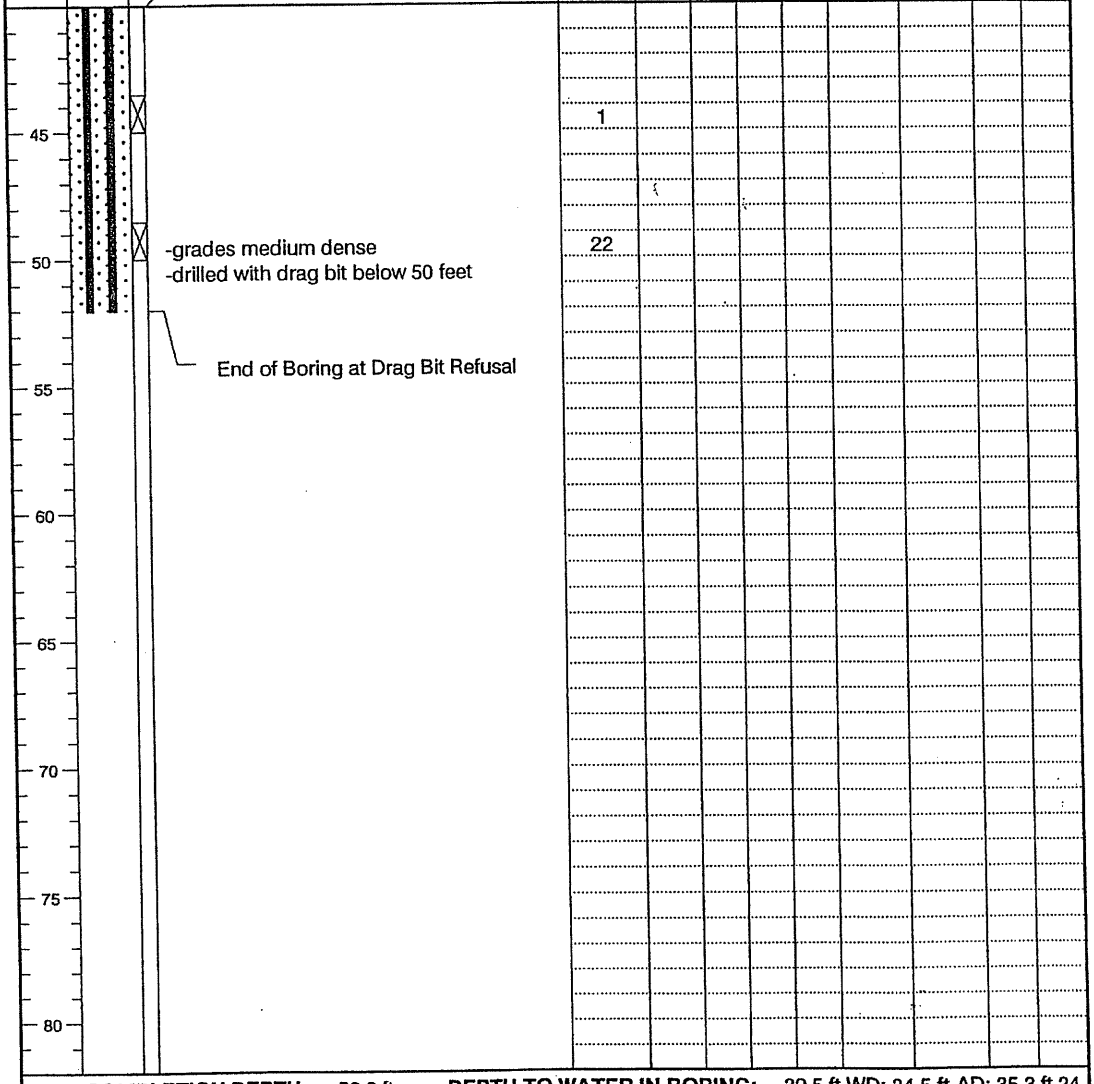
LOG OF BORING NO. P1-3 (cont)

PROJECT : Cherokee County Lined Landfill
Marble, North Carolina

JOB NO.: 96101.02

TYPE : HSA; SS, ST, DB

LOCATION : see Plan



COMPLETION DEPTH: 52.0 ft

DEPTH TO WATER IN BORING: 39.5 ft WD; 34.5 ft AD; 35.3 ft 24 hrs AD

DATE: 4-25-96

GAI CONSULTANTS

PLATE A-9

LOG OF BORING NO. P1-4

PROJECT : Cherokee County Lined Landfill
Marble, North Carolina

JOB NO.: 96101.02

TYPE : HSA; SS

LOCATION : see Plan

DEPTH (FT)	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	WATER CONTENT %	LIQUID LIMIT	PLASTIC LIMIT	COHESION LB / SQ FT PENETRO-METER	COHESION LB / SQ FT UNCONFINED COMPRESSION	RECOVERY, %	RQD, %
			2 ft of fill placed for drilling platform									
			CLAYEY SILT (ML); Dark brown, moist, firm, trace gravel	4								
5			-grades tan, with fine sand	5		35						
10			-grades red									
			SILTY SAND (SM); Brown and black, wet, loose, fine, with gravel	8								
15			-grades brown, saturated, very dense	Ref/5								
20			End of Boring at Auger Refusal									
25												
30												
35												
40												

COMPLETION DEPTH: 18.5 ft

DEPTH TO WATER IN BORING: 14.3 ft WD; 15.3 ft AD; 13.4 ft 24 hrs AD

DATE: 5-8-96

GAI CONSULTANTS

PLATE A-10

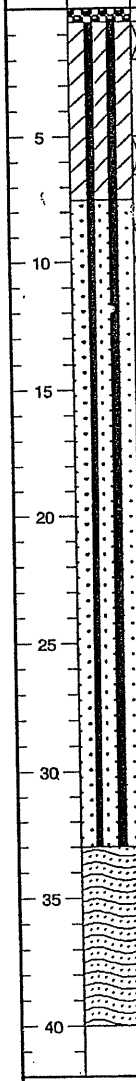
LOG OF BORING NO. P1-5

PROJECT : Cherokee County Lined Landfill
Marble, North Carolina

JOB NO.: 96101.02

TYPE : HSA; SS, NX, RB

LOCATION : see Plan



DEPTH (FT)	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	WATER CONTENT %	LIQUID LIMIT	PLASTIC LIMIT	COHESION LB / SQ FT: PENETRO-METER	COHESION LB / SQ FT: UNCONFINED COMPRESSION	RECOVERY, %	RQD, %
		Topsoil, 6 inches									
		CLAYEY SILT (MH); Red, moist, stiff	15								
5		-grades very stiff, some gravel	26		24						
		SANDY SILT (ML); Red, moist, medium dense, fine, some gravel	20								
10		-grades tan, very dense	50/3		17						
15											
			50/3								
20											
			50/4			31	31				
25											
		-grades saturated	50/5								
30		Auger Refusal at 33 ft									
		SCHIST; Gray, medium hard, slightly weathered, with mica, quartz, garnet, and pyrite								100	45
35		-fractures 60 degrees								100	100
40		Boring continued on next plate									

COMPLETION DEPTH: 62.0 ft

DEPTH TO WATER IN BORING: 30.4 ft WD; 27.0 ft AD; 27.3 ft 24 hrs AD

DATE: 4-26-96

GAI CONSULTANTS

PLATE A-11

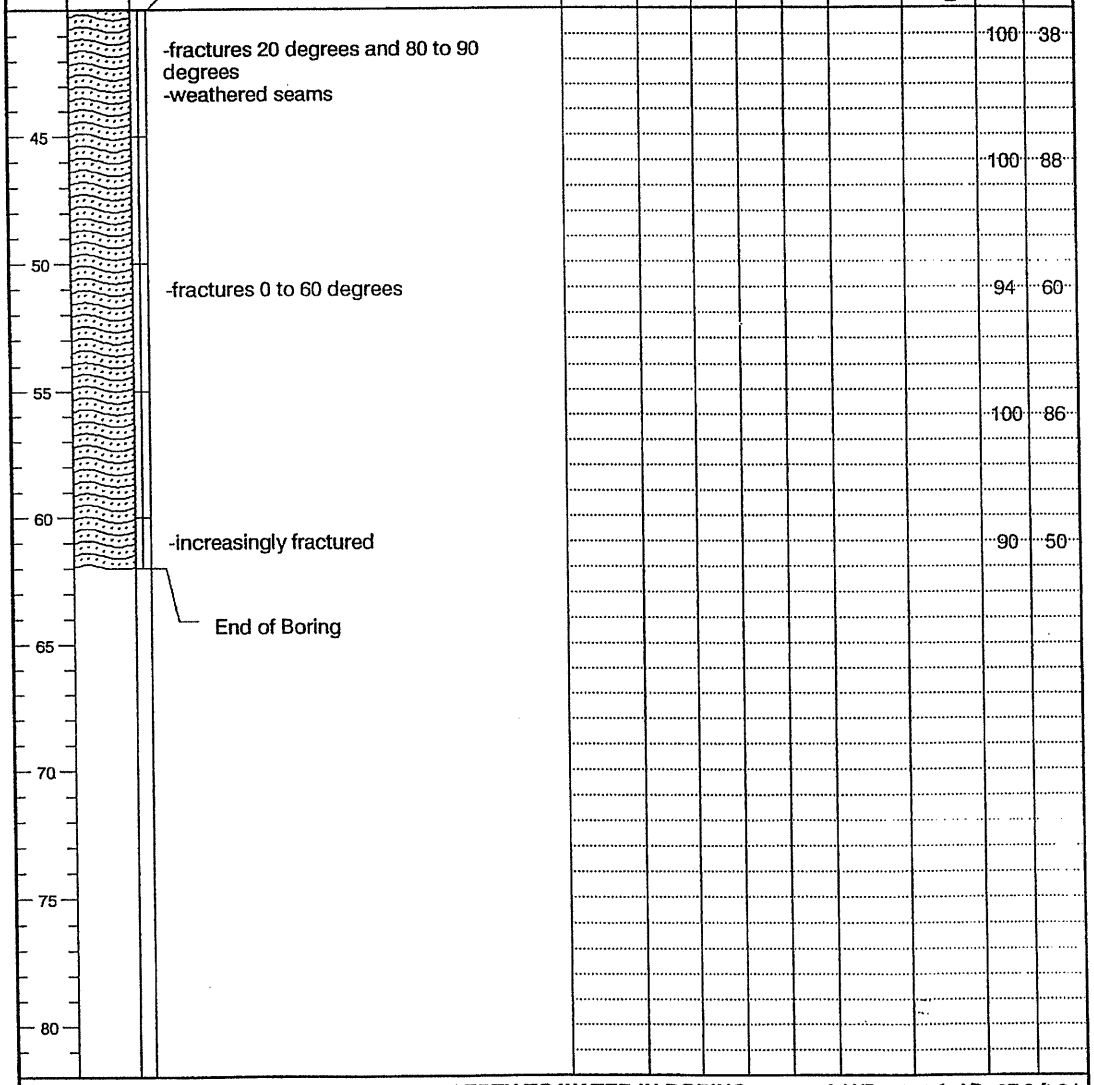
LOG OF BORING NO. P1-5 (cont)

PROJECT.: Cherokee County Lined Landfill
Marble, North Carolina

JOB NO.: 96101.02

TYPE : HSA; SS, NX, RB

LOCATION : see Plan



COMPLETION DEPTH: 62.0 ft

DEPTH TO WATER IN BORING: 30.4 ft WD; 27.0 ft AD; 27.3 ft 24 hrs AD

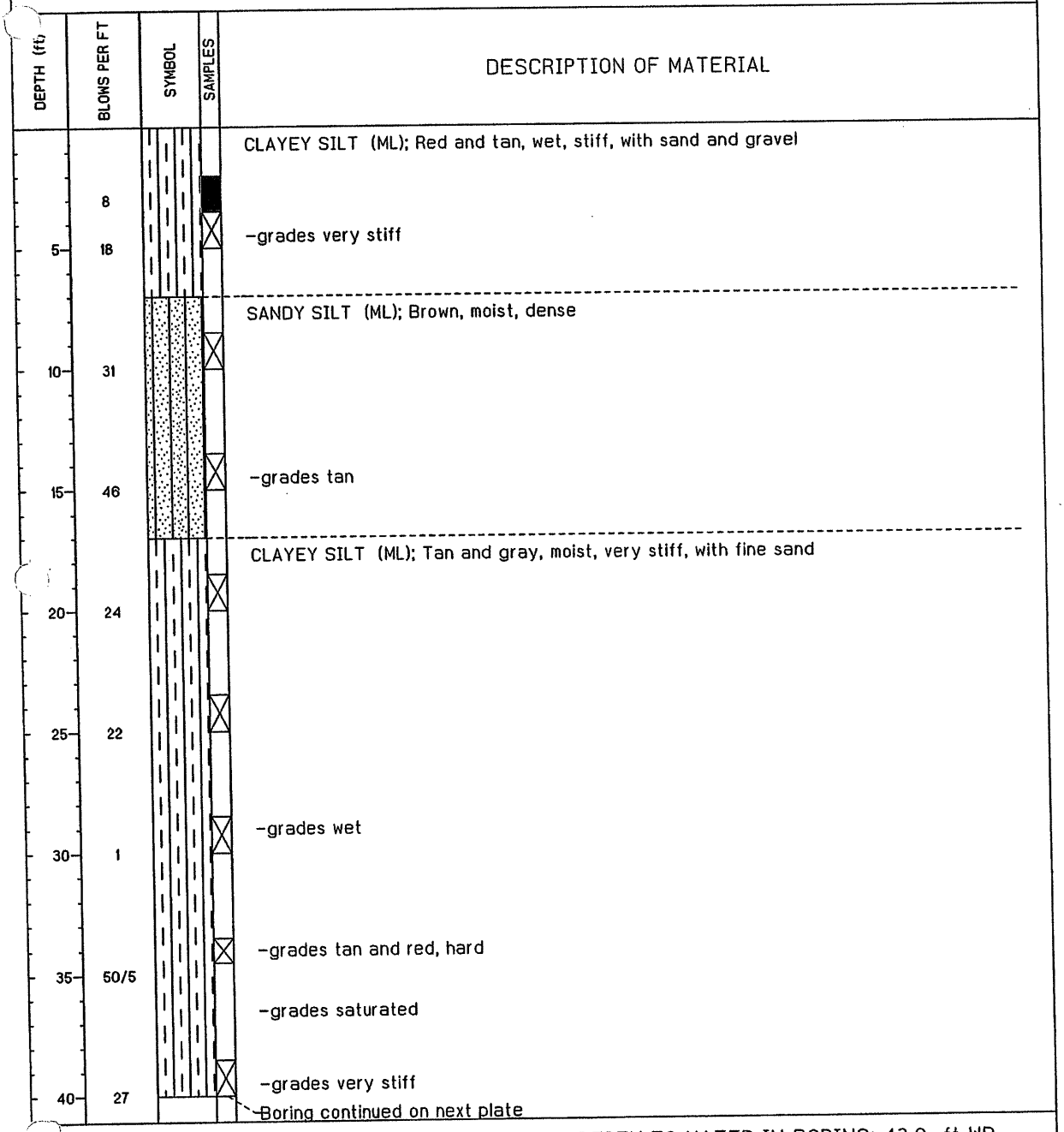
DATE: 4-26-96

GAI CONSULTANTS

PLATE A-12

LOG OF BORING NO. P1-6 (modified)

PROJECT: CHEROKEE COUNTY LINED LANDFILL
JOB NO.: 96101.02
TYPE: HSA; SS, ST, NX, DB
LOCATION: see Plan



COMPLETION DEPTH: 107.5 ft
DATE: 5-1-96

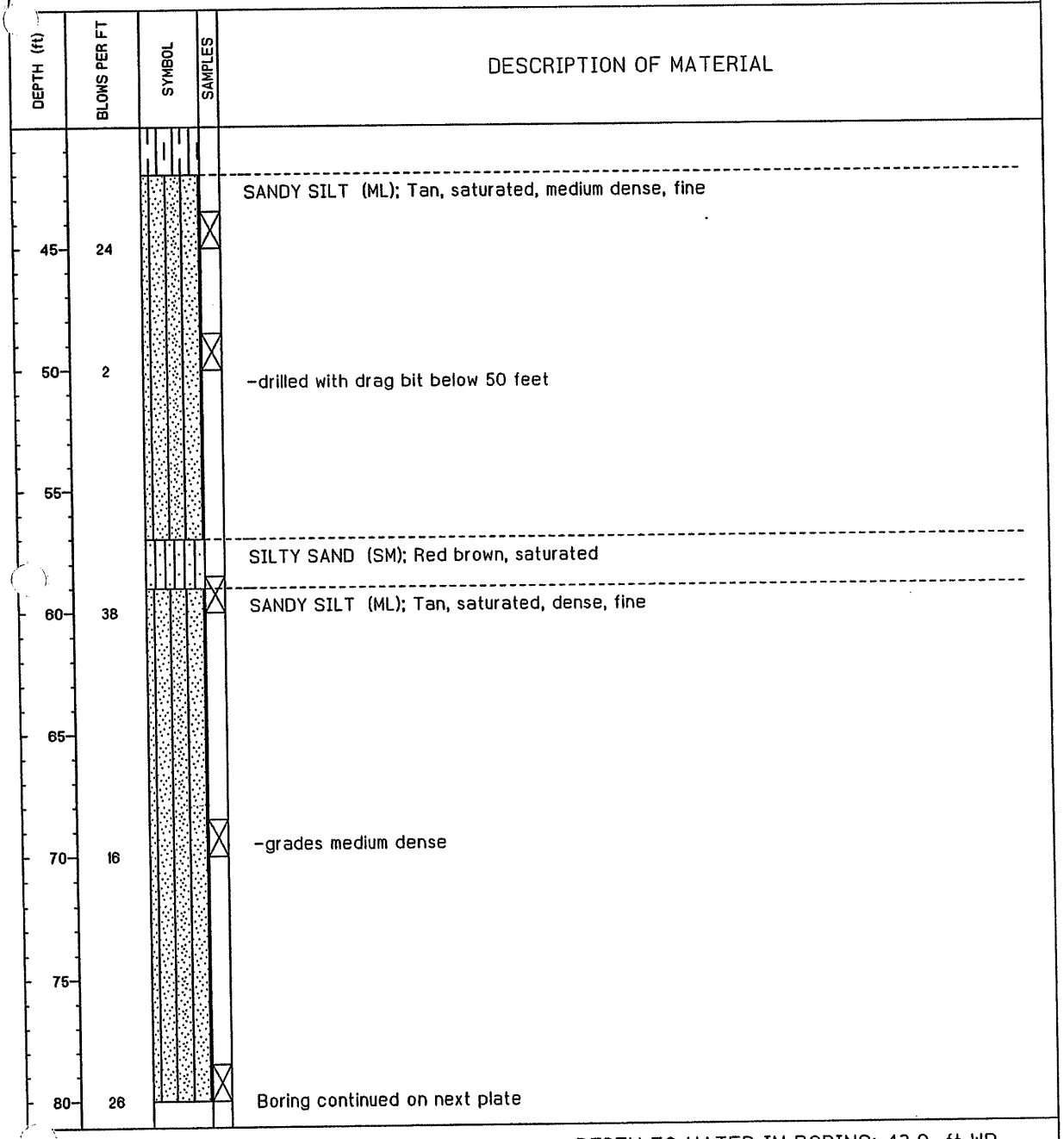
DEPTH TO WATER IN BORING: 43.0 ft WD
35.7 ft AD; 36.4 ft 24 hrs AD

MUNICIPAL ENGINEERING SERVICES COMPANY, P.A.

LOG OF BORING NO. P1-6 (modified)

PROJECT: CHEROKEE COUNTY LINED LANDFILL
JOB NO.: 96101.02

TYPE: HSA; SS, ST, NX, DB
LOCATION: see Plan



COMPLETION DEPTH: 107.5 ft
DATE: 5-1-96

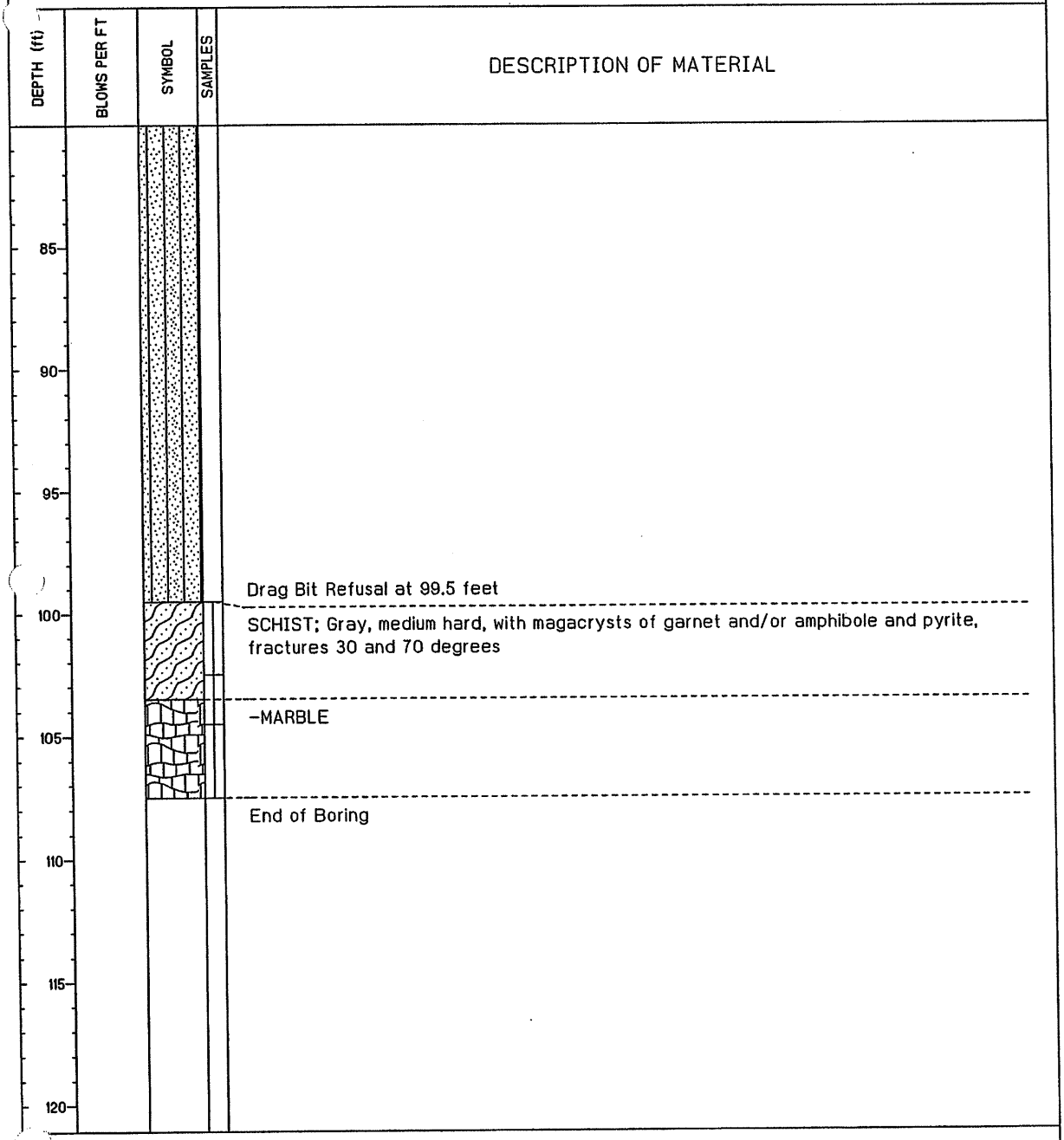
DEPTH TO WATER IN BORING: 43.0 ft WD
35.7 ft AD; 36.4 ft 24 hrs AD

MUNICIPAL ENGINEERING SERVICES COMPANY, P.A.

