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AMENDMENT TO PERMIT

SURRY COUNTY MUNICIPAL SOLID WASTE LANDFILL FACILITIES PHASE 3

Permit Numbers: 8606-MSWLF-1998

Site Location: 237 Landfill Road
Mt. Airy, NC 28030

Applicant: County of Surry

Applicant's Address: Surry County
Solid Waste Department
P.O. Box 342
Dobson, NC 27017

MESCO Project Number
G14048

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SECTION 1.0

ENGINEERING PLAN

1.1 Analysis of the Facility Design and Landfill Capacity

The Surry County Municipal Solid Waste Landfill Facility (MSWLF), Permit number 8606-MSWLF-1998 was originally permitted in 1998. The county currently has two Municipal Solid Waste(MSW) phases of operation permitted (Phases 1, and 2). The County is proposing a vertical expansion(Phase 3) on the existing permitted area of the MSWLF.

The facility is located on approximately 131.6 acres of land with 50.7 acres being used for Municipal Solid Waste Landfill. Existing Phase 1 is approximately 16 acres in size. Phase 2 is approximately 11.0 acres.

The facility consists of the Municipal Solid Waste (MSW). In addition to MSW, White Goods and tires are processed at the facility.

The MSWLF unit is located a minimum of 300' from the property lines, 500' from existing wells, and 50' 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 base liner system consists of a 60 mil HDPE geomembrane liner that is 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 with membrane boots 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 2-4 of development with a vertical expansion being included when a Phase is constructed adjacent to the previous Phase. Each successive phase will vary in size due to being able to expand onto the previously filled areas. The Operation Plan of the Engineering Report will delineate this more clearly. Each individual Phase volume is estimated. The airspace is a net volume excluding the capping requirements.

LIFE EXPECTANCY CALCULATIONS PHASES 2-4

Given:
Life expectancy based on actual air space used in Fiscal Year 2012-2013 is as follows:

Volume requirements based on using 92,587 yards/year, for the first year and an annual increase of 1% for each year thereafter.

Phases	Total Airspace Available	Years of Life
Phase 2(Remaining)	93,003 cubic yards	1.00
Phase 3	489,959 cubic yards	5.29
Phase 4	1,954,396 cubic yards	11.2

Soil requirements for daily cover and final caps for Phase 3:
(Assume a 5:1 Trash to soil ratio)

Soil needed for Daily Cover = 81,660 cubic yards
Soil needed for Closure = 81,312 cubic yards(11.2 acres x 4.5')
Overall Soil Requirements = 162,972 cubic yards

The County owns sufficient additional property which it will utilize for borrow material as needed. There will be sufficient borrow material available to complete the landfill.

Estimated schedule of closure will be approximately 30 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 Alternate 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 18 inches thick with a permeability not to exceed 1.0×10^{-5} cm/sec. and is overlain by a Geosynthetic Clay Liner (GCL) and a geomembrane liner.

   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.

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 50' 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 with membrane boots 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 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 and hauled to the City of Mt. Airy Wastewater Treatment Plant. The leachate is treated according to the pre-treatment agreement with the City of Mt. Airy Wastewater Treatment Plant. 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 also records 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 will be collected in the existing double lined lagoon, which will hold approximately 950,000 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 pumped and hauled to the City of Mt. Airy WWTP, the valves can be turned off which will allow the lagoon to be drained. Once the leachate levels have been lowered, the valves can be opened. 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 storm water falling outside of the existing lined areas will be diverted away from the lined section through the use of diversion berms and ditches. Storm water 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 will be removed from the leachate storage tanks, 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.

1.1.8 Foundation, Settlement, and Slope Stability Analysis

All calculations for Sliding Block Stability Analysis, and Foundation Settlement Calculations were included in the geotechnical evaluation report by ECS, Ltd, presented in the Phase 2 Permit to Construct submittal in 2008. There have been no changes to these conditions, therefore all report findings remain the same. Should the County decide to pursue steeper final cover slopes a report will be done and submitted to the Division for approval.