LOG OF BORING NO. P1-6 (modified)

PROJECT: CHEROKEE COUNTY LINED LANDFILL — JOB NO.: 96101.02

TYPE: HSA; SS, ST, NX, DB — LOCATION: see Plan



COMPLETION DEPTH: 107.5 ft — DEPTH TO WATER IN BORING: 43.0 ft WD

DATE: 5-1-96 — 35.7 ft AD; 36.4 ft 24 hrs AD

MUNICIPAL ENGINEERING SERVICES COMPANY, P.A.

LOG OF BORING NO. P1-7

PROJECT: Cherokee County Lined Landfill
Marble, North Carolina

JOB NO.: 96101.02

TYPE: HSA; SS, DB

LOCATION: see Plan

DEPTH (FT)	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	WATER CONTENT %	LIQUID LIMIT	PLASTIC LIMIT	COHESION LB / SQ FT PENETRO-METER	COHESION LB / SQ FT UNCONFINED COMPRESSION	RECOVERY, %	RQD, %
			Topsoil, 3 inches									
			CLAYEY SILT (ML-MH); Red, moist, stiff	8		28	49	33				
			-grades very stiff	21								
5												
			-grades hard	40		29	54	41				
10												
			CLAYEY SILT (ML); Tan red, moist, very stiff, with sand and gravel	18		21						
15												
			SANDY SILT (ML); Tan, moist, very dense, some gravel	67/11		18						
20												
			-grades medium dense	23								
25												
			-grades light brown and gray, dense, less gravel	49		20						
30												
			-grades light brown, medium dense	23								
35												
			CLAYEY SILT (ML); Light brown, moist, hard	38		17						
40			Boring continued on next plate									

COMPLETION DEPTH: 90.0 ft **DEPTH TO WATER IN BORING:** 43.4 ft AD; 43.0 ft 24 hrs AD

DATE: 5-7-96

GAI CONSULTANTS

PLATE A-16

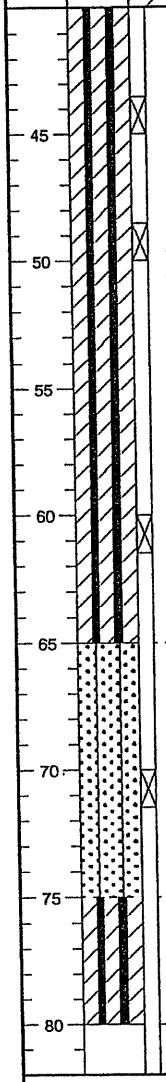
LOG OF BORING NO. P1-7 (cont)

PROJECT : Cherokee County Lined Landfill
Marble, North Carolina

JOB NO.: 96101.02

TYPE : HSA; SS, DB

LOCATION : see Plan



DEPTH (FT)	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	WATER CONTENT %	LIQUID LIMIT	PLASTIC LIMIT	COHESION LB / SQ FT: PENETRO-METER	COHESION LB / SQ FT: UNCONFINED COMPRESSION	RECOVERY, %	RQD, %
				62								
			-grades brown and gray, saturated -drilled with drag bit below 50 feet	2		22						
			-grades light brown, very stiff	21								
			SILTY SAND (SM); Tan, saturated, very dense, coarse, with clay	83								
			CLAYEY SILT (ML); Gray, saturated, very stiff									
			Boring continued on next plate									

COMPLETION DEPTH: 90.0 ft **DEPTH TO WATER IN BORING:** 43.4 ft AD; 43.0 ft 24 hrs AD

DATE: 5-7-96

GAI CONSULTANTS

PLATE A-17

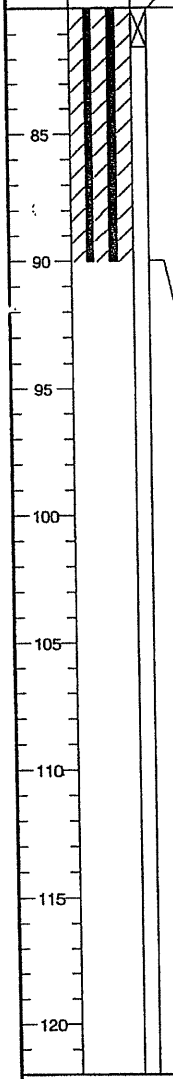
LOG OF BORING NO. P1-7 (cont)

PROJECT : Cherokee County Lined Landfill
Marble, North Carolina

JOB NO.: 96101.02

TYPE : HSA; SS, DB

LOCATION : see Plan



DEPTH (FT)	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	WATER CONTENT %	LIQUID LIMIT	PLASTIC LIMIT	COHESION LB / SQ FT: PENETRO-METER	COHESION LB / SQ FT: UNCONFINED COMPRESSION	RECOVERY, %	RQD, %
				24								

COMPLETION DEPTH: 90.0 ft **DEPTH TO WATER IN BORING:** 43.4 ft AD; 43.0 ft 24 hrs AD

DATE: 5-7-96

GAI CONSULTANTS

PLATE A-18

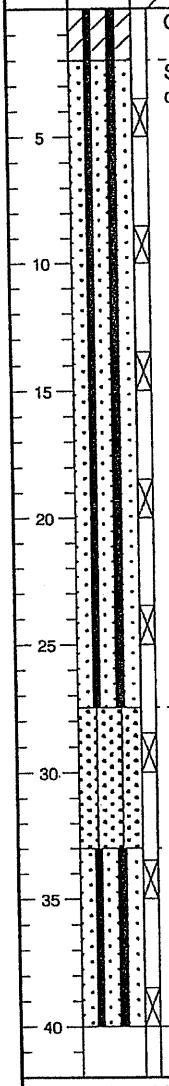
LOG OF BORING NO. P1-8

PROJECT : Cherokee County Lined Landfill
Marble, North Carolina

JOB NO.: 96101.02

TYPE : HSA; SS

LOCATION : see Plan



DEPTH (FT)	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	WATER CONTENT %	LIQUID LIMIT	PLASTIC LIMIT	COHESION LB / SQ FT PENETRO-METER	COHESION LB / SQ FT UNCONFINED COMPRESSION	RECOVERY, %	RQD, %
	CLAYEY SILT (ML-MH); Red, moist									
	SANDY SILT (ML); Light brown, moist, dense	42								
10		33		22	37	37				
15		43								
20	-grades light brown and gray, medium dense	22		17						
25	-grades dense	43								
	SILTY SAND (SM); Dark brown, wet, trace gravel	1		33						
35	SANDY SILT (ML); Light brown and gray, saturated	1								
40	-grades dense	36		26						
	Boring continued on next plate									

COMPLETION DEPTH: 48.0 ft **DEPTH TO WATER IN BORING:** 31.2 ft AD; 32.1 ft 24 hrs AD

DATE: 5-8-96

GAI CONSULTANTS

PLATE A-19

LOG OF BORING NO. P1-8 (cont)

PROJECT : Cherokee County Lined Landfill
Marble, North Carolina

JOB NO.: 96101.02

TYPE : HSA; SS

LOCATION : see Plan

DEPTH (FT)	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	WATER CONTENT %	LIQUID LIMIT	PLASTIC LIMIT	COHESION LB / SQ FT: PENETRO-METER	COHESION LB / SQ FT: UNCONFINED COMPRESSION	RECOVERY, %	RQD, %
45			-grades medium dense, with gravel	19								
50			End of Boring at Auger Refusal									
55												
60												
65												
70												
75												
80												

COMPLETION DEPTH: 48.0 ft **DEPTH TO WATER IN BORING:** 31.2 ft AD; 32.1 ft 24 hrs AD

DATE: 5-8-96

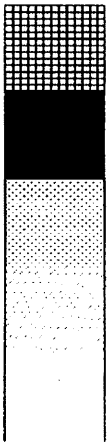
GAI CONSULTANTS

PLATE A-20

APPENDIX B

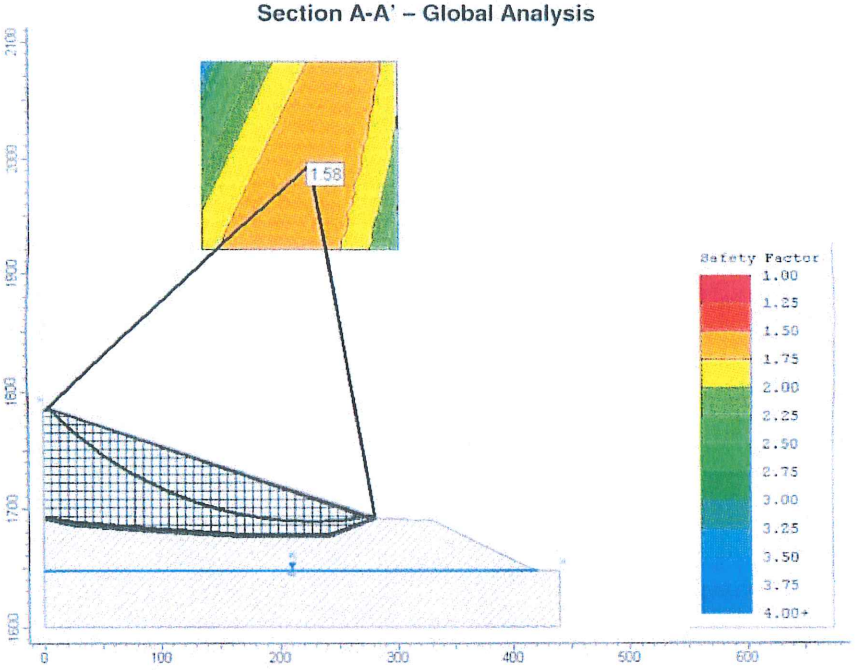
SLOPE STABILITY ANALYSES RESULTS

Material Property Legend

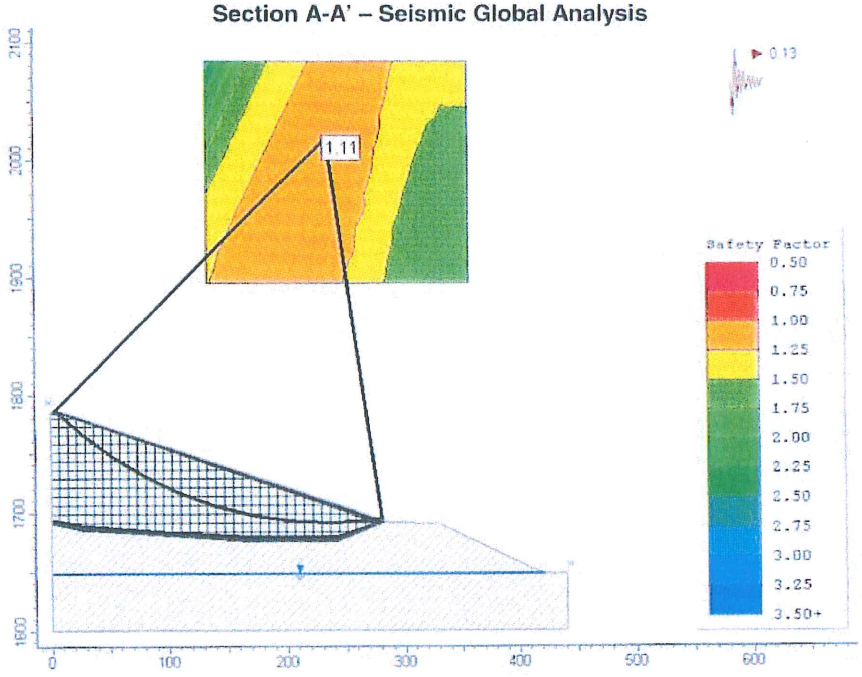


Soil Layer	Unit Weight (PCF)	Friction Angle	Cohesion (psf)
Waste	70	20	200
Clay Liner/Cap	125	20	400
Fill: Silty SAND to Sand SILT	120	30	100
Silty SAND and Sandy SILT	120	30	100
PWR	130	38	500

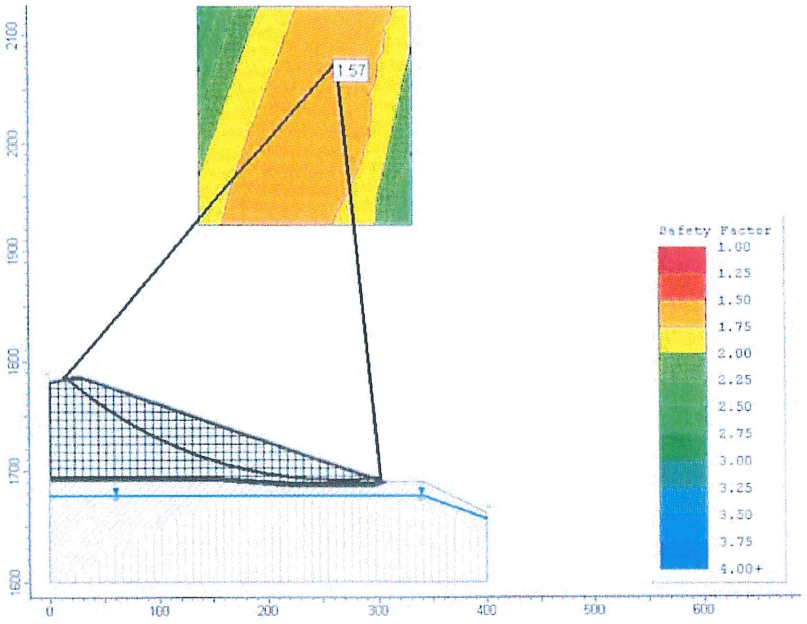
Section A-A' – Global Analysis



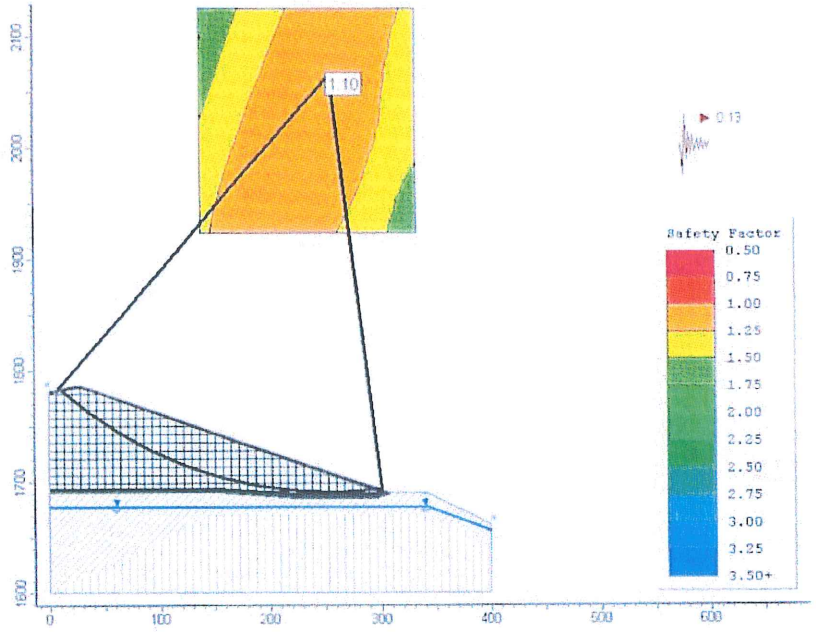
Section A-A' – Seismic Global Analysis



Section B-B' – Global Analysis



Section B-B' – Seismic Global Analysis



SECTION 2.0

OPERATION PLAN

2.1 Introduction

The County Landfill will only accept Municipal Solid Wastes (MSW) from Cherokee, Clay, Graham and Swain Counties. The County will perform a vertical expansion on the existing 10.5 acre Municipal Solid Waste Landfill (Phases 1, 2 and 3) according to Subtitle D requirements.

The perimeter of the lined area is marked off by 3 inch PVC pipe at 100' intervals that are placed in the anchor trenches. Solid waste will not be placed within four (4) feet of this boundary to assure that it is being placed directly above the liner system so that no leachate can flow outside of this area.

All stormwater that comes in contact with solid waste will be handled as leachate. The leachate is collected in the sump area, where it is pumped by force main to the lagoon.

Leachate will be treated at the Town of Andrews Waste Water Treatment Plant. The leachate will have to be tested according to the pretreatment conditions outlined in the pre-treatment agreement.

Leachate will be recirculated. (See Section 2.6).

The leachate lagoon will be inspected on a monthly basis and a report generated and placed in the landfill records. The report will include the date the liner was inspected, the inspector, general observations since the last inspection, visible abrasions, possible stress cracks, or obvious punctures. Stress cracks can occur in wrinkles that are generated from heat expansion or contraction due to freezing. Also, the HDPE liner may deteriorate due to ultra violet light and this can appear as an abrasion where material can be scraped away with a hard object. If any damage or possible weak spots due to ultra violet exposure has been detected, a qualified HDPE installation company shall be notified immediately so that a repair patch can be installed. The leachate level shall not be allowed to exceed the depth of the damaged liner until it has been repaired and tested by the liner installation company. Once this has been accomplished all testing documentation shall be placed in the operating records.

Daily cover is the combination of soil and/or approved Alternate Cover Material (ACM). (See Section 2.2 for cover requirements, see Section 2.4 for approved ACM's).

The County will implement a program at the landfill for detecting and preventing the disposal of hazardous and liquid wastes. The program consists of random inspection of incoming loads at a minimum of 1% of the weekly traffic. Landfill personnel will be trained to recognize hazardous and liquid wastes. Records will be kept on the training and the inspections. (See Section 2.3).

The County will monitor for explosive gases at landfill structures and the perimeter of the landfill. There are eight(8) existing methane monitoring probes. The concentration of methane gases generated by the landfill cannot exceed 25 percent of the lower explosive limit for methane in the structures, and it cannot exceed 100 percent of the lower explosive limit for methane of the landfill property boundary. (See Section 2.5). If methane gas is found to exceed the acceptable limits at either the property boundary or landfill structures, it is the County's responsibility to do the following:

1. Immediately take all necessary steps to ensure protection of human health, i.e. no smoking, temporarily abandon the structure and notify the Division of Solid Waste Management.

2. Within seven days of detection, place in the operating record the methane gas levels detected and a description of the steps taken to protect human health; and

3. Within 60 days of detection, implement a remediation plan for the methane gas releases, place a copy of the plan in the operating record, and notify the Division of Solid Waste management that the plan has been implemented. The plan will describe the nature and extent of the problem and the proposed remedy.

Off and on site erosion will be controlled through erosion control structures and devices. Provisions for a vegetative ground cover sufficient to restrain erosion will be accomplished within 30 working days or 120 calendar days upon completion of any phase of landfill development.

The County will record and retain at the landfill an operating record of the following information:

(1) Inspection records, waste determination records, and training procedures;
(2) Amounts by weight of solid waste received at the landfill;
(3) Waste determination, Leachate sampling data, leachate levels, meteorological data ;
(4) Gas monitoring results and any remediation plans;
(5) Any demonstration, certification, findings, monitoring, testing or analytical data required for surface and groundwater monitoring;
(6) Any monitoring, testing or analytical data required for closure or post-closure;
(7) Any cost estimates and financial assurance documentation.

All information contained in the operating record will be furnished upon request to the Division of Solid Waste Management or be made available at all reasonable times for inspection by the Division.

Ground and surface water will be sampled and analyzed according to Subtitle D Appendix I detection monitoring requirements. The monitoring frequency for all Appendix I detection monitoring constituents will be at least semiannual during the life of the facility (including closure) and the post-closure period. A minimum of four independent samples from each well (background and downgradient) will be collected and analyzed for the Appendix I constituents during the first semiannual sampling event. At least one sample from each well (background and downgradient) will be collected and analyzed during subsequent semiannual sampling events.

If the County determines that there is a statistically significant increase over background for one or more of the constituents listed in Appendix I at any monitoring well at the relevant point of compliance, the County will, within 14 days of the finding, report to the Division of Solid Waste and place a notice in the operating record indicating which constituents have shown statistically significant changes from background levels. The County will establish an assessment monitoring program within 90 days. The County may demonstrate that a source other than the landfill caused the contamination or that the statistically significant increase resulted from an error in sampling, analysis, statistical evaluation, or natural variation in ground-water quality. A report documenting these demonstrations will be certified by a Licensed Geologist or Professional Engineer and approved by the Division of Solid Waste. A copy of this report will be placed in the operating record. If a successful demonstration is made, documented, and approved by the Division, the County may continue detection monitoring. If after 90 days, a successful demonstration is not made, the County will initiate an assessment monitoring program.

2.2 Operational Requirements

1. Waste Acceptance and Disposal Requirements

   a. The Municipal Solid Waste Landfill (MSWLF) will only accept those solid wastes that it is permitted to receive. Cherokee County will notify the Division within 24 hours of attempted disposal of any waste the landfill is not permitted to receive. Signs are placed at the entrance to the Landfill stating that Hazardous and Liquid wastes are not accepted and that random waste screening is performed.

      i. Household Waste Disposal

         (i) The County will maintain approximately 18 six-yard dumpsters for disposal of residential household garbage across from the scale house. Site is always open with five cameras used to maintain compliance. County personnel empty dumpsters daily.

   b. The following wastes are prohibited from disposal at the MSWLF:

      i. Hazardous waste as defined within 15A NCAC 13A, to also include hazardous waste from conditionally exempt small quantity generators.

      ii. Polychlorinated biphenyls (PCB) wastes as defined in 40 CFR 761.

      iii. Bulk or non-containerized liquid waste will not be placed in the landfill unless:

         (i) The waste is household waste other than septic waste and waste oil,
         (ii) The waste is leachate or gas condensate derived from the landfill.

      iv. White Goods, Yard Waste, Tires.

         (i) White goods without refrigerants will be unloaded in the metal recycling area, crushed, placed in an open-bed trailer, and delivered to a metal recycling facility (by a third party).
         (ii) White goods with refrigerants will be unloaded on a concrete pad at the end of the recycling building. After a third party removes Freon, the appliances will be placed in the metal recycling area and handled as white goods without refrigerants.
         (iii) Yard waste (brush, clippings and grass) will be disposed in one of three concrete bunkers located between the scale house and working face.
         (iv) All limbs, brush, trees, and stumps (except for yard waste) will be unloaded at the treatment and processing facility. Periodically, this waste will be ground and will be sold as mulch to the public.
         (v) Scrap tires will be stored on trailers provided (by a third party). Tires still on the wheel will be loaded on the back of the trailer just prior to shipment. Trailers will be delivered to a disposal/recycling facility (by a third party).

      v. Containers holding liquid wastes will not be placed in the landfill unless:

         (i) The container is a small container similar in size to that normally found in household waste;
         (ii) The container is designed to hold liquids for use other than storage; or
         (iii) The waste is household waste.

      vi. For the purpose of this paragraph:

(i) Liquid waste means any waste material that is determined to contain "free liquids" as defined by Method 9095 (Paint Filter Liquids Test), S. W. 846.

c. Spoiled foods, animal carcasses, abattoir waste, hatchery waste, and other animal waste delivered to the disposal site will be covered immediately.

d. The following are items that are banned from the landfill:

i. Beverage containers that are required to be recycled under G.S. 18B-1006.1

ii. Recyclable rigid plastic containers that are required to be labeled as provided BELOW that have a neck smaller than the body of the container and that accept a screw top, snap cap, or other closure. The prohibition on disposal of recyclable rigid plastic containers in landfills does not apply to rigid plastic containers that are intended for use in the sale or distribution or motor oil.

(a) For polyethylene terephthalate, the letters "PETE" and the number 1.
(b) For high density polyethylene, the letters "HDPE" and the number 2.
(c) For vinyl, the letter "V" and the number 3.
(d) For low density polyethylene, the letters "LDPE" and the number 4.
(e) For polypropylene, the letters "PP" and the number 6.
(f) For polystyrene, the letters "PS" and the number 7.
(g) For any other, the letters "OTHER" and the number 7.

iii. Motor vehicle oil filters.

iv. Wooden pallets, except that wooden pallets maybe disposed of in a landfill that is permitted to only accept construction and demolition debris.

v. Discarded computer equipment (effective April 1, 2011).

e. Asbestos waste will be accepted and managed in accordance with 40 CFR 61. The waste will be covered immediately with soil in a manner that will not cause airborne conditions and must be disposed of separate and apart from other solid wastes:

i. At the bottom of the working face or;
ii. In an area not contiguous with other disposal areas. Separate areas will be clearly designated so that asbestos is not exposed by future land disturbing activities.

f. Wastewater treatment sludges may be accepted either as a soil conditioner incorporated into or applied onto vegetative growth layer but in no case greater than six inches in depth. Or wastewater treatment sludges may be co-disposed in the lined area.

g. The County will continue a program at the Landfill for detecting and preventing the disposal of hazardous and liquid wastes. (Section 2.3) This program will include, at a minimum:

i. Random inspections of incoming loads or other comparable procedures;
ii. Records of any inspections;
iii. Training of facility personnel to recognize hazardous and liquid wastes.
iv. If hazardous wastes are identified by facility personnel, Emergency Management or personnel trained, shall be notified to identify the waste and address removal, storage and final deposition of the waste.

h. Waste placement will be within the areal limits of the base liner system and in a manner consistent with the effective permit.

2. Cover material requirements.

a. Except as in Part (b), the County must cover disposed solid waste with six inches of earthen material at the end of each operating day, or at more frequent intervals if necessary, to control disease vectors, fires, odors blowing litter, and scavenging.

b. Alternative cover materials may be used as daily cover on the working face or until it is necessary to cover with earthen material. The alternative cover material must be approved by the Division of Solid Waste and applied according to manufacturers recommendations. At a minimum soil cover will be used once every seven (7) days. (See Section 2.4-Appendix II)

c. Areas which will not have additional wastes placed on them for 12 months or more, but where final termination of disposal operations has not occurred, will be covered with a minimum of one foot of intermediate cover.

3. Disease vector control

a. The County will prevent or control on-site populations of disease vectors using techniques appropriate for protection of human health and the environment. At the end of every day, waste will be covered either by synthetic cover or 6" of soil cover. At a minimum soil will be used once a week. Any waste that requires immediate cover, will be covered immediately with soil.

b. "Disease vectors" means any rodents, flies, mosquitoes, or other animals, including insects, capable of transmitting disease to humans.

4. Explosive gases control

a. The County must ensure that:

i. The concentration of methane gas generated by the landfill does not exceed 25 percent of the lower explosive limit for methane in landfill structures (excluding gas control or recovery system components); and

ii. The concentration of methane gas does not exceed 100 percent of the lower explosive limit for methane at the landfill property boundary.

b. The County will implement a routine methane monitoring program to ensure that the standards of 4 (a) are met. (Section 2.5)

i. The type and frequency of monitoring must be determined based on the following factors:

(i) Soil conditions;
(ii) The hydrogeologic conditions surrounding the facility;
(iii) The hydraulic conditions surrounding the facility;
(iv) The location of facility structures and property boundaries.

ii. The minimum frequency of monitoring will be quarterly.

c. If methane gas levels exceeding the limits specified in 4 (a) are detected, the owner or operator will:

i. Immediately take all necessary steps to ensure protection of human health, i.e. no smoking, temporarily abandon the structure and notify the Division of Solid Waste Management.

ii. Within seven days of detection, place in the operating record the methane gas levels detected and a description of the steps taken to protect human health; and

iii. Within 60 days of detection, implement a remediation plan for the methane gas releases, place a copy of the plan in the operating record, and notify the Division of Solid Waste Management that the plan has been implemented. The plan will describe the nature and extent of the problem and the proposed remedy.

d. "Lower explosive limit" means the lowest percent by volume of a mixture of explosive gases in air that will propagate a flame at 25° C and atmospheric pressure.

e. Emergency response, if necessary, will be provided by the Marble Volunteer Fire Department (VFD) located across Highway 19/74 in Marble, NC. The Marble VFD is reached by dialing "911".

5. Air Criteria

a. The County will ensure that the landfill does not violate any applicable requirements developed under a State Implementation Plan (SIP) approved or promulgated by the US. EPA Administrator pursuant to Section 110 of the Clean Air Act, as amended.

b. Open burning of solid waste, except for the infrequent burning of land clearing debris generated on site or debris from emergency clean-up operations, is prohibited. Any such infrequent burning will be approved by the Division of Solid Waste Management.

c. Earth moving equipment will be provided to control accidental fires and leachate tank trucks used for water or leachate that would be recirculated can also be used. Arrangements have been made with the local fire department to provide actual fire protection. This Fire department has access at all times to the landfill to provide fire fighting services when needed. Landfill personnel can use soil to isolate the fire so it will not spread any further but actual fighting of the fire should be the responsibility of the trained fire department.

d. Fires that occur at the landfill will be reported to the Division of Solid Waste Management within 24 hours and written notification will be submitted within 15 days.

6. Access and safety requirements

a. The landfill will be adequately secured by means of gates, chains, beams, fences and other security measures approved by the Division of Solid Waste Management to prevent unauthorized entry.

b. An attendant will be on duty at the site at all times while it is open for public use to ensure compliance with operational requirements.

c. The access road to the site will be of all-weather construction and maintained in good condition.

d. Dust control measures will be implemented when necessary. If dust problems should arise, the county will use any reasonable means necessary to reduce it. At a minimum the county will spray water on necessary areas.

e. Signs providing information on tipping or disposal procedures, the hours during which the site is open for pubic use, the permit number and other pertinent information will be posted at the site entrance.

f. Signs will be posted stating that no hazardous or liquid waste can be received.

g. Traffic signs or markers will be provided as necessary to promote an orderly traffic pattern to and from the discharge area and to maintain efficient operating conditions.

h. The removal of solid waste from the landfill will be prohibited unless the County approves and the removal is not performed on the working face.

i. Barrels and drums will not be disposed of unless they are empty and perforated sufficiently to ensure that no liquid or hazardous waste is contained therein, except fiber drums containing asbestos.

j. Emergency response, if necessary, will be provided by the Marble Volunteer Fire Department (VFD) located across Highway 19/74 in Marble, NC. The Marble VFD is reached by dialing "911".

7. Erosion and Sedimentation Control Requirements

a. Adequate sediment control measures (structures or devices), will be utilized to prevent silt from leaving the landfill.

b. Adequate sediment control measures (structures or devices), will be utilized to prevent excessive on-site erosion.

c. Provisions for a vegetative ground cover sufficient to restrain erosion will be accomplished within **15 working days** or **30 calendar days** upon completion of any phase of landfill development.

8. Drainage Control and Water Protection Requirements

a. Surface water will be diverted from the operational area and will not be impounded over waste.

b. Solid waste will not be disposed of in water.

c. Leachate will be contained on site and properly treated prior to discharge.

d. The landfill will not:

(i) Cause a discharge of pollutants into waters of the United States, including wetlands, that violates any requirements of the Clean Water Act, including, but not limited to, the National Pollutant Discharge Elimination System (NPDES) requirements pursuant to Section 402.

(ii) Cause the discharge of a nonpoint source of pollution to waters of the United States, including wetlands, that violates any requirements of an area-wide or state-wide water quality management plan that has been approved under Section 208 or 319 of the Clean Water Act, as amended.

9. Liquids Restriction

a. Bulk or non-containerized liquid waste will not be placed in the landfill unless:

(i) The waste is household waste other than septic waste and waste oil,

(ii) The waste is leachate or gas condensate derived from the landfill.

b. Containers holding liquid wastes will not be placed in the landfill unless:

(i) The container is a small container similar in size to that normally found in household waste;

(ii) The container is designed to hold liquids for use other than storage; or

(iii) The waste is household waste.

c. For the purpose of this paragraph:

(i) Liquid waste means any waste material that is determined to contain "free liquids" as defined by Method 9095 (Paint Filter Liquids Test), S. W. 846.

d. Test for free liquids:
Sludges or other wastes may be tested for free liquids after previous screening tests have shown that the waste is not hazardous and does not contain PCB's. The specified test to determine whether or not a material is considered to be a liquid is the Paint Filter Test method 9095. The procedure for conducting this test is as follows:

(i) Obtain standard 400- micron paint filter;

(ii) Place a properly-sized, clean, dry funnel in a ring stand or similar device;

(iii) Fold the filter and line the funnel with it;

(iv) Place a 100 ml sample of waste into the funnel;

(v) Place a clean, dry container under the funnel; and,

(vi) Check in exactly 5 minutes to see if any liquid is in the container.

(vii) If any liquid passes through the filter in 5 minutes or less, the waste is considered to be a liquid. The filtrate can be water, oil or any combination of any non-hazardous liquids.

10. Record keeping Requirements

a. The County MSWLF will record and retain at the facility, or an alternative location near the facility approved by the Division of Solid Waste Management, in an operating record the following information as it becomes available.

(i) Inspection records, waste determination records, and training procedures;

(ii) Amounts by weight of solid waste received at the landfill to include source of generation.

(iii) Waste determination, Leachate sampling data, leachate levels, meteorological data ;

(iv) Gas monitoring results and any remediation plans;

(v) Any demonstration, certification, findings, monitoring, testing or analytical data required for surface and groundwater monitoring;

(vi) Any monitoring, testing or analytical data required for closure or post-closure; and,

(vii) Any cost estimates and financial assurance documentation.

b. All information contained in the operating record will be furnished upon request to the Division of Solid Waste Management or be made available at all reasonable times for inspection by the Division.

c. The County will maintain a copy of the operation plan at the landfill.

11. Spreading and Compacting Requirements

a. The landfill will restrict solid waste into the smallest area feasible, typically 60' x 75' area.

b. Solid waste will be compacted as densely as practical into cells. The compactor should run over an area of solid waste a minimum of 6 times.

c. Appropriate methods such as fencing and diking will be provided within the area to confine solid waste subject to be blown by the wind. At the conclusion of each day of operation, all windblown material resulting from the operation will be collected and returned to the area.

12. Leachate Management Plan

a. The County will periodically maintain the leachate collection system.

b. The County will maintain records for the amount of leachate collected.

c. The County will quality sample their leachate bi-annually for Appendix I (Section 2.3) constituents, pH, BOD, COD, TDS, phosphate, nitrate, and sulfate. The sample will be obtained from the lagoon and sampled the same time as the monitoring wells.

d. The leachate is being treated by the Town of Andrews Waste Water Treatment Plant.

e. Under extreme operational conditions Cherokee County has the option of shutting down the flow of leachate to the lagoon by shutting off the pump. The leachate will be temporarily stored within the MSWLF units until such a time the flow of leachate can continue to the lagoon. If any rain or other event requires storage of leachate or storm water in the cell, the Division of Solid Waste will be notified immediately followed by written communication.

f. Leachate will be recirculated. (See Section 2.6).

g. The leachate lines shall be flushed at least once per year. This can be done by using a tanker full of either leachate or plain water. The liquid can either be pumped or gravity flow into the cleanouts provided at the ends of the lines. Once the water is unloaded into the collection system, there needs to be a visual inspection at the lagoon to assure that the water unloaded into the system appears at the lagoon in a short period of time. This is observed as an increase in the flow that is observed prior to unloading the water into the system.

In the event that it cannot be visually determined whether or not the flow in the leachate line at the lagoon has not increased, a flow measuring device shall be used at the end of the

leachate line flowing into the lagoon. The measurements need to be done prior to dumping water into the collection system and after.

If it is determined that a blockage is in the line, the line shall be pressure cleaned and videoed to assure that the blockage has been removed.

Records of all flushing either by gravity or pressurized shall become part of the operating record. Any videos that have been taken shall also become part of the operating record.

13. Recycling Plan

i. Metal Recycling

(i) All metal will be unloaded on the ground near the scale house building, crushed, loaded into an open-bed trailer and transported to market (by a third party).

ii. Glass Recycling

(i) Glass will be collected at the facility and at convenience centers around the county. The material will be picked up at the convenience centers by County personnel and transported to the landfill facility where it will be unloaded into two concrete bunkers (one for clear glass-the other for green/brown glass) The glass will be crushed by County personnel and then transported to market (by a third party).

iii. Batteries

(i) Automobile/boat batteries will be stored on a pallet near the metal collection area and will be transported to market (by a third party).

(ii) Recyclable batteries/cell phones are collected inside the scale house and at county convenience centers. Each battery/cell phone is individually wrapped in a plastic bag, placed in a transportation box, then transported to market (by a third party).

iv. Electronics

(i) Electronics will be collected on a concrete pad located at one end of the facility where they will be placed on pallets, wrapped and secured in stretch wrap, and delivered to market (by a third party).

v. Other Recycling

(i) Cardboard, plastic, newspapers, and aluminum cans from the convenience centers will be transported to the facility recycling center by County personnel. The materials will be sorted, baled and stored at the facility until there is enough weight of each type material to constitute a shipment. Materials will be delivered to market (by a third party). Fluorescent bulbs are recycled by the vendor.

2.3 Appendix I

A. INTRODUCTION

The municipal solid waste stream is made up of wastes from all sectors of society. The waste is often categorized by its source or its characteristics. Terms used include commercial, industrial, residential, biomedical, hazardous, household, solid, liquid, demolition/construction, sludge, etc. Regardless of how one classifies wastes, the bottom line is that wastes are delivered to the landfill and a management decision must be made to either reject or accept them. This responsibility rests with the manager of the landfill. Wastes which are not authorized to be accepted at the landfill create a number of potential problems including: (1) liability due to future releases of contaminants; (2) bad publicity if media learns of unacceptable waste entering the landfill; (3) potential for worker injury; (4) exposure to civil or criminal penalties; (5) damage to landfill environmental control systems.

B. HAZARDOUS WASTE REGULATIONS AND MANAGEMENT

In the United States, hazardous waste is regulated under RCRA, Subtitle C. A waste is hazardous if it is listed as a hazardous waste by the Administrator of the Environmental Protection Agency (EPA) in the Code of Federal Regulations, Title 40, Part 261, or if it meets one or more of the hazardous waste criteria as defined by EPA. These criteria are:

- Ignitability
- Corrosivity
- Reactivity
- Toxicity

1. Ignitability

Ignitable waste is a waste that burns readily, causes a fire by friction under normal circumstances, or is an oxidizer. Any waste having a flash point of <140F falls in this category. Flash point is that temperature at which a liquid gives off vapors that will ignite when an open flame is applied. Under Department of Transportation (DOT) definitions, a flammable liquid has a flash point of >100 F. A combustible liquid has a flash point between 100 and 200 F. Therefore, a flammable liquid is always hazardous while a combustible liquid may or may not be hazardous depending upon its flash point.

2. Corrosivity

A corrosive waste is one having a very high or a very low pH. The pH of a liquid is a measure of how acidic or basic (alkaline) the material is. The pH scale ranges from 0 to 14. High numbers are basic and low numbers are acidic. A substance having a pH $\leq$2.0 or $\geq$12.5 is defined as hazardous under RCRA.

3. Reactivity

A waste is reactive if it is normally unstable: reacts violently with water; forms an explosive mixture with water; contains quantities of cyanide or sulfur that could be released to the air; or can easily be detonated or exploded. These wastes may fall into any one of several DOT categories.

4. Toxicity Characteristic Leaching Procedure (TCLP)

A waste is TCLP toxic if the concentration of any constituent in Table 1 exceeds the standard assigned to that substance. The TCLP is a methodology which attempts to simulate the conditions within a landfill. An acidic solution is passed through a sample of waste and the resultant "leachate" is analyzed for contaminants. The TCLP is designed to detect heavy metals, pesticides and a few other organic and inorganic compounds. The purpose of the test is to prevent groundwater

contamination by highly toxic materials. TCLP tests the mobility of 40 different elements and compounds.

Except in certain specified circumstances, regulated quantities of hazardous waste must be disposed of at a permitted hazardous waste disposal facility. In accordance with 40 CFR Part 261.3, **any material contaminated by a hazardous waste is also deemed to be a hazardous waste and must be managed as such.** Hazardous waste from conditionally exempt small quantity generators are to be disposed of in a Hazardous waste disposal facility. RCRA permits are also required to store, transport, and treat hazardous waste.

C. POLYCHLORINATED BIPHENYL'S (PCBs)

1. Introduction

PCBs are nonflammable and conduct heat without conducting electricity. These compounds were most frequently used as an additive to oil or other liquids in situations where heat was involved. The PCBs enhance the heat conducting properties of the liquid and thereby increase the heat dissipation or cooling effect obtained. They have also been used in lubricants and paint. In the United States one of the most common applications was in electric transformers. The only effective method for destroying PCBs is high Temperature incineration which is relatively expensive due to a shortage of PCB incineration capacity.

TABLE 1

T.C.L.P. CONSTITUENTS & REGULATORY LEVELS (mg/L)			
CONSTITUENT	REG LEVEL	CONSTITUENT	REG LEVEL
Arsenic	5.0	Hexachlorobenzene	0.13
Barium	100	Hexachloro-1,3-butadiene	0.5
Benzene	0.5	Hexachloroethane	3.0
Cadmium	1.0	Lead	5.0
Carbon Tetrachloride	0.5	Lindane	0.4
Chlordane	0.03	Mercury	0.2
Chlorobenzene	100	Methoxychlor	10.0
Chloroform	6.0	Methyl ethyl ketone	200
Chromium	5.0	Nitrobenzene	2.0
m-Cresol	200	Pentachlorophenol	100
o-Cresol	200	Pyridine	5.0
p-Cresol	200	Selenium	1.0
Cresol	200	Silver	5.0
1,4-Dichlorobenzene	10.0	Tetrachloroethylene	0.7
1,2-Dichloroethane	0.7	Toxaphene	0.5
1,1-Dichloroethylene	0.5	Trichloroethylene	0.5
2,4-Dichlorophenoxyacetic acid	0.7	2,4,5-Trichlorophenol	400
2,4-Dinitrotoluene	0.13	2,4,6-Trichlorophenol	2.0
Endrin	0.02	2,4,5-TP (Silvex)	1.0
Heptachlor (and its hydroxide)	0.008	Vinyl Chloride	0.2

By law PCB's are no longer used as dielectrics in transformers and capacitors manufactured after 1979. There are many millions of pounds of PCBs still in use or in storage. One example is the ballasts used in fluorescent light fixtures. It has been estimated that there are between 0.5 million and 1.5 billion ballasts currently in use in this country. Due to the long life of these units, about half of these may be of pre-1979 manufacture and contain PCBs. Since each ballast contains about one ounce of nearly pure PCB fluid, there are about **20 to 30 million pounds** of PCBs in existing lighting fixtures.

These items are not the subject to RCRA Subtitle D Waste Screening!

Commercial or industrial sources of PCB wastes that should be addressed by the program include:

- Mineral oil and dielectric fluids containing PCBs;
- Contaminated soil, dredged material, sewage sludge, rags, and other debris from a release of PCBs;
- Transformers and other electrical equipment containing dielectric fluids; and
- Hydraulic machines.

2. PCB Regulatory Requirements

As contrasted to hazardous wastes, the Toxic Substance Control Act regulates PCBs based on the concentration of PCBs in the waste rather than the source or characteristic of the waste. The regulations concerning PCB disposal are spelled out in 40 CFR Part 761. Subtitle D of RCRA merely requires that PCB waste not be disposed in a MSW landfill. PCB management requirements include:

Waste containing more than 500 ppm of PCBs must be incinerated. Waste containing from 50 to 500 ppm must be disposed of by incineration, approved burning, or in chemical waste landfill permitted to receive such wastes. The regulations are silent concerning wastes containing less than 50 ppm of PCBs; however, the regulations cannot be circumvented by diluting stronger wastes.

D. FUNDAMENTALS OF WASTE SCREENING

1. Know Your Generators and Haulers

Since the level of sophistication of your waste screening program will be a reflection of the likelihood of hazardous waste and PCB waste being in your incoming waste, **knowledge of the commercial industrial base of your service area is critical.** Some examples are the automotive industry, which generates solvents, paint wastes, lead acid batteries, grease and oil; the dry cleaning industry, which may generate filters containing dry cleaning solvents; metal platers which generate heavy metal wastes; and other industries which generate a variety of undesirable wastes; e.g. chemical and related products, petroleum refining, primary metals, electrical and electronic machinery, etc.

Landfill managers should also know the haulers and trucks serving the businesses in their community which are likely to carry unacceptable wastes.

Some local governments and solid waste management agencies have enacted legislation requiring haulers to provide a manifest showing the customers whose wastes make up that particular load. Such a manifest is an extremely useful tool when a load is found to contain prohibited wastes. It is unwise to accept wastes from unknown, unlicensed, or otherwise questionable haulers.

2. Inspections

An inspection is typically a visual observation of the incoming waste loads by an individual who is trained to identify regulated hazardous or PCB wastes that would not be acceptable for disposal at the MSWLF unit. The training of landfill personnel will be conducted by a local EMS official or a SWANA certification. An inspection is considered satisfactory if the inspector knows the nature of all materials received in the load and is able to discern whether the materials are potentially regulated hazardous wastes or PCB wastes.

Ideally, all loads should be screened; however, it is generally not practical to inspect in detail all incoming loads. Random inspections, therefore, can be used to provide a reasonable means to

adequately control the receipt of inappropriate wastes. Random inspections are simply inspections made on less than every load. At a minimum the inspection frequency will not be less than one percent of the waste stream.

The frequency of random inspections may be based on the type and quantity of wastes received daily, and the accuracy and confidence desired in conclusions drawn from inspection observations. Because statistical parameters are not provided in the regulation, a reasoned, knowledge-based approach may be taken. A random inspection program may take many forms such as inspecting every incoming load one day out of every month or inspecting one or more loads from transporters of wastes of unidentifiable nature each day. If these inspections indicate that unauthorized wastes are being brought to the MSWLF site, the random inspection program should be modified to increase the frequency of inspections.

Inspection priority also can be given to haulers with unknown service areas, to loads brought to the facility in vehicles not typically used for disposal of municipal solid waste, and to loads transported by previous would-be offenders. For wastes of unidentifiable nature received from sources other than households (e.g., industrial or commercial establishments), the inspector should question the transporter about the source/composition of the materials.

Loads will be inspected on the working face of the landfill.

An inspection flow chart to identify, accept, or refuse solid waste is provided as Figure 1.

Inspections of materials may be accomplished by discharging the vehicle load in an area designed to contain potentially hazardous wastes that may arrive at the facility. The waste should be carefully spread for observation using a front end loader or other piece of equipment. The Division of Solid Waste recommends that waste should be hand raked to spread the load. Personnel should be trained to identify suspicious wastes. Some indications of suspicious wastes are:

- Hazardous placards or markings;
- Liquids;
- Powders or dusts;
- Sludges;
- Bright or unusual colors;
- Drums or commercial size containers; or
- Chemical odors.

Cherokee County will follow these procedures when suspicious wastes are discovered.

- Segregate the wastes;
- Question the driver;
- Review the manifest (if applicable);
- Contact possible source;
- Call the State Solid Waste Management Department;
- Use appropriate protective equipment;
- Contact laboratory support if required; and
- Notify the local Hazardous Material Response Team.

Containers with contents that are not easily identifiable, such as unmarked 55-gallon drums, should be opened only by properly trained personnel. Because these drums could contain hazardous waste, they should be refused whenever possible. Upon verifying that the solid waste is acceptable, it may then be transferred to the working face for disposal.

Testing typically would include the Toxicity Characteristic Leaching Procedure (TCLP) and other tests for characteristics of hazardous wastes including corrositivity, ignitability, and reactivity. Wastes that

are suspected of being hazardous should be handled and stored as a hazardous waste until a determination is made.

If the wastes temporarily stored at the site are determined to be hazardous, Cherokee County is responsible for the management of the waste. If the wastes are to be transported from the facility, the waste must be: (1) stored at the MSWLF facility in accordance with requirements of a hazardous waste generator, (2) manifested, (3) transported by a licensed Treatment, Storage, or Disposal (TSD) facility for disposal.

E. RECORD KEEPING AND NOTIFICATION REQUIREMENTS

Records must be kept pursuant to an incident where regulated hazardous waste or prohibited waste is found at the landfill. It is also recommended that records be kept of all screening activities and incidents, whether or not, regulated or prohibited wastes are found. This will help prove that the landfill owner/operator has acted in a prudent and reasonable manner.

The best way to prove compliance with this requirement is to document each inspection including:

Date and time of waste detection
Hauler name (company and driver)
Waste(s) detected
Waste generator(s) if able to identify
Action(s) taken to manage or return material(s)
Efforts taken if extreme toxicity or hazard was discovered
Landfill employee in responsible charge

40 CFR Part 258 requires that records should be maintained at or near the landfill site during its active life and as long after as may be required by the appropriate state or local regulations.

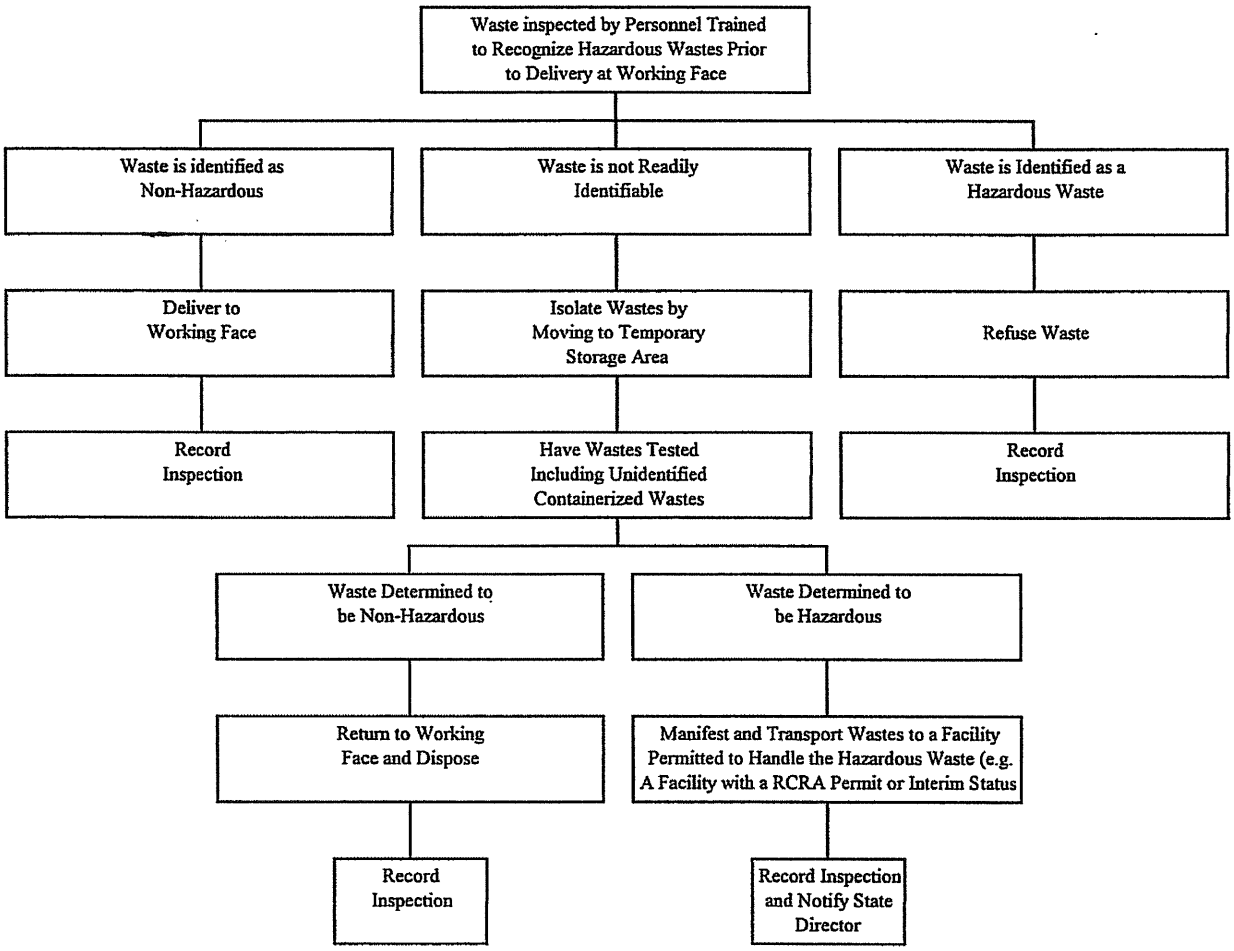


FIGURE 1
Hazardous Waste Inspection Decision Tree
Inspection Prior to Working Face

WASTE SCREENING CHECK LIST
(CHECK ALL THAT APPLY)

CONTAINERS	**YES**	**NO**
FULL	____	____
PARTIALLY FULL	____	____
EMPTY	____	____
CRUSHED	____	____
PUNCTURED	____	____
POWDERS/DUSTS		
IDENTIFIED	____	____
UNKNOWN	____	____
SATURATION	____	____
LABEL/HAZARDOUS	____	____
ODOR/FUMES		
STRONG	____	____
FAINT	____	____
HEAT	____	____
ITEMS FOUND		
BATTERIES	____	____
OIL	____	____
BIOMEDICAL	____	____
RADIOACTIVE	____	____
ASHES/RESIDUE	____	____
SOD/SOIL	____	____
LIQUID	____	____
HAZARDOUS	____	____
PCB'S	____	____

Action Taken

_____

_____

_____

_____

_____

DETAILED SCREENING REPORT

WASTE SOURCE_____
ADDRESS_____
_____
_____

PROBABLE [ ] SUSPECTED [ ] CONFIRMED [ ]

WASTE HAULER_____
ADDRESS_____
_____
_____

DRIVER'S NAME_____
DETAIL_____
_____
_____

NOTIFIED:

WASTE SOURCE [ ] HAULING MANAGEMENT [ ] SITE MANAGEMENT [ ]

STATE [ ] FEDERAL [ ]

NAME_____
WITNESS (IF ANY)_____
DATE_____TIME_____ AM PM
_____

ACTION REQUIRED:

2.4 Appendix II - Alternate Cover Materials (ACM)

ACM: Automotive Shredder Residuals (ASR)

Approved Landfill Use: MSWLF and C&DLF (lined)

Material Characteristics: Automotive shredder residuals are the fines remaining after scrap cars have passed through a shredder and all recoverable materials have been removed. ASR can consist of glass, synthetic fibers, rubber, plastics, automobile liquids residue, metal fines and dirt. It is possible for the ASR to contain substances considered hazardous such as lead, cadmium and PCB.

Usage Criteria:

1. ASR can be applied, in lieu of soil, to a depth of six inches given calm site (weather) conditions.
2. If site (weather) conditions are, or are forecast to be , windy the ASR must either be:
   a). Mixed with soil at a ration of 50% soil with 50% ASR prior to application on the working face, or
   b) Placed on the working face to a minimum depth of 3" and then covered with soil a minimum depth of 3".
3. During use of ASR as an ACM, soil cover to a full depth of six inches shall be applied once per week.
4 ASR shall not be used on any exterior/outside slopes and may not be used for intermediate cover.
5. The ASR must be sourced from within the approved service are of the landfill facility.

* **A CDLF equipped with a liner system may use the ASR as alternate daily cover only. Use of more than six inches equates to disposal. ASR is not a C&D waste. To dispose of ASR in a lined CDLF, contact the Permitting Branch of the solid Waste Section for further clarification.**

ACM: Construction and Demolition Debris (C&D) Fines

Approved Landfill Use: MSWLF and C&DLF (lined)

Material Characteristics: Construction and Demolition Debris Fines are, generally, the residuals and fine particles remaining in the bottom of dumpsters, roll-off containers and trucks used in the transportation or processing of C&D debris.

Usage Criteria:

1. C&D Fines can be applied, in lieu of soil, to a full depth of six inches given calm site (weather) conditions.
2. If site (weather) conditions are, or are forecast to be , windy the ASR must either be:
   a). Mixed with soil at a ration of 50% soil with 50% C&D Fines prior to application on the working face, or
   b) Placed on the working face to a minimum depth of 3" and then covered with soil a minimum depth of 3".
3. During use of C&D Fines as an ACM, soil cover to a full depth of six inches shall be applied once per week.
4 C&D Fines shall not be used on any exterior/outside slopes and may not be used for intermediate cover.
5. The ASR must be sourced from within the approved service are of the landfill facility.

* **Warning: C&D fines can contain large percentages of drywall dust or gypsum. These materials may produce significant amounts of hydrogen sulfide, an obnoxious smelling compound. If odor problems develop, the use of the fines should be suspended immediately and the offending area covered with soil.**

ACM: Petroleum Contaminated Soils (PCS)

Approved Landfill Use: MSWLF and C&DLF (lined)*, IndLF (lined)*

Material Characteristics: Petroleum Contaminated Soils are, generally, native soils contaminated with some petroleum liquid. Generally, these soils are to be sourced from environmental cleanup sites, spill sites or sites associated with above ground or underground storage tank (AST or UST) removal. In the case of ACM usage, petroleum is narrowly defined as low to medium boiling point petroleum derived fuels such as gasoline, kerosene, diesel, motor oil, mineral spirits and fuel oils #11 through #6. All other petroleum derived liquids such as solvents, acids, tars and asphalts are excluded. In all cases, the concentration of Total Petroleum Hydrocarbons (TPH) in the PCS cannot exceed 3,000 parts per million (PPM) regardless of type or test method. The material may not contain chlorinated solvents or other hazardous materials or exhibit the hazardous characteristic of flammable.

Usage Criteria:

1. PCS can be applied, in lieu of soil, to a full depth of six inches.
2. The PCS must be stockpiled within the disposal area and shall be managed and applied in such a way that runoff cannot leave the lined landfill area.
3. The PCS shall be managed in such a way to prevent run-off and fugitive emissions (i.e. use of tarps, berms and/or wetting to prevent blowing).
4. PCS is prohibited from disposal. Therefore, the facility may not accept more PCS than can be used in a 45 day period. The amount of PCS accepted should not exceed 20% of the permitted facility average monthly waste stream.
5. PCS shall not be used on any exterior/outside slopes and may not be used for intermediate cover.
6. The PCS must be sourced from within the approved service area of the landfill facility.
7. PCS can only be used at lined landfill facilities.
8. Records must be maintained in the facility operating record indicating the volume of PCS accepted and applied at the facility on a daily basis.

* **A CDLF or IndLF equipped with a liner system may use the PCS as alternate daily cover only. Use of more than six inches equates to disposal. PCS is neither a C&D nor an Industrial waste. To dispose of PCS in a lined CDLF, or an non-CCB industrial landfill, contact the Permitting Branch of the Solid Waste Section for further clarification.**

ACM: Spray-applied Mortar Coating (SMC)

Approved Landfill Use: MSWLF, C&DLF and IndLF

Material Characteristics: SMC is, generally, a commercially sourced non-flammable, non-toxic product containing proprietary components including mix setting agents, reinforcing materials and cement. Other components, such as latex paint, may also be added to the mixture. All of the components are mixed on site with water and/or leachate to produce a slurry that is then spray applied to the working face.

Usage Criteria:

1. SMC can be applied, in lieu of soil, given appropriate site (weather) conditions.
2. SMC must be applied in accordance with the manufacturer's application guidelines.
3. SMC must be applied in two directions to ensure adequate coverage.
4. During the use of SMC as an ACM, soil cover to a full depth of six inches shall be applied once per week unless otherwise approved by the Section.
5. The use of non-hazardous latex or water based paint in the mixture is approved provided that the paint has been collected for recycling.

ACM: Foam Coating (Foam)

Approved Landfill Use: MSWLF, C&DLF and IndLF

Material Characteristics: Foam Coating is, generally, a commercially sourced non-flammable, non-toxic, non-hardening water based product. The proprietary liquid concentrate is delivered to the site and diluted with water prior to application with proprietary equipment.

Usage Criteria:

1. Foam can be applied, in lieu of soil, given appropriate site (weather) conditions.
2. Foam must be applied in accordance with the manufacturer's application guidelines.
3. During the use of Foam as an ACM, soil cover to a full depth of six inches shall be applied once per week.
4. The use of non-hazardous latex or water based paint in the mixture is approved provided that the paint has been collected for recycling.
5. Foam shall not be used on any exterior/outside slopes and may not be used for intermediate cover.

ACM: Foundry Sand (Sand)

Approved Landfill Use: MSWLF, C&DLF (lined)* and IndLF (lined)*

Material Characteristics: Foundry Sand is , generally, a by-product of the smelting and forging processes for metals fabrication. Metal pieces and particulate may also be found in the sand. Prior to use, a Toxicity Characteristic Leaching Procedure (TCLP) analysis must be performed to ensure no hazardous constituents are found in the sand at the source. The TCLP analysis results must be submitted with the Operation Plan revision.

Usage Criteria:

1. Sand can be applied, in lieu of soil, to a full depth of six inches.
2. The Sand must be stockpiled within the disposal area and shall be managed and applied in such a way that runoff cannot leave the lined landfill area.
3. The Sand shall be managed in such a way to prevent runoff and fugitive emissions (i.e. use of tarps, berms and/or wetting to prevent blowing).
4. Sand is prohibited from disposal. Therefore, the facility may not accept more Sand than can be used in a 45 day period. The amount of Sand accepted should not exceed 20% of the permitted facility average monthly waste stream.
5. Sand shall not be used on any exterior/outside slopes and may not be used for intermediate cover.
6. The Sand must be sourced from within the approved service area of the landfill facility.
7. Sand can only be used at lined landfill facilities.
8. Records must be maintained in the facility operating record indicating the volume of Sand accepted and applied at the facility on a daily basis.

* **A CDLF or IndLF equipped with a liner system may use the Sand as alternate daily cover only. Use of more than six inches equates to disposal. Sand is not a C&D waste. To dispose of Sand in a lined CDLF, a lined landfill not previously permitted to accept it or a or an non-CCB industrial landfill, contact the Permitting Branch of the Solid Waste Section for further clarification.**

ACM: Soil/Mulch Mixture (S&M)

Approved Landfill Use: MSWLF, C&DLF and IndLF

Material Characteristics: Soil/Mulch Mixture is, generally, a mixture of native soils and wood mulch generated from grinding of yard trash, land clearing debris and pallets constructed of unpainted and untreated natural wood. Additionally, shredded tire chips may be used in addition to, or in lieu of, wood mulch.

Usage Criteria:

1. S&M can be applied, in lieu of soil, to a full depth of six inches.
2. S&M can be mixed at a ratio from 80% soil to 20% mulch up to 50% soil to 50% mulch by volume.
3. During the use of S&M as an ACM, soil cover to a full depth of six inches shall be applied once per week.
4. S&M may not be used for intermediate cover.

ACM: Synthetic Tarps (Tarps)

Approved Landfill Use: MSWLF, C&DLF and IndLF

Material Characteristics: Synthetic Tarps are, generally, a commercially sourced non-flammable, non-toxic, sheet product constructed of an impermeable synthetic polymer typically reinforced with fibers. Acceptable sheet products include, but are not limited to, geotextiles, polyethylene membranes, plastic film, tarps and composite geotextile/plastic membranes. Tarps may be applied by hand, using landfill equipment and/or and Automatic Tarping Machine (ATM).

Usage Criteria:

1. Tarps can be applied, in lieu of soil, given appropriate site (weather) conditions.
2. Tarps must cover the entire working face. Any waste not covered by tarps must be covered by soil.
3. Tarps must be secured in place with the use of soils or other ballast system such as tires or sand bags.
4. During the use of Tarps as an ACM, soil cover to a full depth of six inches shall be applied once per week.
5. Tarps shall not be used on any exterior/outside slopes and may not be used for intermediate cover.

2.5 Appendix III - Explosive Gas Control Plan

Quarterly, the County landfill will monitor the explosive gas at the landfill structures and at or near the landfill boundary. The permanent probes will consist of a plastic stand pipe similar to a piezometer used for groundwater detection. A typical permanent methane probe is detailed in the operation drawings. The permanent probe will be constructed at a depth of six (6) feet. A 6" diameter hole will contain a one (1) inch slotted PVC pipe. The bottom two (2) feet will be backfilled with non-carbonate pea gravel with a bentonite seal one (1) foot thick above it. The remaining three (3) feet will be backfilled with *in situ* soils. The one (1) inch PVC pipe will be approximately three (3) feet above the existing grade. The PVC pipe will be capped with a one (1) inch PVC cap, one quarter (1/4) inch NPT hose barb, and 1" tubing, plugged or capped.

The location and spacing of the methane monitoring probes is somewhat arbitrary. The locations were determined by the relationship of solid waste with property lines and landfill structures. The spacing of the monitoring probes is between 200 and 400 feet. The migration of methane gas is induced by pressure gradients. The methane will move from areas of high pressure to those of low pressure following the path of least resistance. The methane will migrate vertically until it reaches the landfill cap, where it will begin to flow horizontally. This occurs until it finds a pathway out, either by the installed methane collection trenches or migration through the permeable *in situ* soils. Since methane is lighter than air, it wants to escape into the atmosphere. It has been our experience that whenever gas is migrating no matter what the spacing or depth of the monitoring probes, the gas will fill the void created by the monitoring point and an explosive meter will monitor the level. The six foot depth of the monitoring probes is to ensure a stable monitoring point. The only time a shallow monitoring point has not worked is in a very heavy, impermeable clay layer that acts as a seal to the migration of the gas. If a clay layer is encountered during the construction of the monitoring points, it will either be moved beyond the clay or excavated to a depth that is in the conductive zone below the clay.

There are 8 existing permanent probes surrounding Phases 1 and 2. Cherokee County's landfill is designed with a base liner system and cap system, there should be no migration of methane in the permeable *in situ* soils.

The gas can be detected by use of an instrument that reports the percent of lower explosive limit. The instrument being used is the Gas Tech GP 204.

Based on current conditions, there are eight(8) existing monitoring points. Quarterly, a County employee will visit each monitoring point either the temporary or permanent. The monitoring points consist of all methane probes and leachate collection system cleanouts. Using the detection instrument, he will determine if methane gas has filled the probes. If the probe is near the property line and methane gas is detected at or beyond the lower explosive limit (100% LEL), it must then be determined if the gas is migrating across the landfill boundary. If the probe is on the boundary or methane gas has migrated beyond the boundary , a remediation plan must be completed by Cherokee County.

Other points of monitoring will be the landfill structures. Each structure will be monitored for methane using the following methods:

1. All crawl spaces will be monitored;
2. All corners in the structure will be monitored;
3. Any holes, cracks and pipes through the foundation will be monitored

If methane gas is detected beyond 25% of its lower explosive limit in any structure, check the calibration of the monitor and resample. If the reading is still above 25%, evacuate the building and try to find the source of gas. If the source is found try to remove the source. If this fails a remediation plan is stated in the operational requirements.

2.6 Appendix IV - Recirculation Plan

The County does intend to utilize recirculation as a means of disposal of their leachate. The intention is to utilize recirculation as a method by which some relief can be given to the pumping and hauling. This relief will come in the form of evaporation and retention of water within the solid waste. The remaining leachate will be hauled to the Town of Andrews Waste Water Treatment Plant for disposal. Cherokee County must obtain a permit from the Division of Solid Waste before leachate recirculation can begin.

No water that comes in contact with the present surface of solid waste runs off any where other than the leachate collection system.

The County will spread the leachate over the surface of the solid waste, that is at a minimum five feet (5') deep, within the landfill. The spreading will be accomplished by one of two methods. The first method is by simply backing their leachate hauling truck into the landfill. A spreader hose will then be attached to the leachate tank and Cherokee County personnel will manually discharge the leachate over the solid waste. The second method will utilize the tank truck except the leachate will be used to wet down solid waste that is piled up from being dumped from a truck or trucks. Once this pile is wet, it will be spread around the working face by the trash compactor.

At a later date, a pump system may be incorporated into the system. The pump system will pump directly from the leachate lagoon and the leachate spread in a manner as it was from the tank truck.

Monthly monitoring will be performed to measure the leachate head at the leachate head detection well and analyze the leachate for BOD, COD, temperature and pH.

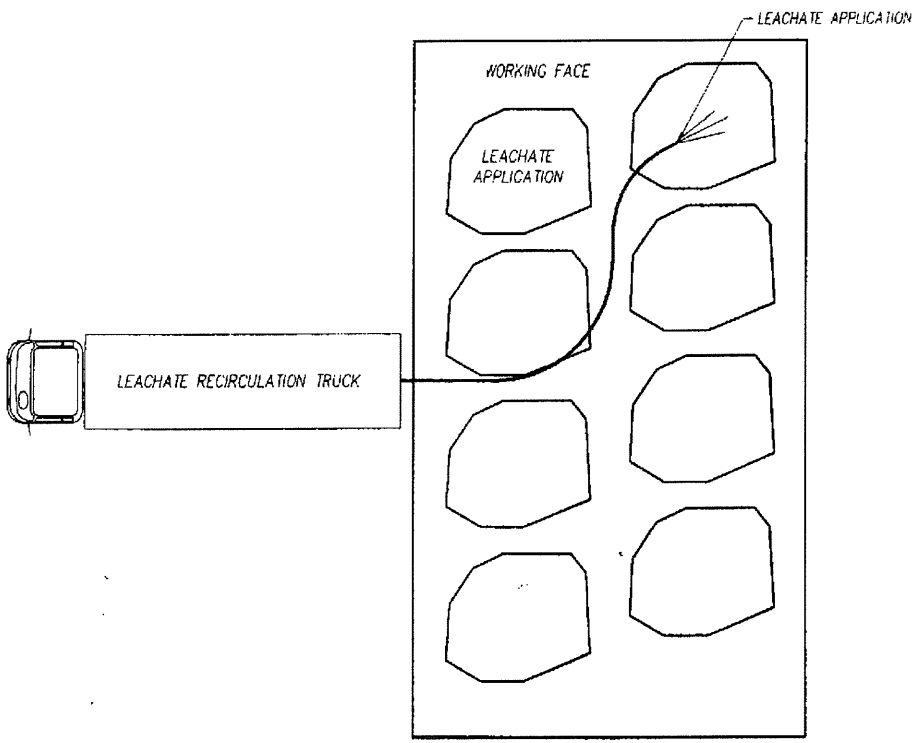
The following conditions will be met by Cherokee County:

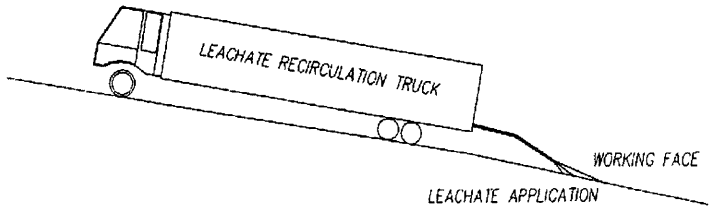
- A rain gauge and thermometer will be placed on site
- A base line sampling of leachate has been performed (See Attachment 1)
- A brief description of the equipment and its associated specifications is submitted (see Attachment 2)
- Weekly record of leachate head measurements (see Attachment 3)
- Weekly record of leachate recirculated and leachate disposed (see Attachment 4)
- Weekly record of visual monitoring log (see Attachment 5)
- Weekly record of rainfall and lagoon depth (see Attachment 6)
- Records will be kept on a weekly basis
- No leachate will be applied on less than one lift (8 feet) of waste
- No leachate will be recirculated when it is raining, or when the waste is too wet
- No run off or side seepage will be allowed
- Odors will be controlled
- Leachate depth will be monitored in the leachate head detection well to ensure that the head on the liner does not exceed one foot for more than 24 hours.
- The application system will be properly maintained and documented
- Leachate will be tested every 30 days and a progress report will be submitted annually

ATTACHMENT 1

BASELINE DATA

TO BE ADDED IN THE FUTURE





ATTACHMENT 2

ATTACHMENT 3

CHEROKEE COUNTY LEACHATE RECIRCULATION DATA

DATE	VOLUME RECIRCULATED	RECIRCULATION AREA (Section of Landfill)	VOLUME HAULED FOR DISPOSAL

ATTACHMENT 4

CHEROKEE COUNTY VISUAL MONITORING LOG

DATE	INDIVIDUAL MONITORING	OBSERVATIONS

ATTACHMENT 5

CHEROKEE COUNTY RAINFALL LOG

DATE	RAINFALL (INCHES)

2.7 Appendix V

Cherokee County Leachate Collection System Inspection Log

Rainfall

_____ inches ***(measured after each occurrence)***

Pump Readings

Phase 1 Pump:

_____ Date
_____ Hrs. Run (total weekly)*
_____ Gallons Pumps (total weekly)**

Manually Operate Pump_____ Date (monthly)

Main Pumps:

_____ Date
_____ Hrs. Run Pump 1 (total weekly)*
_____ Hrs. Run Pump 2 (total weekly)*
_____ Gallons Pumps (total weekly)**

Manually Operate Pump_____ Date (monthly)

Leachate Lagoon

Inspection of Liner _____ Date (Monthly)
Repairs to Liner _____ Date

Leachate Lines

Date Videoed _____
Date Flushed _____

Comments

_____
_____
_____
_____
_____
_____

_____

Hours Run/Week = *Previous Week's Hours – This Weeks Hours*
***Gallons Pumped/Week** = *Previous week's gallons – This week's gallons*

2.8 Engineering/Operation Drawings

2.8.1 Title Sheet
2.8.2 Index Sheet
2.8.3 Existing Conditions
2.8.4 1st Year Fill Plan
2.8.5 2nd Year Fill Plan
2.8.6 3rd Year Fill Plan
2.8.7 4th Year Fill Plan
2.8.8 5th Year Fill Plan
2.8.9 Final Fill with Methane Venting Plan
2.8.10 Miscellaneous Details

MUNICIPAL SOLID WASTE LANDFILL FACILITY

ENGINEERING/OPERATION PLAN

PHASE 4

Permit Number: 2002-MSW-1998

Site Location: 10160 US Hwy 19
Marble, NC 28905

Applicant: The County of Cherokee

Applicant's Address: Cherokee County Courthouse
75 Peachtree Street
Murphy, NC 28906

COUNTY COMMISSIONERS

C.B. McKinnon, Chairman
Cal Stiles, Vice-Chairman
Dan Eichenbaum
Roy Dickey
Gary Westmoreland

COUNTY MANAGER

Randy Wiggins

SOLID WASTE DIRECTOR

Jeff Clark

Engineer
Municipal Engineering Services Company, P.A.
Garner, NC - Boone, NC

NORTH CAROLINA PROFESSIONAL SEAL 31029 ENGINEER STEVEN R. GANDY
7/1/15

by _____
Professional Engineer
(Garner Office)

Municipal Engineering Services Company, P.A.
P.O. BOX 97 GARNER, N.C. 27529 (919) 772-5393
P.O. BOX 349 BOONE, N.C. 28607 (828) 262-1767
LICENSE NUMBER: C-0281

SCALE:	1:1
DATE:	6/22/2015
DRWN. BY:	L. CRAWFORD
CHKD. BY:	S.GANDY
PROJECT NUMBER	G15043
DRAWING NO.	T1
SHEET NO.	1 OF 11

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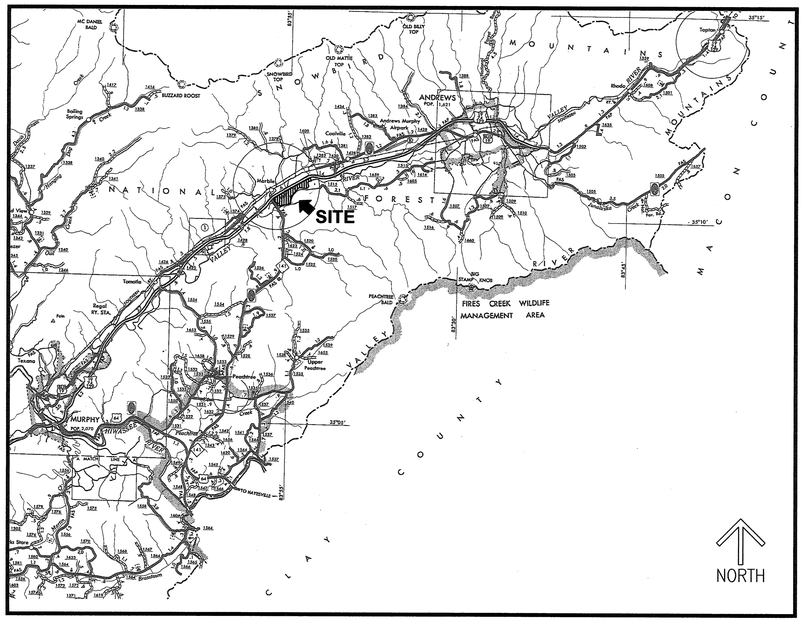
INDEX

SHEET NO.	DRAWING NO.	DESCRIPTION
1	T1	TITLE SHEET
2	T2	INDEX AND VICINITY MAP
3	E1	EXISTING CONDITIONS
4	E2	1st YEAR FILL PLAN
5	E3	2nd YEAR FILL PLAN
6	E4	3rd YEAR FILL PLAN
7	E5	4th YEAR FILL PLAN
8	E6	5th YEAR FILL PLAN
9	E7	FINAL FILL WITH METHANE VENTING PLAN
10	E8	MISCELLANEOUS DETAILS
11	E9	BORROW SITE LOCATION



VICINITY MAP

Municipal Engineering Services Company, P.A.
P.O. BOX 97 GARNER, N.C. 27529 (919) 772-5393
P.O. BOX 349 BOONE, N.C. 28607 (828) 262-1767
LICENSE NUMBER: C-0281

MUNICIPAL SOLID WASTE LANDFILL FACILITY
CHEROKEE COUNTY
MARBLE, NORTH CARIOLINA

DATE	BY	REV.	DESCRIPTION

ENGINEERING/OPERATION PLAN – PHASE 4
INDEX AND VICINITY MAP

NORTH CAROLINA PROFESSIONAL SEAL 31020 ENGINEER STEVEN R. GANDY

7/1/15

SCALE:	1:1
DATE:	6/22/2015
DRWN. BY:	L. CRAWFORD
CHKD. BY:	S. GANDY
PROJECT NUMBER	G15043
DRAWING NO.	T2
SHEET NO.	2 OF 11

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LEGEND

150 EXISTING CONTOURS

150 PROPOSED CONTOURS

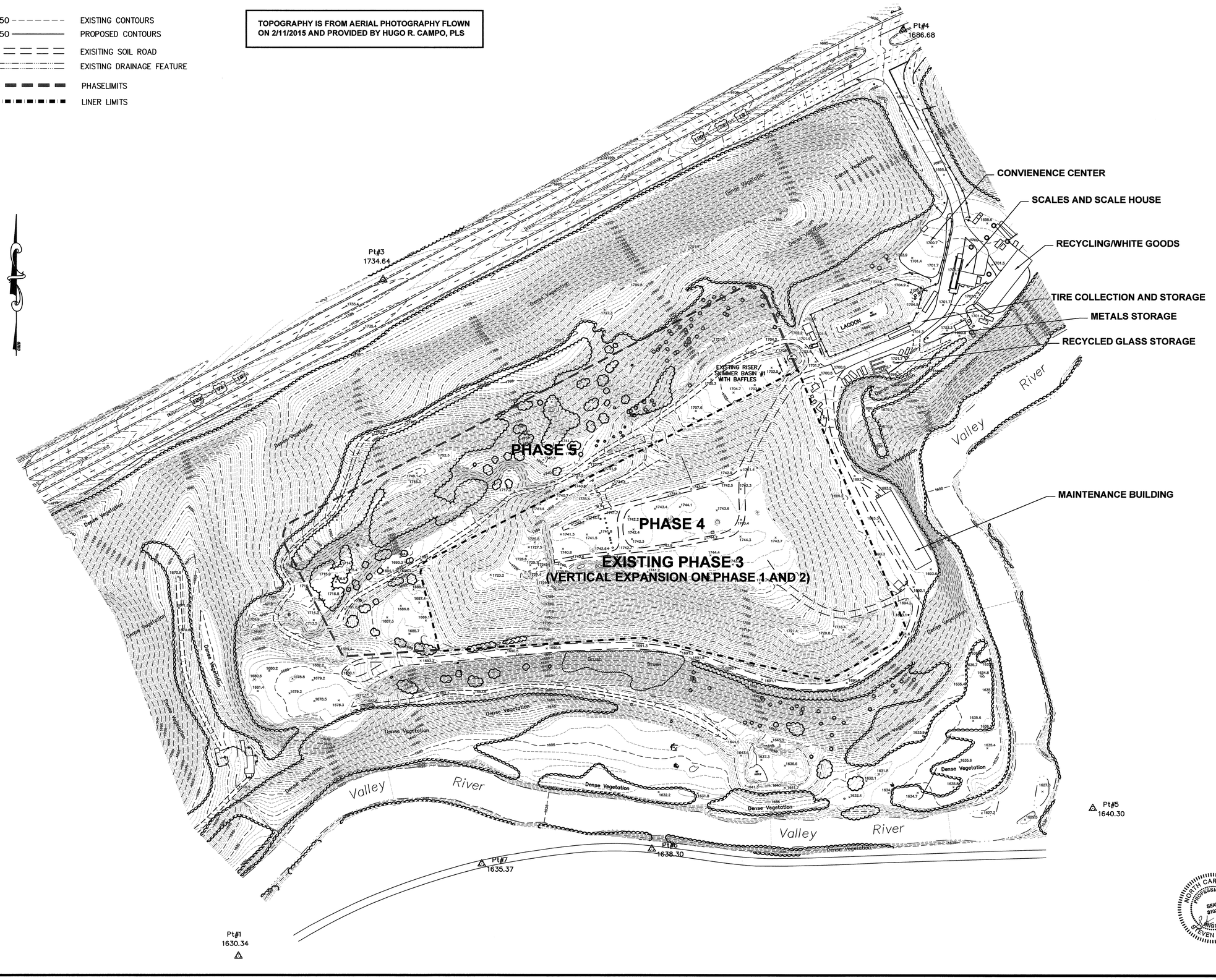
EXISITING SOIL ROAD

EXISTING DRAINAGE FEATURE

PHASELIMITS

LINER LIMITS

TOPOGRAPHY IS FROM AERIAL PHOTOGRAPHY FLOWN ON 2/11/2015 AND PROVIDED BY HUGO R. CAMPO, PLS



Municipal Engineering Services Company, P.A.
P.O. BOX 97, GARNER, N.C. 27529 (919) 772-5393
P.O. BOX 349 BOONE, N.C. 28607 (828) 262-1767
LICENSE NUMBER: C-0281

MUNICIPAL SOLID WASTE LANDFILL FACILITY
CHEROKEE COUNTY
MARBLE, NORTH CAROLINA

DATE	BY	REV.	DESCRIPTION

ENGINEERING/OPERATION PLAN – PHASE 4
EXISTING CONDITIONS AS OF 2/11/2015

NORTH CAROLINA PROFESSIONAL SEAL 31020 ENGINEER STEVEN R. GANDY

7/1/15

SCALE:	1" = 100'
DATE:	6/22/2015
DRWN. BY:	L. CRAWFORD
CHKD. BY:	S. GANDY
PROJECT NUMBER	G15043
DRAWING NO.	E1
SHEET NO.	3 OF 11

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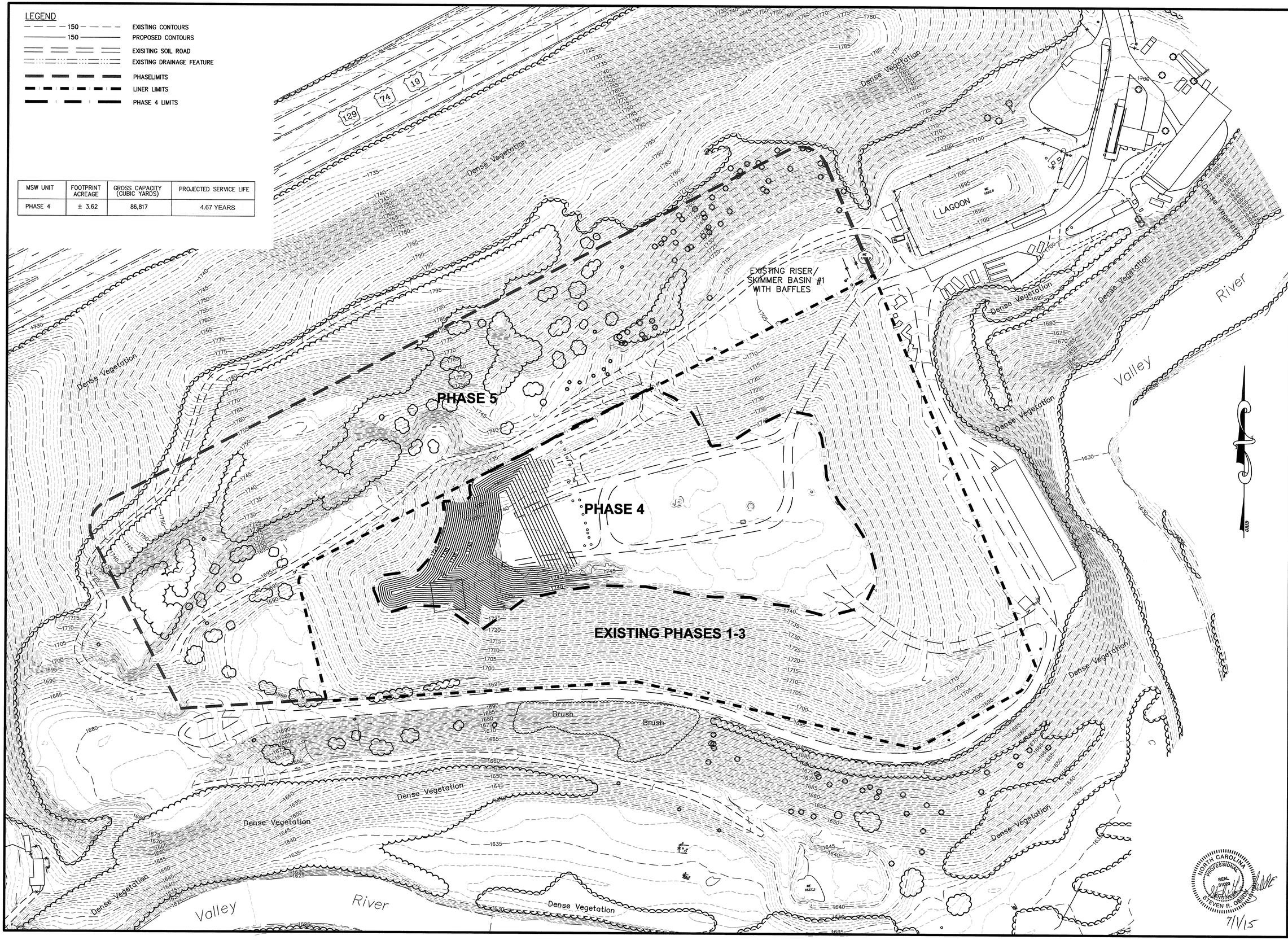
LEGEND

- 150 — EXISTING CONTOURS
- 150 — PROPOSED CONTOURS
- EXISITING SOIL ROAD
- EXISTING DRAINAGE FEATURE
- PHASELIMITS
- LINER LIMITS
- PHASE 4 LIMITS

MSW UNIT	FOOTPRINT ACREAGE	GROSS CAPACITY (CUBIC YARDS)	PROJECTED SERVICE LIFE
PHASE 4	± 3.62	86,817	4.67 YEARS



Municipal Services Engineering Company, P.A.
P.O. BOX 97, GARNER, N.C. 27529 (919) 772-5393
P.O. BOX 349, BOONE, N.C. 28607 (828) 262-1767
LICENSE NUMBER: C-0281

MUNICIPAL SOLID WASTE LANDFILL FACILITY
CHEROKEE COUNTY
MARBLE, NORTH CAROLINA

DATE	BY	REV.	DESCRIPTION

ENGINEERING/OPERATION PLAN – PHASE 4
1st YEAR FILL PLAN

NORTH CAROLINA PROFESSIONAL SEAL 31092 ENGINEER STEVEN R. GANDY
7/1/15

SCALE:	1" = 60'
DATE:	6/22/2015
DRWN. BY:	L. CRAWFORD
CHKD. BY:	S. GANDY
PROJECT NUMBER	G15043
DRAWING NO.	E2
SHEET NO.	4 OF 11

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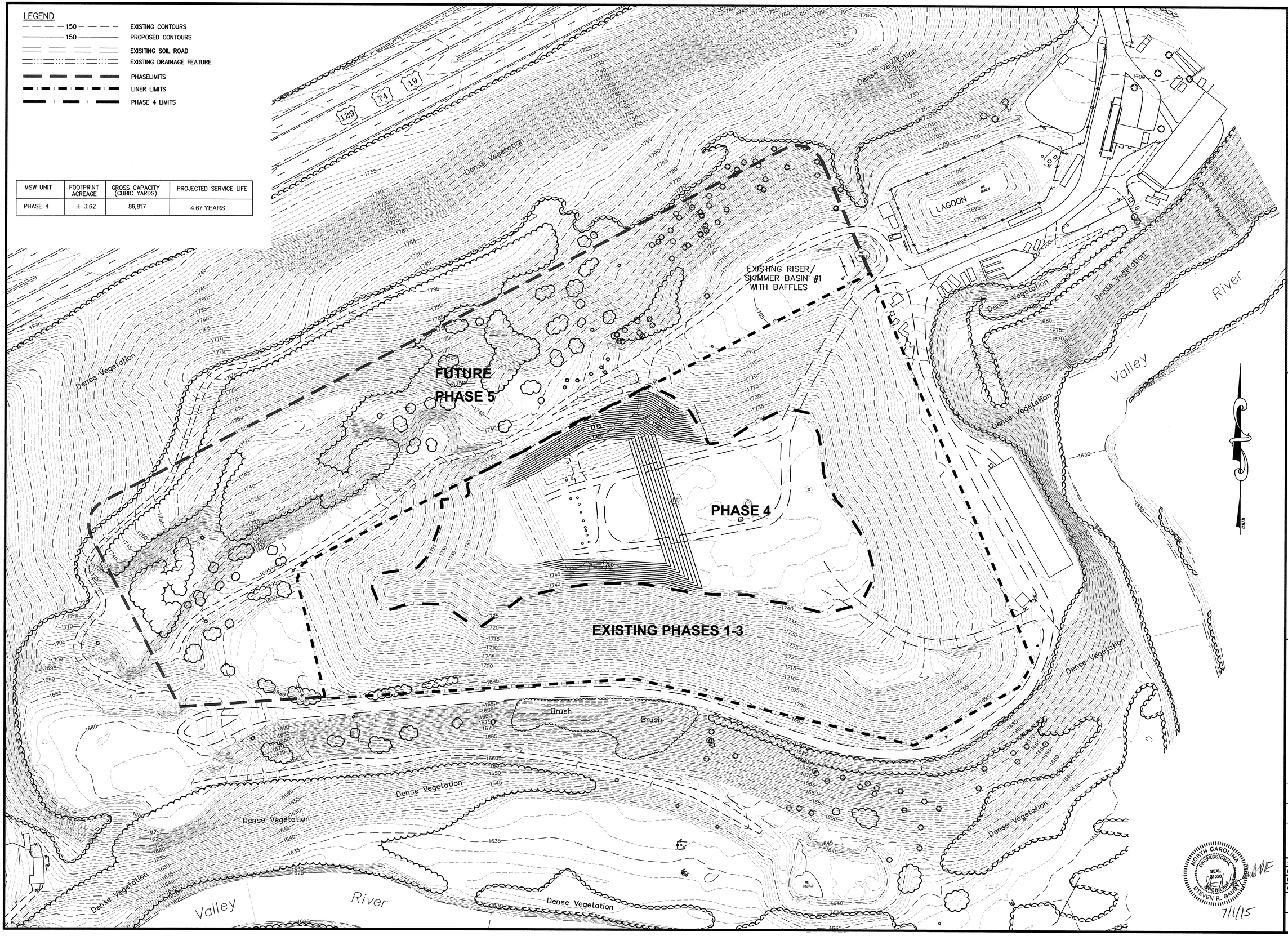
- 150 EXISTING CONTOURS
- 150 PROPOSED CONTOURS
- EXISITING SOIL ROAD
- EXISTING DRAINAGE FEATURE
- PHASELIMITS
- LINER LIMITS
- PHASE 4 LIMITS

MSW UNIT	FOOTPRINT ACREAGE	GROSS CAPACITY (CUBIC YARDS)	PROJECTED SERVICE LIFE
PHASE 4	± 3.62	86,817	4.67 YEARS



Municipal Solid Waste Engineering Company, P.A.
P.O. BOX 97 GARNER, N.C. 27529 (919) 772-5393
P.O. BOX 349 BOONE, N.C. 28607 (828) 262-1767
LICENSE NUMBER: C-0281

MUNICIPAL SOLID WASTE LANDFILL FACILITY
CHEROKEE COUNTY
MARBLE, NORTH CAROLINA

DATE	BY	REV.	DESCRIPTION

ENGINEERING/OPERATION PLAN – PHASE 4
2nd YEAR FILL PLAN

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 31020 STEVEN R. GANDY
7/1/15

SCALE:	1" = 60'
DATE:	6/22/2015
DRWN. BY:	L. CRAWFORD
CHKD. BY:	S. GANDY
PROJECT NUMBER	G15043
DRAWING NO.	E3
SHEET NO.	5 OF 11

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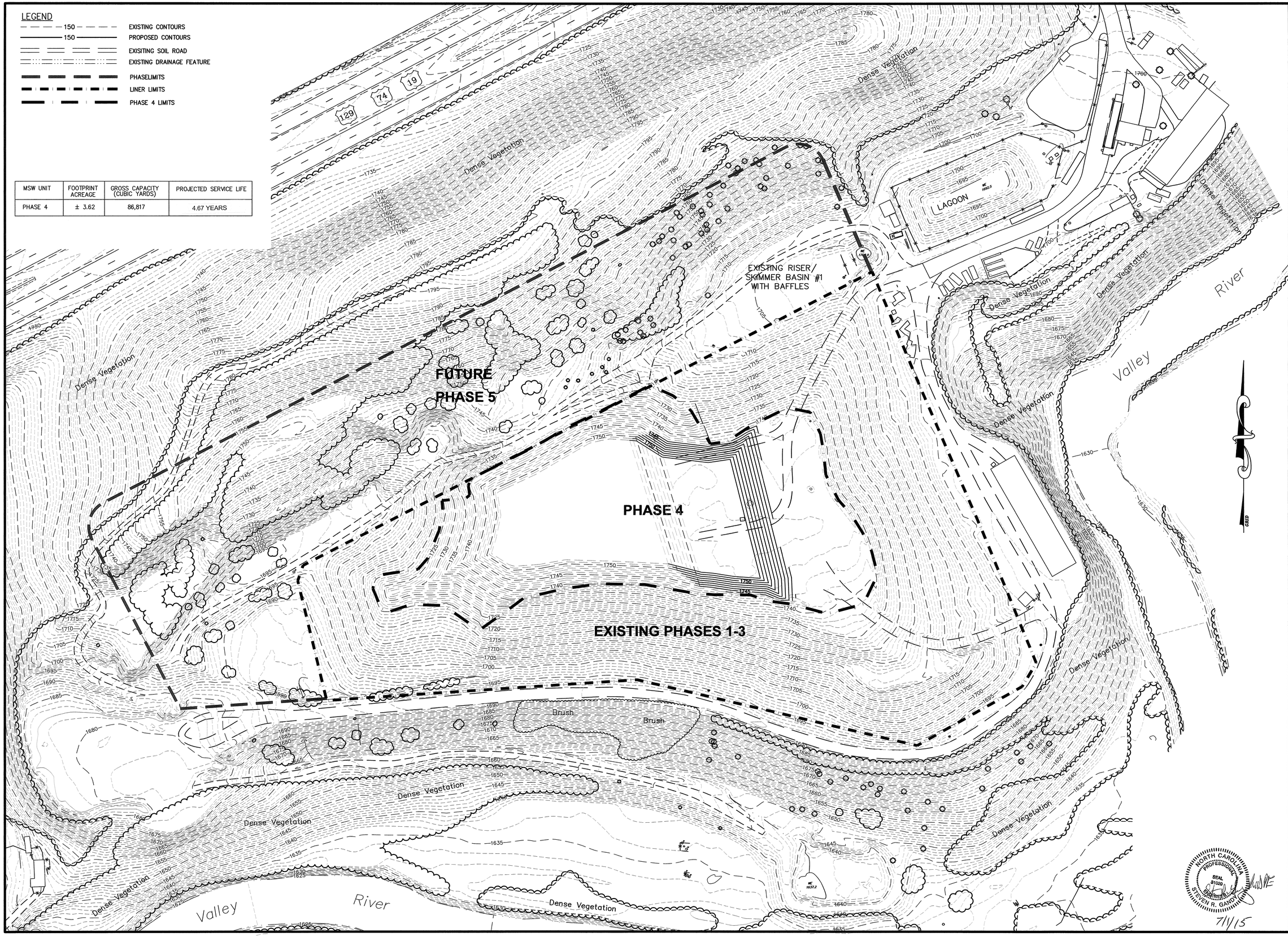
LEGEND

- 150 — EXISTING CONTOURS
- 150 — PROPOSED CONTOURS
- EXISITING SOIL ROAD
- EXISTING DRAINAGE FEATURE
- PHASELIMITS
- LINER LIMITS
- PHASE 4 LIMITS

MSW UNIT	FOOTPRINT ACREAGE	GROSS CAPACITY (CUBIC YARDS)	PROJECTED SERVICE LIFE
PHASE 4	± 3.62	86,817	4.67 YEARS



Municipal Services Engineering Company, P.A.
P.O. BOX 97 GARNER, N.C. 27529 (919) 772-5393
P.O. BOX 349 BOONE, N.C. 28607 (828) 262-1767
LICENSE NUMBER: C-0281

MUNICIPAL SOLID WASTE LANDFILL FACILITY CHEROKEE COUNTY MARBLE, NORTH CAROLINA

DATE	BY	REV.	DESCRIPTION

ENGINEERING/OPERATION PLAN – PHASE 4
3rd YEAR FILL PLAN

SCALE:	1" = 60'
DATE:	6/22/2015
DRWN. BY:	L. CRAWFORD
CHKD. BY:	S. GANDY
PROJECT NUMBER	G15043
DRAWING NO.	E4
SHEET NO.	6 OF 11

NORTH CAROLINA PROFESSIONAL SEAL 31020 ENGINEER STEVEN R. GANDY

7/1/15

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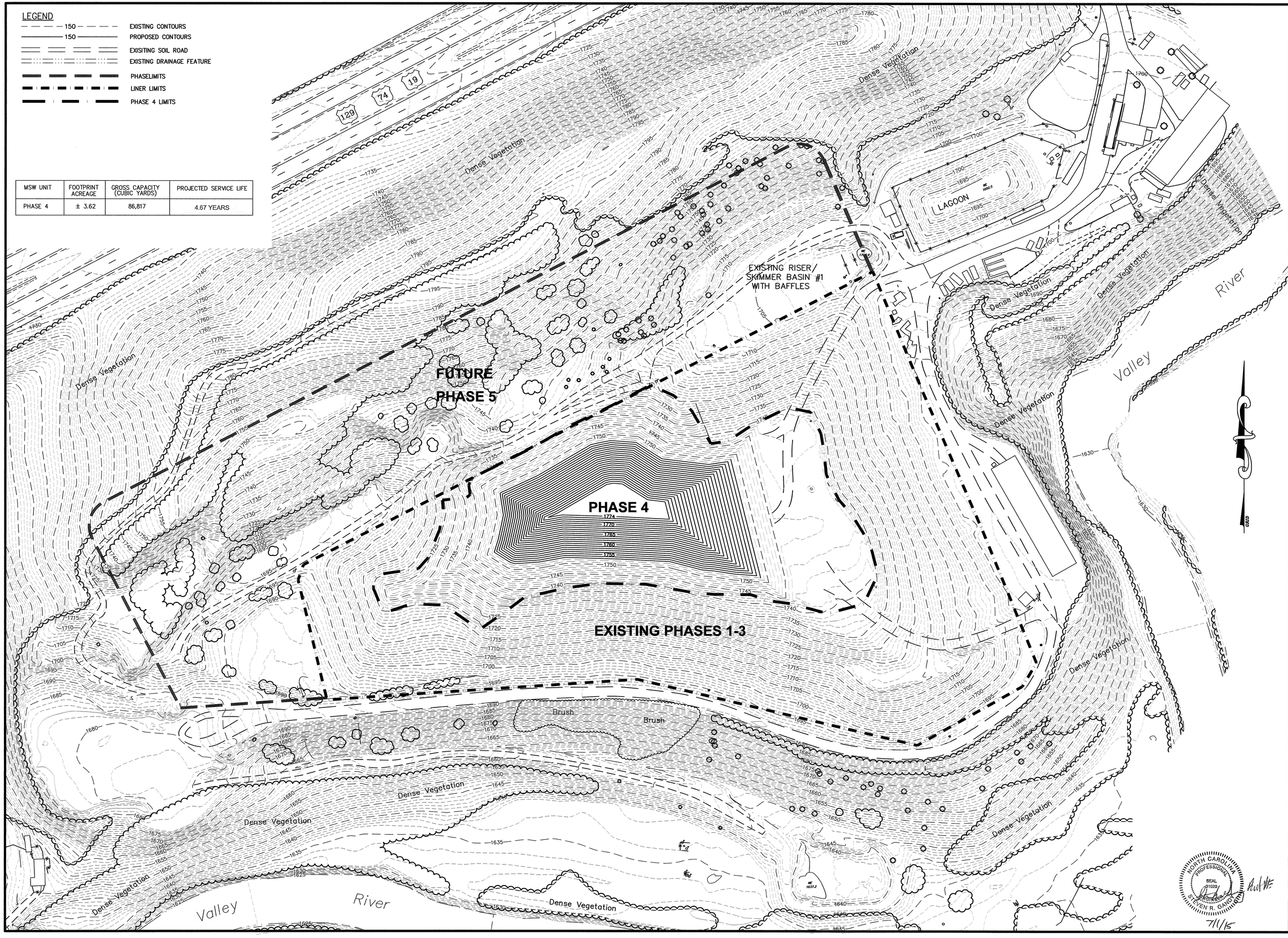
LEGEND

- 150 — EXISTING CONTOURS
- 150 — PROPOSED CONTOURS
- EXISITING SOIL ROAD
- EXISTING DRAINAGE FEATURE
- PHASELIMITS
- LINER LIMITS
- PHASE 4 LIMITS

MSW UNIT	FOOTPRINT ACREAGE	GROSS CAPACITY (CUBIC YARDS)	PROJECTED SERVICE LIFE
PHASE 4	± 3.62	86,817	4.67 YEARS



Municipal Engineering Services Company, P.A.
P.O. BOX 97, GARNER, N.C. 27529 (919) 772-5393
P.O. BOX 349 BOONE, N.C. 28607 (828) 262-1767
LICENSE NUMBER: C-0281

MUNICIPAL SOLID WASTE LANDFILL FACILITY
CHEROKEE COUNTY
MARBLE, NORTH CAROLINA

DATE	BY	REV.	DESCRIPTION

ENGINEERING/OPERATION PLAN – PHASE 4
4th YEAR FILL PLAN

SCALE:	1" = 60'
DATE:	6/22/2015
DRWN. BY:	L. CRAWFORD
CHKD. BY:	S. GANDY
PROJECT NUMBER	G15043
DRAWING NO.	E5
SHEET NO.	7 OF 11

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 31030 STEVEN R. GANDY
7/1/15

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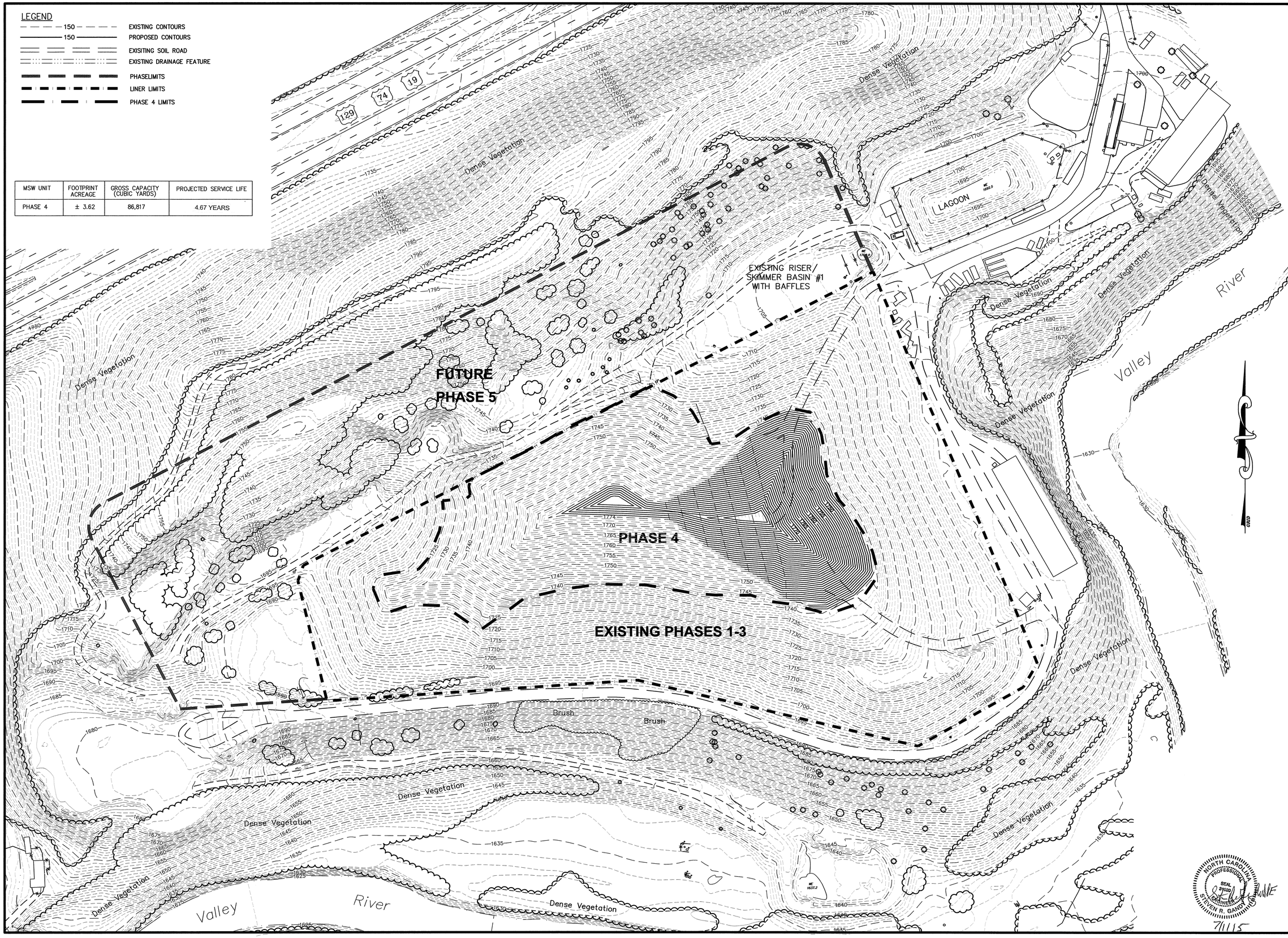
LEGEND

- 150 — EXISTING CONTOURS
- 150 — PROPOSED CONTOURS
- EXISITING SOIL ROAD
- EXISTING DRAINAGE FEATURE
- PHASELIMITS
- LINER LIMITS
- PHASE 4 LIMITS

MSW UNIT	FOOTPRINT ACREAGE	GROSS CAPACITY (CUBIC YARDS)	PROJECTED SERVICE LIFE
PHASE 4	± 3.62	86,817	4.67 YEARS



Municipal Engineering Services Company, P.A.
P.O. BOX 97, GARNER, N.C. 27529 (919) 772-5393
P.O. BOX 349 BOONE, N.C. 28607 (828) 262-1767
LICENSE NUMBER: C-0281

MUNICIPAL SOLID WASTE LANDFILL FACILITY
CHEROKEE COUNTY
MARBLE, NORTH CAROLINA

DATE	BY	REV.	DESCRIPTION

ENGINEERING/OPERATION PLAN – PHASE 4
5th YEAR FILL PLAN

NORTH CAROLINA PROFESSIONAL SEAL 31020 ENGINEER STEVEN R. GANDY

7/11/15

SCALE:	1" = 60'
DATE:	6/22/2015
DRWN. BY:	L. CRAWFORD
CHKD. BY:	S. GANDY
PROJECT NUMBER	G15043
DRAWING NO.	E6
SHEET NO.	8 OF 11

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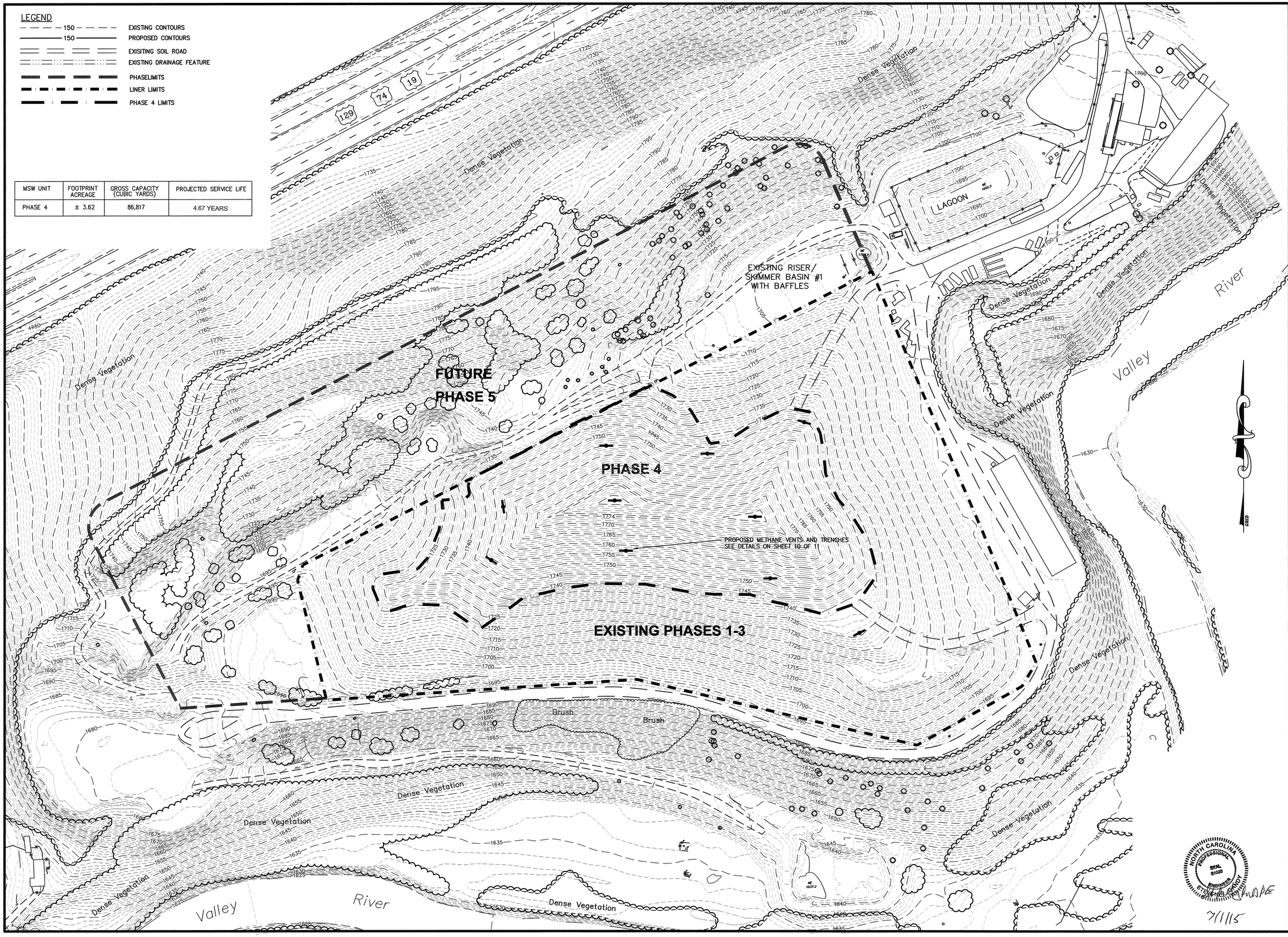
LEGEND

- 150 — EXISTING CONTOURS
- 150 — PROPOSED CONTOURS
- EXISITING SOIL ROAD
- EXISTING DRAINAGE FEATURE
- PHASELIMITS
- LINER LIMITS
- PHASE 4 LIMITS

MSW UNIT	FOOTPRINT ACREAGE	GROSS CAPACITY (CUBIC YARDS)	PROJECTED SERVICE LIFE
PHASE 4	± 3.62	86,817	4.67 YEARS



NORTH CAROLINA PROFESSIONAL SEAL 31020 ENGINEER STEVEN A. GANDY

7/1/15

Municipal Engineering Services Company, P.A.

P.O. BOX 97 GARNER, N.C. 27529 (919) 772-5393

P.O. BOX 349 BOONE, N.C. 28607 (828) 262-1767

LICENSE NUMBER: C-0281

MUNICIPAL SOLID WASTE LANDFILL FACILITY
CHEROKEE COUNTY
MARBLE, NORTH CAROLINA

DATE	BY	REV.	DESCRIPTION

ENGINEERING/OPERATION PLAN – PHASE 4
FINAL FILL WITH METHANE VENTING PLAN

SCALE:	1" = 60'
DATE:	6/22/2015
DRWN. BY:	L. CRAWFORD
CHKD. BY:	S. GANDY
PROJECT NUMBER	G15043
DRAWING NO.	E7
SHEET NO.	9 OF 11

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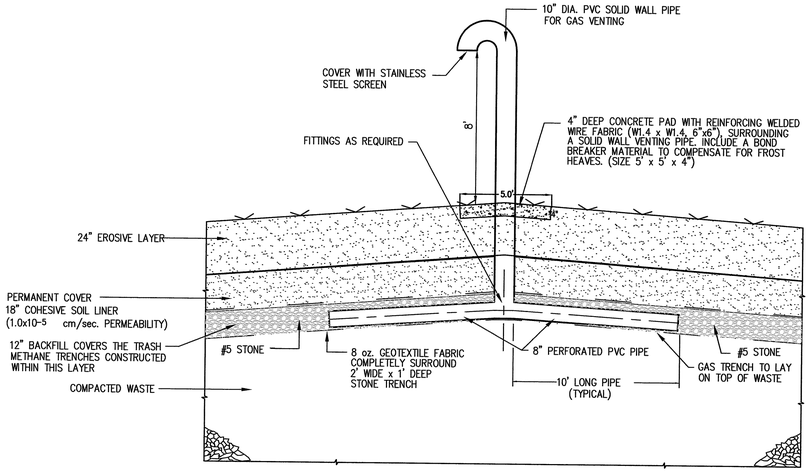
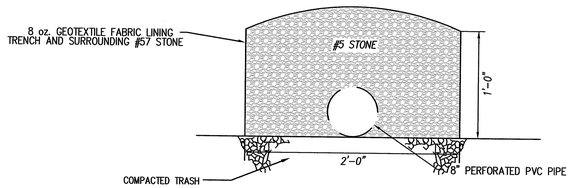


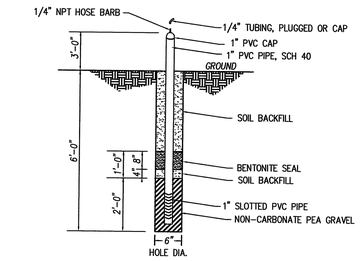
TYPICAL METHANE VENTING AND CAP CLOSURE DETAIL

N.T.S.



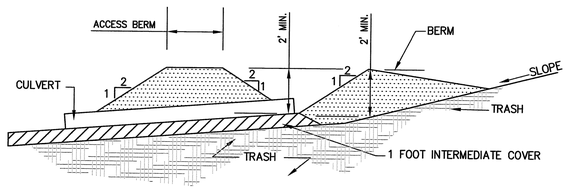
PERMANENT METHANE TRENCH DETAIL

N.T.S.



METHANE GAS MONITORING PROBE

N.T.S.



TYPICAL ACCESS ROAD, CULVERT, AND BERM DETAIL

N.T.S.

Municipal Engineering Services Company, P.A.
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LICENSE NUMBER: C-0281

MUNICIPAL SOLID WASTE LANDFILL FACILITY
CHEROKEE COUNTY
MARBLE, NORTH CAROLINA

DATE	BY	REV.	DESCRIPTION

ENGINEERING/OPERATION PLAN – PHASE 4
MISCELLANEOUS DETAILS

SCALE:	1:1
DATE:	6/22/2015
DRWN. BY:	L. CRAWFORD
CHKD. BY:	S. GANDY
PROJECT NUMBER	G15043
DRAWING NO.	E8
SHEET NO.	10 OF 11

NORTH CAROLINA PROFESSIONAL SEAL 31020 ENGINEER STEVEN R. GANDY

7/1/15

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LEGEND

150 EXISTING CONTOURS

150 PROPOSED CONTOURS

EXISITING SOIL ROAD

EXISTING DRAINAGE FEATURE

PHASELIMITS

LINER LIMITS

TOPOGRAPHY IS FROM AERIAL PHOTOGRAPHY FLOWN ON 2/11/2015 AND PROVIDED BY HUGO R. CAMPO, PLS

TOPOGRAPHY IS FROM AERIAL PHOTOGRAPHY FLOWN IN 1996 BY TRIANGLE AERIAL MAPPING.

Pt#3
1734.64

Pt#2
1702.75

Pt#1
1630.34

Pt#6
1638.30

Pt#7
1635.37

PHASE 5

PHASE 4

EXISTING PHASE 3
(VERTICAL EXPANSION ON PHASE 1 AND 2)

BORROW SITE

EXISTING RISER/ SKIMMER BASIN #1 WITH BAFFLES

LAGOON

SKIMMER BASIN

300' BUFFER

Dense Vegetation

Brush

Valley

River

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Municipal Engineering Services Company, P.A.

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LICENSE NUMBER: C-0281

MUNICIPAL SOLID WASTE LANDFILL FACILITY
CHEROKEE COUNTY
MARBLE, NORTH CAROLINA

DATE	BY	REV.	DESCRIPTION

ENGINEERING/OPERATION PLAN – PHASE 4
BORROW SITE LOCATION

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 31020 STEVEN R. GANDY

7/1/15

SCALE:	1" = 100'
DATE:	6/22/2015
DRWN. BY:	L. CRAWFORD
CHKD. BY:	S. GANDY
PROJECT NUMBER	G15043
DRAWING NO.	E9
SHEET NO.	11 OF 11

SECTION 3.0

CLOSURE PLAN

3.1 Introduction

The County will cap their landfill within 180 days after the final receipt of solid waste. The cap system will consist of 12 inches bridging material (temporary cover), 18 inches of cohesive soil liner with a permeability no greater than 1.0×10^{-5} cm/sec, 40 mil Linear Low Density Polyethylene (LLDPE), drainage layer, 24 inches of protective/erosive layer. The cap contains gas venting system consisting of a series of washed stone trenches below the soil liner that will be vented through 10" diameter PVC pipes that penetrate the cap. The cap system will also include the proper seeding and mulching of the erosive layer and other erosion control devices.

The largest area to be closed within the permitted life will be 10.5 acres.

The Division requires that the Engineer certifies that the constructed cap is built according to approved plans and specifications. The Engineer that will accomplish this task is the one who did the planning and has written the Closure Plan specifications.

Before construction can begin, a pre-construction meeting will be held and the responsibilities and duties of each party will be discussed.

The Contractor is responsible for following and meeting the requirements set forth in the contract documents. The Contractors will provide to the Owner of the landfill and the Engineer a completed landfill constructed by Division's approved plans and specifications. The Contractor will give the Engineer a schedule for completion of the landfill including dates for expected construction of the cohesive soil test pad, cohesive soil cap, erosive layer, and estimated time for project completion. The Contractor is responsible for providing a foreman to remain on site at all times during construction, provide qualified personnel to conduct quality control, scheduling and coordinating the subcontractors, provide progress reports and as-built drawings, and coordinating construction activities with the Engineer. The foreman is responsible for supervising and coordinating with his crew, subcontractors, quality control personnel, attending all meetings and notifying the Engineer's Construction Observer when any discrepancies occur. The Contractor will meet with the Construction Observer on a daily basis to discuss the days construction activities. The results of all tests and any change in schedule shall be given to the Construction Observer as soon they are known by the Contractor. The Contractor must be registered in the State of North Carolina.

The Engineer is responsible for providing the engineering design, drawings and specifications, contract documents and Construction Quality Assurance (CQA) needed for construction of the landfill. The Engineer is responsible for conducting the pre-construction meeting, which will lay out the foundation for the project. The Engineer will approve any design changes and certify to the Division that the cap was constructed according to the requirements of Rule .1621 Construction Quality Assurance Plan and .1624 Construction requirements for MSWLF Facilities, and Division approved plans and specifications. This will be accomplished by on-site observation and independent laboratory soil testing to test site-specific soil properties including permeability. The Engineer will provide Quality Assurance by spot testing along side the Contractor, who will be providing the Quality Control. The Engineer will certify that the construction was completed in accordance with the CQA manual. The Engineer must be a professional engineer registered in North Carolina.

The Construction Observer (CO) is the Engineer's representative on-site. It is the CO's responsibility to know and interpret the plans and specifications of the project. On a daily basis the CO will coordinate with the Foreman to help ensure a quality product for the Owner. The CO will keep a daily log on the activities of the Contractor, keep notes on all meetings, and handle all quality assurance activities indicated in this document. The CO will keep a log of all material delivered on site and ensure the materials meets or exceeds the specifications indicated in this report. If the need arises, additional meetings will be scheduled as determined by the CO.

The estimate of the maximum inventory of wastes ever on-site over the active life to date of the landfill facility is 513,898 cubic yards.

Prior to beginning closure, the County shall notify the Division of Solid Waste that a notice of the intent to close the unit has been placed in the operating record. The County shall begin closure activities no later than thirty (30) days after the date on which the landfill receives the final wastes or if the landfill has remaining capacity and there is a reasonable likelihood that the landfill will receive additional wastes, no later than one year after the most recent receipt of wastes. Extensions beyond the one-year deadline for beginning closure may be granted by the Division of Solid Waste if the County demonstrates that the landfill has the capacity to receive additional waste and the County has taken and will continue to take all steps necessary to prevent threats to human health and the environment from the closed landfill.

The County shall complete closure activities in accordance with the closure plan within 180 days following the final receipt of waste. Extensions of the closure period may be granted by the Division of Solid Waste if the County demonstrates that closure will, of necessity, take longer than one hundred eighty (180) days and the County has taken and will continue to take all steps to prevent threats of human health and environment from the enclosed landfill.

Estimated schedule of closure will be approximately 20 years.

Following closure of the landfill, the County shall notify the Division that a certification, signed by the project engineer, verifying that closure has been completed in accordance with the closure plan, and has been placed in the operating record. The County shall record a notation on the deed to the landfill property and notify the Division of Solid Waste that the notation has been recorded and a copy has been placed in the operating record. The notation on the deed shall in perpetuity notify any potential purchaser of the property that the land has been used as a landfill and its use is restricted under the closure plan approved by the Division of Solid Waste. The County may request permission from the Division to remove the notation from the deed if all waste are removed from the landfill.

3.2 Cap System

All materials and equipment shall be furnished by an established and reputable manufacturer or supplier. All materials and equipment shall be new and shall be of first class ingredients and construction, designed and guaranteed to perform the service required and shall conform with the following standard specifications or shall be the product of the listed manufacturers or similar and equal thereto as approved by the Engineer.

3.3 Cohesive Soil Cap

All materials and equipment shall be furnished by an established and reputable manufacturer or supplier. All materials and equipment shall be new and shall be of first class ingredients and construction, designed and guaranteed to perform the service required and shall conform with the following standard specifications or shall be the product of the listed manufacturers or similar and equal thereto as approved by the Engineer.

Cohesive Soil Cap Borrow Material

Test Name	Test Method	Contractor/Engineer Frequency
Moisture/Density	ASTM D698/D1557	1 per 5000 c.y.
Remolded Permeability	ASTM D5084	1 per 5000 c.y.
Atterberg Limits	ASTM D4318	1 per 5000 c.y.
Visual Classification	ASTM D2488	1 per 5000 c.y.
Grain Size Distribution	ASTM D422	1 per 5000 c.y.

Cohesive Soil Cap Test Pad

Test Name	Test Method	Contractor/Engineer Frequency
Field Moisture/Density	ASTM D1556 (sand cone) ASTM D2922/D3017 (nuclear gauge) ASTM D2937 (drive cylinder)	3 per lift
Permeability	ASTM D5084	1 per lift
Remolded Permeability	ASTM D5084	1 per lift
Atterberg Limits	ASTM D4318	1 per lift
Visual Classification	ASTM D2488	1 per lift
Grain Size Distribution	ASTM D422	1 per lift

In-Place Cohesive Soil Cap

Test Name	Test Method	Contractor/Engineer Frequency
Field Moisture/Density	ASTM D1556 (sand cone) ASTM D2922/D3017 (nuclear gauge) ASTM D2937 (drive cylinder)	1 per lift per acre
Permeability	ASTM D5084	1 per lift per acre
Atterberg Limits	ASTM D4318	1 per lift per acre
Visual Classification	ASTM D2488	1 per lift per acre
Grain Size Distribution	ASTM D422	1 per lift per acre

(a) Suitable on-site and/or off-site soils may be used as cohesive soil cap if it can achieve an in-place permeability of 1.0×10^{-5} cm/sec or less and meets all testing requirements indicated in the material testing paragraph in this section. Wyoming bentonite or an approved equivalent may be blended with the soil to lower the soil's permeability.

(b) A permeability "window" shall be developed for each type of soil from the borrow material that will be used for construction of the cohesive soil cap. The window shall be plotted on a semi-log plot with moisture content versus density. Laboratory testing to develop the window shall include a series of remolded samples compacted to various dry densities and moisture contents utilizing the same compactive effort (ASTM D 698 or D 1557). The remolded samples shall be tested for permeability to determine whether or not the particular soil type will provide the maximum permeability (1.0×10^{-5} cm/sec) at various dry densities and moisture contents. The window is then developed from the accepted remolded samples and moisture contents from the semi-log plot. A straight line is typically drawn between the acceptable points on the moisture-density curve to indicate a range of probable acceptable permeability results. The window will be used in the construction of the test strip to verify the laboratory remolded permeability results.

(c) Atterberg limits and grain size distribution shall also be conducted on the bulk samples used to prepare the permeability window ASTM D2488, D4318, D422. These tests can be used as indices on random samples collected from the borrow site during construction to verify the soil type is the same as was used to develop the "window". As a minimum, sufficient visual classifications and Atterberg limits shall be conducted in association with each permeability test to verify that the construction materials meet specifications.

(d) A test strip of compacted cohesive soil cap shall be prepared to verify the permeability "window" prior to general installation of the cohesive soil cap. The test strip will be used to verify the results from the remolded permeabilities from the borrow site utilizing the permeability window(s) for each soil type that is going to be used for construction of the cohesive soil cap. At a minimum, the verification will consist of three moisture density tests, one Atterberg limits test, one grain size distribution test (ASTM D2488, D4318, and D422), and one Shelby Tube sample for each lift constructed in the test pad. Laboratory permeability tests shall be performed on tube (Shelby or drive tubes) samples of the cohesive soil cap after placement

and compaction. The permeability must be a maximum of 1.0 $x10^{-5}$cm/sec. Tests shall be performed in accordance with the ASTM D5084. The test strip shall be approximately 2,500 sq. ft. in surface area and constructed to conform geometrically to the site topography with a minimum lateral dimension in any direction of 25 ft. The test strip shall consist of at least three compacted 6 inch lifts of cohesive soil cap. Placement and testing of the test strip shall be in conformance with the construction specifications and requirements for general installation of the cohesive soil cap. Test results from the test strip shall be used to guide placement and achievement of the required maximum permeability of 1.0 x 10^{-5} cm/sec of the cohesive soil cap. The test strip may be used as an integral part of the overall cohesive soil cap if it meets the required specification for the cap. All results shall be given to the Construction Observer.

(e) The soils shall be placed to the total thickness shown on the plans in maximum 8-inch thick loose lifts with a maximum 6" compacted lift compacted preferably at a moisture content between 0 to 3% above optimum moisture content to 95% standard Proctor maximum dry density (ASTM Test Designation D698). A sheepsfoot roller or approved alternative may be used to compact the soil cap provided the compaction and permeability requirements can be achieved. Each lift shall be tested for permeability, moisture content, particle size distribution analysis, Atterberg limits, moisture-density-permeability relation, and if needed percent bentonite admixed with soil, prior to the placement of the succeeding lift and visually inspected to confirm that all soil clods have been broken and that the surface is sufficiently scarified so that adequate bonding can be achieved. Soils for cohesive soil cap shall be screened, disced, or prepared using any other approved method as necessary to obtain a homogeneous cohesive soil with clod sizes in a soil matrix no larger than about 1.5 inches in maximum diameter. After each lift, the surface shall be scarified prior to the placement of the next lift to provide good bonding from one lift to the next.

(f) The cohesive soil cap shall be tested to evaluate the coefficient of permeability. The coefficient of permeability of the soil cap shall be equal to or less than 1.0 x 10^{-5} cm/sec after placement and compaction. The soil cap must be a minimum of 1.5 feet thick.

(g) Laboratory permeability tests shall be performed on tube (Shelby or drive tubes) samples of the cohesive soil cap after placement and compaction. The permeability must be a maximum of 1.0 x 10^{-5}cm/sec. Tests shall be performed in accordance with ASTM D5084.

(h) The soil cap shall be tested a minimum of one soil sample per lift per acre for laboratory permeability. All permeability testing will be on random samples judged by the Engineer to be representative of the most permeable soil conditions for the area being tested. The project engineer shall certify that the materials used in construction were tested according to the Division approved plans. If after placement of the soil cap it fails the required tests, the material will either be reworked or replaced. The soil cap must remain moist at all times, if any section becomes dry, rework the dry area and moisten.

(i) A minimum of two (2) inches of soil shall be removed prior to securing each sample for permeability testing. The sampling tube shall be advanced vertically into the soil with as little soil disturbance as possible and should be pushed using a uniform pressure. The sampling tube (Shelby tube), when extracted, shall be free of dents, and the ends shall not be distorted. A backhoe or approved alternative should be used to advance the sampling tube (Shelby tube) as long as disturbance is minimized. Drive tube samples of the cap may be obtained for permeability testings. If the Engineer judges the sample to be too disturbed, another sample shall be taken. Once an acceptable sample has been secured and properly prepared, all sample excavations shall be backfilled to grade with a 50% mixture of bentonite and similar soils in maximum 3-inch loose lifts and hand tamped with a blunt tool to achieve a tight seal equivalent to the original density.

(j) No additional construction shall proceed on the soil layers at the area being tested until the Engineer has reviewed the results of the tests and judged the desired permeability is being achieved.

(k) As a minimum, sufficient visual classifications (ASTM Test Designation D2488) , analyses (ASTM Test Designation D422) and Atterberg limits (ASTM Test Designation D4318) shall be conducted in association with each permeability test to verify that the construction materials meet specifications. The minimum number of tests will be 1 per lift per acre.

(l) If the soil for the cohesive soil cap is incapable of achieving the required permeability when compacted, bentonite or approved alternative may be mixed with the soils to decrease the permeability. The amount of additive required must be determined in the laboratory. Where additives are required, the soil shall be placed in maximum 8-inch thick loose lifts and compacted preferably between 0 to +3% optimum moisture content to 95% standard Proctor maximum dry density (ASTM Test Designation D698) for the soil-additive mixture. All other compaction procedures for the soil apply.

(m) Surfaces to be lined shall be smooth and free of debris, roots, and angular or sharp rocks larger than three-eight (3/8) inches in diameter to a depth of six (6) inches. The cohesive soil cap shall have no sudden sharp or abrupt changes in grade.

(n) The Contractor shall protect the cohesive soil cap from desiccation, flooding and freezing. Protection, if required, may consists of a thin plastic protective cover, (or other material as approved by the engineer) installed over the completed cohesive soil cap until such time as the placement of flexible membrane liner begins. Areas found to have any desiccation cracks or which exhibit swelling, heaving or other similar conditions shall be replaced or reworked by the contractor to remove these defects.

(o) The thickness and grade of the soil cap will be verified by the surveyor before placement of the geomembrane liner. The soil cap will be surveyed at 100' grid points where the elevations of the top of landfill will be checked with the top of soil cap to verify 1.5 feet of soil cap. The grade will then be verified with the surveyed information. The survey will be performed by NC licensed surveyors.

(p) Surface Acceptance. Upon request, the Flexible Membrane Liner manufacturer installer shall provide the Engineer with a written acceptance of the surface prior to commencing installation. Subsequent repairs to the cohesive soil cap and the surface shall remain the responsibility of the contractor.

3.4 Flexible Membrane Liner Method of Deployment

All materials and equipment shall be furnished by an established and reputable manufacturer or supplier. All materials and equipment shall be new and shall be of first class ingredients and construction, designed and guaranteed to perform the service required and shall conform with the following standard specifications or shall be the product of the listed manufacturers or similar and equal thereto as approved by the Engineer.

Flexible Membrane Liner Tests

Test Name	Description	Test Method	Frequency
Air Test	Air Test Seams		Every Seam
Vacuum Test	Every welded area		Where air test impossible
Destructive Tests	Seam Strength	ASTM D4437	Every 500' of seam

Qualified liner installers, seamers, and the liner foreman shall meet a minimum requirement of 1,000,000 square feet of geomembrane installation. There are no other minimum qualifications needed by other parties. 40 mil Linear Low Density Polyethylene (LLDPE) is to be placed in direct contact with moist cohesive soil cap. The extrusion rods and/or brads used in seaming the rolls together shall be derived from the same base resin as the liner and shall meet the following minimum properties:

Smooth 40 mil LLDPE Liner Specifications

Property	Test Method	Test Value	Contractor/Engineer Test Frequency
Thickness (min. ave.)	D5199	nom. (mil)	Per roll
- lowest individual for 8 out of 10 values		-10%.	
Density (max.)	D1505/D792	0.939	200,000 lb
Tensile Properties (1)(min. ave.)	D638 Type IV		20,000 lb
- yield stress lb/in		64	
- break stress lb/in		152	
- yield strain %		13	
- break strain %		800	
2% Modulus - psi (max.)	D5323	30,000	20,000 lb
Tear Resistance- lb/in (min ave.)	D1004	22	45,000 lb
Puncture Resistance- lb/in (min ave.)	D4833	56	45,000 lb
Axi-Symmetric Break Strain- % (min)	D5617	30	200,000 lb
Stress Crack Resistance- hr (2)	D5397 (App.)	n/a	per GRI-GM10
Carbon Black Content- %	D1603 (3)	2.0-3.0	20,000 lb
Carbon Black Dispersion	D5597	note (4)	45,000 lb
Oxidative Induction Time (OIT) (min ave,) (5)			
(a) Standard OIT	D3895	120 min.	
-or-			200,000 lb
(b) High Pressure OIT	D5885	500 min.	
Oven Aging at 85°C (6)	D5721		
(a) Standard OIT (min. ave) -% retained after 90 days	D3895	55	per each formulation
-or-			
(b) High Pressure OIT (min ave) -% retained after 90 days	D5885	80	
UV Resistance (7)			
(a) Standard OIT (min ave)	D3890	N.R. (8)	
-or-			per each formulation
(b) High Pressure OIT (min ave) -% retained after 1600 hrs (9)	D5885	50	

(1) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction yield elongation is calculated using a gage length of 33 mm Break elongation is calculated using a gage length of 50 mm

(2) The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.

(3) Other methods such as D4128 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D1603 (tube furnace) can be established.

(4) Carbon black dispersion for 10 different views: - all 10 in Categories 1 or 2

(5) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(6) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

(7) The condition of the test should be 20 hr UV cycle at 75°C followed by 4hr condensation at 60°C.

(8) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.

(9) UV resistance is based on percent retained value regardless of the original HP-OIT value.

(1) Preparation for Geomembrane Deployment

(a) Panel Layout

Prior to commencement of liner deployment, layout drawings shall be produced to indicate the panel configuration and location of seams for the project.

(b) Identification

Each panel used for the installation shall be given a numeric or alpha-numeric identification number consistent with the layout drawing. This identification number shall be related to manufacturing roll number that identifies the resin type, batch number and date of manufacture.

(c) Verification

The manufacturers certification will be given to the construction observer. The construction observer will inspect all certifications. If the certification does not meet specifications, it will be rejected. Adequate laboratory QA/QC conformance testing shall be performed by contractor/engineer to verify minimum requirements.

(2) Field Panel Placement

(a) Location

The Flexible Membrane Liner Manufacturer/Installer shall install field panels at the location indicated on the layout drawing. If the panels are deployed in a location other than that indicated on the layout drawings, the revised location shall be noted in the field on a layout drawing which will be modified at the completion of the project to reflect actual panel locations.

(b) Weather Conditions

Geomembrane deployment shall not be carried out during any precipitation, nor in the presence of excessive moisture (i.e. fog, dew), in an area of standing water, or during high winds.

(c) Method of Deployment

(1) The method and equipment used to deploy the panels must not damage the geomembrane or the supporting subgrade surface.

(2) No personnel working on the geomembrane will smoke, wear shoes that can damage the geomembrane, or engage in actions which could result in damage to the geomembrane.

(3) Adequate temporary loading and/or anchoring, (i.e. sandbags, tires), which will not damage the geomembrane, will be placed to prevent uplift of the geomembrane by wind. If uplift occurs, additional sandbags will be placed in necessary areas.

(4) The geomembrane will be deployed in a manner to minimize wrinkles. The geomembrane will have no fold overs.

(5) Any damage to a panel of the geomembrane will be repaired. Any area of a panel seriously damaged (torn, twisted, or crimped) will be marked, cut out and removed from the work area with resulting seaming and/or repairs performed.

(3) Field Seaming

(a) Layout

In general, seams shall be oriented parallel to the slope, i.e., oriented along, not across the slope. Whenever possible, horizontal seams should be located not less than five (5) feet from the toe of the slope. Each seam made in the field shall be numbered in a manner that is compatible with the panel layout drawing for documentation of seam testing results.

(b) Personnel

All personnel performing seaming operations shall be trained in the operation of the specific seaming equipment being used and will qualify by successfully welding a test seam. The project foreman will provide direct supervision of all personnel seaming to verify proper welding procedures are followed. Qualified liner installers, seamers, and the liner foreman shall meet a minimum requirement of 1,000,000 square feet of geomembrane installation. There are no other minimum qualifications needed by other parties.

(c) Equipment

(1) Fusion Welding

Fusion Welding consists of placing a heated wedge, mounted on a self propelled vehicular unit, between two (2) overlapped sheets such that the surface of both sheets are heated above the polyethylene's melting point. After being heated by the wedge, the overlapped panels pass through a set of preset pressure wheels which compress the two (2) panels together so that a continuous homogeneous fusion weld is formed. The fusion welder is equipped with a temperature readout device which continuously monitors the temperature of the wedge.

(2) Extrusion Fillet Welding

Extrusion fillet welding consists of introducing a ribbon of molten resin along the edge of the seam overlap of the two (2) sheets to be welded. The molten polymer causes some of the material of each sheet to be liquefied resulting in a homogeneous bond between the molten weld bead and the surfaces of the sheets. The extrusion welder is equipped with gauges giving the temperature in the apparatus and the preheat temperature at the nozzle.

(d) Weather Conditions

The Flexible Membrane Liner Manufacturer/Installer will rely on the experience of the Project Superintendent and the results of test seams to determine seaming restrictions by weather. Many factors, such as ambient temperature, humidity, wind, sunshine, etc., can effect the integrity of field seams and must be taken into account when deciding whether or not seaming should proceed. Responsibility for monitoring these conditions shall lie with the Project Superintendent; however, the Engineer may suspend any seaming operation which is, in his opinion, at the risk of providing the Owner with a quality product. Test seams are required prior to daily production seaming to determine if the weather conditions will effect the Flexible Membrane Liner System's ability to produce quality seams. Additional non-destructive and destructive testing of production seams substantiate the decision made by the Project Superintendent to seam on any given day.

(4) Seam Preparation

(a) Fusion Welding

(1) Overlap the panels of geomembrane approximately four (4) inches.

(2) Clean the seam area prior to seaming to assure the area is clean and free of moisture, dust, dirt, debris of any kind. No grinding is required for fusion welding.

(3) Adjust the panels so that seams are aligned with the fewest possible number of wrinkles and "fishmouths".

(4) A movable protective layer may be used, at the discretion of the Flexible Geomembrane Liner System Project Superintendent, directly below the overlap of geomembrane that is to be seamed to prevent build-up of moisture between the panels.

(b) Extrusion Welding

(1) Overlap the panels of geomembrane a minimum of three (3) inches.

(2) Temporarily bond the panels of geomembrane to be welded taking care not to damage the geomembrane.

(3) Grind seam overlap prior to welding within one (1) hour of welding operation In a manner that does not damage the geomembrane. Limit grinding to ¼" outside of the extrusion weld area.

(4) Clean the seam area prior to seaming to assure the area is clean and free of moisture, dust, dirt, and debris of any kind.

(5) Purge the extruder prior to beginning the seam to remove all heat-degraded extrudate from the barrel.

(6) Keep welding rod clean and off the ground.

(5) Test Seams

Test seams shall be performed at the beginning of each seaming period and at least once each four (4) hours for each seaming apparatus used that day. Test seams shall be made on fragment pieces of the geomembrane liner and under the same conditions as actual seams.

(a) Test Seam Length

The test seam shall be at least three (3) feet long and should be made by joining two (2) pieces of geomembrane at least 9" in width.

(b) Sample Procedure

(1) Visually inspect the seam for squeeze out, footprint, pressure and general appearance.

(2) Two random samples one (1) inch wide shall be cut from the test seam. The specimens shall then be tested in peel using a field tensiometer and shall not fail in the seam. If a specimen fails the entire procedure shall be repeated.

(3) If any of the second set of specimens fail, the seaming apparatus shall not be accepted and shall not be used for seaming until the deficiencies are corrected and a passing test seam is achieved.

(4) After completion of these tests, the remaining portion of test seam can be discarded. Documentation of the test seams will be maintained listing seam identification number, welder's name, temperature control setting and test results.

(5) Passing test results records shall be maintained.

(6) General Seaming Procedures

(a) Seaming shall extend to the outside edge of panels to be anchored. While welding a seam, monitor and maintain the proper overlap.

(b) Inspect seam area to assure area is clean and free of moisture, dust, dirt, debris of any kind.

(c) While welding a seam, monitor temperature gauges to assure proper settings are maintained and that the seaming apparatus is operating properly.

(d) Align wrinkles at the seam overlap to allow welding through the wrinkle.

(e) Fishmouths or wrinkles at seam and overlaps that cannot be welded through shall be cut along the ridge in order to achieve a flat overlap. The cut fishmouth or wrinkle shall be seamed. Any portion where the overlap is inadequate shall be patched with an oval or round patch of the same geomembrane extending a minimum of six (6) inches beyond the cut in all directions.

(f) All cross/butt seams between two (2) rows of seamed panels shall be welded during the coolest time of the day to allow for contraction of the geomembrane.

(g) All "T" joints shall have the overlap from the wedge welder seam trimmed back to allow an extrusion fillet weld. Then grind ¼ of an inch minimum on either side of the wedge seam, then extrusion weld all of the area prepared by grinding.

3.5 Flexible Membrane Liner Tests

The installation crews will non-destructively test all field seams over their full length using air pressure testing, vacuum testing or other approved methods, to verify the continuity and integrity of the seams.

(a) Air Pressure Testing

The welded seam created by double hot-wedge fusion welding process is composed of two distinct welded seams separated by an unwelded channel approximately 3/8 of an inch between the two welded seams permits the double hot-wedge fusion seams to be tested by inflating the sealed channel with air to a predetermined pressure, and observing the stability of the pressurized channel over time.

(1) Equipment for Air Testing

An air pump (manual or motor driven) capable of generating and sustaining a pressure between 25 to 30 psi.

A rubber hose with fittings and connections.

A sharp hollow needle, or other approved pressure feed device with a pressure gauge capable of reading and sustaining a pressure between 25 to 30 psi.

(2) Procedure for Air Testing

Seal both ends of the seam to be tested.

Insert needle or other approved pressure feed device into the sealed channel created by the fusion weld.

Inflate the test channel to a pressure between 25 to 30 psi, in accordance with the following schedule, close valve, and observe initial pressure after approximately 2 minutes.

INITIAL PRESSURE SCHEDULE *

Material (Mil)	Min. Psi	Max. Psi
40	25	30
60	27	30
80	30	30
100	30	30

* Initial pressure settings are read after a two minute "relaxing period". The purpose of this "relaxing period" is to permit the air temperature and pressure to stabilize.

Observe and record the air pressure five (5) minutes after "relaxing period" ends and when initial pressure setting is used. If loss of pressure exceeds the following or if the pressure does not stabilize, locate faulty area and repair.

MAXIMUM PERMISSIBLE PRESSURE DIFFERENTIAL AFTER 5 MINUTES - LLDPE

Material (Mil)	Pressure Diff.
40	4 psi
60	3 psi
80	3 psi
100	3 psi

At the conclusion of the pressure test the end of the seam opposite the pressure gauge is cut. A decrease in gauge pressure must be observed or the air channel will be considered "blocked" and the test will have to be repeated after the blockage is corrected.

Remove needle or other approved pressure feed device and seal resulting hole by extrusion welding.

(3) In the event of a Non-Complying Air Pressure Test, the following procedure shall be followed:

Check seam end seals and retest seams.
If non-compliance with specified maximum pressure differential re-occurs, cut one (1) inch samples from each end of the seam and additional samples.

Perform destructive peel tests on the samples using the field tensiometer.

If all samples pass destructive testing, remove the overlap left by the wedge welder and vacuum test the entire length of seam.

If a leak is located by the vacuum test, repair by extrusion welding. Test the repair by vacuum testing.

If no leak is discovered by vacuum testing, the seam will pass non-destructive testing.

If one or more samples fail the peel tests, additional samples will be taken.

When two (2) passing samples are located, the seam between these two (2) locations will be considered non-complying. Capping or removal of the non-complying seam are the only two (2) acceptable methods for repairing failed seams. Non-destruct test the entire length of the repaired seam.

(b) Vacuum Testing

This test is used when the geometry of the weld makes air pressure testing impossible or impractical or when attempting to locate the precise location of a defect believed to exist after air pressure testing. The penetration will be tested using this method.

(1) Equipment for Vacuum Testing

Vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft neoprene gasket attached to the bottom, port hole or valve assembly, and a vacuum gauge.

Vacuum pump assembly equipped with a pressure controller and pipe connection.

A rubber pressure/vacuum hose with fittings and connections.

A bucket and means to apply a soapy solution.

A soapy solution.

(2) Procedure for Vacuum Testing

Trim excess overlap from seam, if any.

Turn on the vacuum pump to reduce the vacuum box to approximately 5 inch of mercury, i.e., 5 psi gauge.

Apply a generous amount of a solution of strong liquid detergent and water to the area to be tested.

Place the vacuum box over the area to be tested and apply sufficient downward pressure to "seat" the seal strip against the liner.

Close the bleed valve and open the vacuum valve.

Apply a minimum of 5 in. Hg vacuum to the area as indicated by the gauge on the vacuum box.

Ensure that a leak tight seal is created.

For a period of not less than 30 seconds, examine the geomembrane through the viewing window for the presence of soap bubbles.

If no bubbles appear after 30 seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum 3 in. overlap, and repeat the process.

(3) Procedure for Non-Complying Test

Mark all areas where soap bubbles appear and repair the marked areas.

Retest repaired areas.

(c) Destructive Testing

(1) Concept

The purpose of destructive testing is to determine and evaluate seam strength. These tests require direct sampling and thus subsequent patching. Therefore destructive testing should be held to a minimum to reduce the amount of repairs to the geomembrane.

(2) Procedure for Destructive Testing

All Destructive tests will be done according to ASTM D4437. Destructive test samples shall be marked and cut out randomly at a minimum average frequency of one test location every 500 feet of seam length.

Additional destructive tests may be taken in areas of contamination, offset welds, visible crystallinity or other potential cause of faulty welds at the descretion of the Project Superintendent and Engineer.

Sample Size

The sample should be twelve (12) inches wide with a seam fourteen (14) inches long centered lengthwise in the sample. The sample may be increased in size to accommodate independent laboratory testing by the owner at the owner's request or by specific project specifications.

A one (1) inch sample shall be cut from each end of the test seam for field testing.

The two (2), one (1) inch wide samples shall be tested in the field in a tensiometer for peel ASTM D4437. Tensile strength is essentially a measurement of the greatest tension stress a substance can bear without tearing. If the liner tears before any part of the seam does the test is successful. If any field sample fails to pass, it will be assumed the sample fails destructive testing.

(3) Procedure in the event of Destructive Test Failure

Cut additional field samples for testing. In the case of a field production seam, the samples must lie a minimum of ten (10) feet in each direction from the location of the failed sample. Perform a field test for peel strength. If these field samples pass, then laboratory samples can be cut and forwarded to the laboratory for full testing.

If the laboratory samples pass then reconstruct the seam between the two (2) passing samples locations.

Heat tack the overlap along the length of the seam to be reconstructed and extrusion weld.

Vacuum test the extrusion weld.

If either of the samples fail, then additional samples are taken in accordance with the above procedure until two (2) passing samples are found to establish the zone in which the seam should be reconstructed.

All passing seams must be bounded by two (2) locations from which samples passing laboratory destructive tests have been taken.

In cases of reconstructed seams exceeding 150 feet, a destructive sample must be taken and pass destructive testing from within the zone in which the seam has been reconstructed.

All destructive seam samples sent to the Flexible Membrane Liner System's laboratory shall be numbered.

(d) Quality Assurance Laboratory Testing

(1) Destructive samples sent to the laboratory will be tested for "shear strength" and "peel adhesion" (ASTM D4437 as modified by NSF). Five (5) specimens shall be tested for each test method with data recorded. Four (4) out of the five (5) specimens must pass for each test in order for the seam to pass the destructive test.

(2) Defects and Repairs

(a) The Project Superintendent shall conduct a detailed walk through and visually check all seams and non-seam areas of the geomembrane for defects, holes, blisters and signs of damage during installation.

(b) All other installation personnel shall, at all times, be on the lookout for any damaged areas. Damaged areas shall be marked and repaired.

(c) Repair Procedures

Any portion of the geomembrane showing a flaw or failing a destructive or non-destructive test shall be repaired. Several procedures exist for repair and the decision as to the appropriate repair procedure shall be made by the Project Superintendent. Repairs need to be made in a timely manner to protect the moist cohesive soil liner and flexible membrane liner. If inclement weather is approaching, steps need to be made to protect the cohesive soil cap such as a temporary cover. If cohesive soil cap is damaged, it must be reworked. Procedures available for liner repair:

Patching - used to repair large holes, tears and destructive sample locations. All patches shall extend at least six (6) inches beyond the edges of the defect and all corners of patches shall be rounded.

Reconstruction - used to repair seams bounded by passing destruct samples.

Grinding and welding - used to repair sections of extruded seams.

Spot welding or seaming - used to repair small tears, pinholes or other minor localized flaws.
Capping - used to repair lengths of failed extruded seams.

Removal of a bad seam and replacement with a strip of new material seamed into place.

(d) Verification of Repairs

Every repair shall be non-destructively tested. Repairs which pass the non-destructive test shall be deemed adequate. Large repairs may require a destructive test. Repair test results shall be logged. The repair location shall be recorded on an as-built drawing.

3.6 Protective Cover

(1) HPDE Geocomposite Drainage Netting manufactured by SKAPS Industries, or approved equal

GEOCOMPOSITE PROPERTIES

PROPERTY	TEST	UNITS	MINIMUM AVERAGE ROLL VALUE
Thickness	ASTM D 5199	inch	0.305
Transmissivity[1] (15,000 psf)	ASTM D 4716	m^2/sec	$3x10^{-5}$
Ply Adhesion	ASTM D 413 or F 904	lb/in	2.0

COMPONENT PROPERTIES

GEONET	TEST	UNITS	MINIMUM AVERAGE ROLL VALUE
Polymer Density	ASTM D 1505	g/cm^3	0.94
Carbon Black Content	ASTM D 4218	%	2.0
Thickness	ASTM D 5199	inches	0.200
Mass per unit area	ASTM D 5261	lbs/ft^2	0.162
Transmissivity[1]	ASTM D 4716	m^2/sec	$1x10^{-3}$@ 15,000 psf
Tensile Strength	ASTM D 5035	lbs/in	45

GEOTEXTILE	TEST	UNITS	MINIMUM AVERAGE ROLL VALUE
Fabric Weight	ASTM D 5261	oz/yd^2	7.1
Thickness	ASTM D 5199	mils	95
Grab Strength	ASTM D 4632	lbs	210
Water Flow Rate	ASTM D 4491	gpm/ft^2	110
Apparent opening size (AOS)	ASTM D 4751	mm (Sieve Size)	0.150 (100)

1. Measured using water @ 20° C (68° F) with a gradient of one, between two steel plates, after one hour. Value may vary, based on dimensions of the transmissivity specimen and specific laboratory.
2. Component properties are tested prior to the lamination process. They cannot be tested on the final product.

The geocomposite will be handled in such a manner as to ensure the geocomposite are not damaged in any way. On slopes, the geocomposite will be secured in the anchor trench and then rolled down the slope in such a manner as to continually keep the geocomposite sheet in tension. If necessary, the geocomposite will be positioned by hand after being unrolled to minimize wrinkles. Geocomposite can be placed in the horizontal direction (i.e., across the slope) in some special locations (e.g., where extra layers are required or where slope is less than 10:1).
Geocomposite will not be welded to the geomembrane. Geocomposite will be cut using approved cutters,(i.e., hook blade, scissors, etc.) Care should be taken to prevent damage to underlying layers. Care must be taken not to entrap dirt in the geocomposite that could cause clogging of the drainage system, and or stones that could damage the adjacent geomembrane.

Adjacent rolls of geocomposite will be overlapped by at least four inches and securely tied. Tying can be achieved by plastic fasteners. Tying devices will be white or yellow for easy inspection. Metallic devices are not allowed. Tying will be five to ten feet along the bottom of the slope. Tying will be every five feet along the slope, every two feet across the slope and at the top of the berm. Tying in the anchor trench will be done in one foot intervals. In the corners of the side slopes where overlaps between perpendicular geocomposite strips are required, an extra layer of geocomposite will be

unrolled along the slope, on top of the previously installed geocomposite, from the top to bottom of the slope.

Any holes or tears in the geocomposite will be repaired by placing a patch extending two feet beyond edges of the hole or tear. The patch will be secured to the original geocomposite by tying every twelve inches. If the hole or tear width across the roll is more than 50% the width of the roll, the damaged area will be cut out and the two portions of the geocomposite will be joined.

The engineer will visually inspect the drainage layer before placement of the erosive layer, if any defects are detected they will be repaired before placement of erosive layer.

(2) Erosive Layer

The soil for the erosive layer shall consist of any soils suitable of supporting vegetative growth. The erosive layer shall be installed using low ground pressure equipment such as a Caterpillar D6H LGP, or approved equal, with ground pressure not exceeding 4.71 psi. When installing the erosive layer, the contractor shall adhere to the following guidelines:

(a) A minimum of twelve inches (12") of cover between low ground pressure equipment and the liner is required at all times. Roadways for entering and for transporting material over slopes and capped/lined areas shall have a minimum depth of four feet (4').

(b) Avoid undue stress on the liner at all times. Cover material must be pushed up slopes, never down to help minimize wrinkles. Material must be placed to minimize wrinkles, wrinkles in excess of two feet in height are unacceptable. If a wrinkle is more than two feet in height, soil will be placed on top of the wrinkle to decrease the height. Fold over of the liner will not be allowed. A worker must walk along side earth moving equipment and remove all rocks, stones, roots or other debris that could cause damage to the liner. Equipment operators must avoid sharp turns or quick stops that could pinch and tear the liner.

(c) If damage does occur, report it to the Project Manager immediately so that repairs can be performed without needless delay.

(d) Do not work wet cover material that cannot support equipment.

(e) Equipment operators and all other personnel must be qualified and must exercise good judgment and common sense at all times.

(3) Vegetative Layer

Native vegetation will be used as approved by the Erosion Control Plan.

3.7 Methane Venting System

Gas Venting System

NC.D.O.T. No.5 stone, Geotextile fabric, and 8" and 10" plastic pipes will be used in the construction of the Gas venting system.

(1) Stone in Trenches and Surrounding Perforated Collection Piping

Stone for methane collection system shall meet the requirements of NC DOT aggregate, standard size No. 5 and shall contain no fines. Stone must pass the sieve analysis test for No. 5 stone performed at the quarry.

(2) Geotextile Fabric

Geotextile fabric surrounding the stone/piping shall be non-woven needle punched fabric with the following minimum properties:

1)	Weight	8.0 oz/yd^2	ASTM D-3776
2)	Grab Strength	205 lbs.	ASTM D-4632
3)	Grab Elongation	50%	ASTM D-4632
4)	Trapezoidal Tear Strength	85 lbs.	ASTM D-4533
5)	Puncture Strength	100 lbs.	ASTM D-4833
6)	Mullen Burst Strength	320 psi	ASTM D-3786
7)	Permittivity	1.4 sec^{-1}	ASTM D-4491

Geotextile fabric shall be manufactured by Polyfelt , TNS Advanced Technologies, or approved equal.

(3) Plastic Pipe

Plastic gravity sewer pipe and fittings used for methane vent shall be unplasticized polyvinyl chloride (PVC) and conform to the requirements of ASTM Designation D-3034 on ASTM F679, Type PSM, Class 12454-B, SDR-35 with elastomeric gasket joints. PVC pipe and fittings shall be as manufactured by J-M Pipe, Certainteed, H&W Industries or equal. The methane riser pipe shall be a 10 inch solid wall PVC pipe.

3.8 Closure Costs

The largest area to be closed within the permitted life will be Phases 1-4 (on Phases 1, and 2's 10.5 Ac. footprint). The estimated costs shown below are only for Phases 1-4. Post Closure will be 30 years after closure.

Closure will consist of the following which costs are estimated as being done by a third party.

1. 18" of $1x10^{-5}$ cm/sec. soil cover;
2. 40 Mil LLDPE Liner and Drainage net;
3. Erosion Control Devices;
4. 24" Erosive layer;
5. Seeding and Mulching;
6. Mobilization/Demobilization;
7. Labor Costs; and
8. Stone for methane gas collection.
9. Geotextile for methane gas collection.
10. Vent pipes for methane gas collection.
11. Engineering Costs and QA/QC of the Composite liner and certification of closure.

Estimate of Probable Costs:

1. 18" of $1x10^{-5}$ cm/sec. soil cover for 10.5 acres:

   Total yardage + 30% = 33,033 yd^3 @ a cost of \$7.00/yd^3
   ∴ Cost = \$231,231

2. 40 Mil LLDPE Liner and Drainage net for 10.5 acres

   Total Footage + 30% = 594,594 ft^2 @ a cost of \$0.85/ft^2
   ∴ Cost = \$505,405

3. Erosion Control devices

   Estimated costs @ \$40,000
   ∴ Cost = \$40,000

4. 24" Erosive soil layer for 10.5 acres.

   Total yardage + 30% = 44,044 yd^3 @ a cost of \$5.00/yd^3
   ∴ Cost = \$220,220

5. Seeding and Mulching for 10.5 acres.

   Estimated cost of \$2,000/acre
   ∴ Cost = \$21,000

6. Mobilization/Demobilization.

   Estimated cost of \$80,000
   ∴ Cost = \$80,000

7. Labor Costs.

   Estimated cost of \$150,000
   ∴ Cost = \$150,000

8. Stone for methane gas venting.

Total estimated linear feet =1615 ft.
Total estimated volume for a 2'x1' trench = 3,230 ft^3
with a density of 120 lbs/ft^3 total weight =194 tons @ a cost of $18.00/ton
$\therefore$ Cost = $3,492

9. Geotextile for methane gas venting.

Total estimated linear feet = 1615 ft.
Total estimated perimeter for a 2'x1' trench = (1615 ft $\times$ 6 ft) = 9,690 ft^2
9,690 ft^2 @ a cost of $0.20/ ft^2
$\therefore$ Cost = $1,938

10. Vent pipes for methane gas venting.

Estimated cost @ $600.00 each (10).
$\therefore$ Cost = $6,000

11. Engineering Costs and QA/QC of the Composite liner and certification of closure.

Estimated cost = $120,000.00
$\therefore$ Cost = $120,000.00

Total of Estimated Phase 3 Closure Costs:

1.	$ 231,231
2.	$ 505,405
3.	$ 40,000
4.	$ 220,220
5.	$ 21,000
6.	$ 80,000
7.	$ 150,000
8.	$ 3,492
9.	$ 1,938
10.	$ 6,000
11.	$ 120,000
Total:	$ 1,379,286

SECTION 4.0

POST-CLOSURE PLAN

4.1 Introduction

CONTACTS:

Name:	Jeff Clark
Title:	Solid Waste Director
Phone No.:	(828) 837-2621
Email:	jeff.clark@cherokeecounty-nc.gov
Address:	Cherokee County Courthouse 75 Peachtree Street Murphy, NC 28906

DESCRIPTION OF USE:

The County has no future use planned for their landfill at this time.

DESCRIPTION OF MAINTENANCE ACTIVITIES:

The County landfill will be monitored quarterly for evidence of settlement, subsidence and ponding in the cap system. The entire site will be monitored quarterly for evidence and effects of erosion. The erosion control plan will be preserved. Annually in the Spring, the vegetative cover will be monitored to assure a good stand of vegetation, and where needed, it will be reseeded. These maintenance activities will take place over the entire post closure period of thirty years.

The leachate collection system will be monitored annually and flushed out if necessary. Leachate will be collected and treated until the generation of leachate has stopped due to capping.

DESCRIPTION OF MONITORING ACTIVITIES:

The County will monitor and analyze ground and surface water semi-annually for (Subtitle D Appendix I) constituents for a period of thirty years. The County will also monitor methane gas at landfill structures and the boundary quarterly for the thirty-year period.

COMPLETION OF POST-CLOSURE CARE

Following completion of the post-closure care period for each MSWLF unit, the owner or operator will notify the Division of Solid Waste that a certification, signed by a registered professional engineer, verifying that post-closure care has been completed in accordance with the post-closure plan, has been placed in the operating record.

CLOSURE OF LEACHATE STORAGE FACILITIES

The County will close the leachate lagoon within 180 days after liquid collection has ceased.

All solid waste will be removed from the leachate lagoon, connecting sewer lines, and manholes. All solid waste removed will be properly handled and disposed of according to federal and State requirements. All connecting lines will be disconnected and securely capped or plugged.

All waste residues, contaminated system components (composite liner system), contaminated subsoils, structures and equipment contaminated with waste will be removed and appropriately disposed. If the groundwater surrounding the impoundment is contaminated, other corrective actions to remediate a contaminant plume may be required by the Department. If the groundwater surrounding the lagoon is found not to be contaminated, the liner system may remain in place if drained, cleaned to remove all traces of waste, and both liners punctured so that drainage is allowed. The lagoon is to be backfilled and regraded to the surrounding topography.

4.2 Post Closure Costs

The largest closed area to be monitored within the post closure life will be Phases 1-4 (10.5 Ac.).

Post Closure Costs:

Methane gas, ground water and surface water will be monitored for 30 years after closure. The cap will also have to be monitored for the 30 year period. All costs include reports, data analysis, and certifications.

1. Ground and Surface Water monitoring semiannually for 30 years for appendix I constituents and statistical analysis.

   Estimated cost/sample = $840.00/sample
   Total annual samples = 2(6 wells + 1 surface) = 14 samples/year
   Estimated cost = 30 years x 14 samples/year x $840.00/sample = $352,800

   ∴ Cost = $352,800

2. Methane Gas monitoring quarterly for 30 years.
   Estimate $600.00/quarter = $2,400.00/year
   Estimated cost = 30 year x $2,400.00 = $72,000.00

   ∴ Cost = $72,000.00

3. Cap Monitoring and repairing any problems.
   Estimate $60,000 for the 30 years.

   ∴ Cost = $60,000

4. Closure of sedimentation and erosion control devices.
   Estimate $24,000.00 for closure

   ∴ Cost = $24,000

5. Leachate Management.
   Estimate $300,000.00 for the 30 years.

   ∴ Cost = $300,000

6. Closure of leachate lagoon.
   Estimate $30,000 for Closure.

7. Maintenance of gas vents, monitoring wells , etc.
   Estimate $60,000

Total of Estimated Post Closure Costs:

1.	$ 352,800
2.	$ 72,000
3.	$ 60,000
4.	$ 24,000
5.	$ 300,000
6.	$ 30,000
7.	$ 60,000
Total:	$ 898,800

4.3 Potential Assessment and Corrective Action (PACA) Estimate

Approved PACA Cost Estimate = **$2,084,586.70**

SECTION 5.0

FINANCIAL ASSURANCES

TO BE SUBMITTED AT A LATER DATE