1.1.9 Applicable Location Restriction Demonstrations

All location restrictions were handled in the site study.

SECTION 2.0

OPERATION PLAN

2.1 Introduction

The Surry County Landfill can accept Municipal Solid Wastes (MSW) from a 90 mile radius from Surry County. Surry County has constructed a Municipal Solid Waste Landfill (Phases 1 and 2) according to Subtitle D requirements. The facility has been constructed with 18 inches of cohesive soil (permeability of 1.0×10^{-5} cm/sec) with reinforced geosynthetic clay liner (GCL), 60 mil High Density Polyethylene liner (HDPE), 36 inches of protective cover over the liner and a leachate collection system which flows to the existing leachate lagoon.

The perimeter of the lined area has been marked off by 2 inch PVC pipe at approximately 200' intervals that were placed in the anchor trenches. Solid waste will not be placed within minimum of two(2) and a maximum of 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 gravity flows to the lagoon.

Leachate is being treated at the City of Mt. Airy Wastewater Treatment Plant. The leachate has to be tested according to the pretreatment conditions outlined in the pre-treatment agreement. There is a force main constructed to pump the leachate to the treatment plant.

The leachate is pumped to the Mt. Airy WWTP when the leachate is at a certain level in the lagoon. Once the pump(s) have been automatically turned on, the leachate is pumped down to another level where a float turns the pump(s) off. This cycle is repeated as many times as necessary to keep the leachate lagoon at a certain level. If necessary, the pumps can be manually operated to completely empty the lagoon.

The leachate lagoon will be inspected on a quarterly 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.

Operational cover will be the combination of soil and synthetic cover. The synthetic cover (Approved ACM) will be used on a daily basis. Soil cover will be placed on waste that has had synthetic cover on it for 7 days. (See cover requirements under operational requirements).

The County is monitoring for explosive gases at landfill structures and the perimeter of the landfill. 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-Appendix III) 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 is recording and retaining 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 is being sampled and analyzed according to Subtitle D Appendix I detection monitoring requirements. The monitoring frequency for all Appendix I (Section 2.3) 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 which it is permitted to receive. Surry 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.

   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.

      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. Asbestos waste will be accepted. The waste will be put in a hole dug out of the existing waste and buried immediately.

   e. 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.

   f. Surry County will continue a program at the Landfill for detecting and preventing the disposal of hazardous and liquid wastes. (Section 5.3-Appendix I) 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.

g. 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 (ACM) such as synthetic cover may be used as daily cover on the working face. The alternative material must be one that has been approved by the Division of Solid Waste and applied according to manufacturer's recommendations. At a minimum, soil cover will be used once every 7 days on areas that has been cover with the ACM for that period. (Section 5.4-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. The intermediate cover shall be placed in a manner to insure coverage of all waste.

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 an ACM 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 5.5-Appendix III)

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.

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 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.

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 **30 working days** or **120 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 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 , waste determination , and training records;

(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.

b. Solid waste will be compacted as densely as practical into cells.

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.

12. Leachate Management Plan

a. The County will periodically maintain the leachate collection system by visual inspection and annually flushing of the collection lines. At least once every 5 years, inspect the accessible lines by utilizing closed circuit television.

b. The County will maintain records for the amount of leachate pumped to the WWTP.

c. The County will quality sample their leachate bi-annually for Appendix I (Section 5.3) 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 City of Mt. Airy WastewaterTreatment Plant.

e. Under extreme operational conditions the County has the option of shutting down the flow of leachate to the lagoon by a valve. The leachate will be temporarily stored within the MSWLF units until such a time the flow of leachate can continue to the lagoon.

13. Storm Water Management

a. Until the waste in Phase 2 reaches the top of the berm, not all storm water can be diverted from then landfill. Once the waste has reached the top of the berm of Phase 2, the storm water will be diverted to the outside of the landfill to discharge points that are monitored according to the NPDES storm water permit.

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.

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.

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.

The 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, 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.

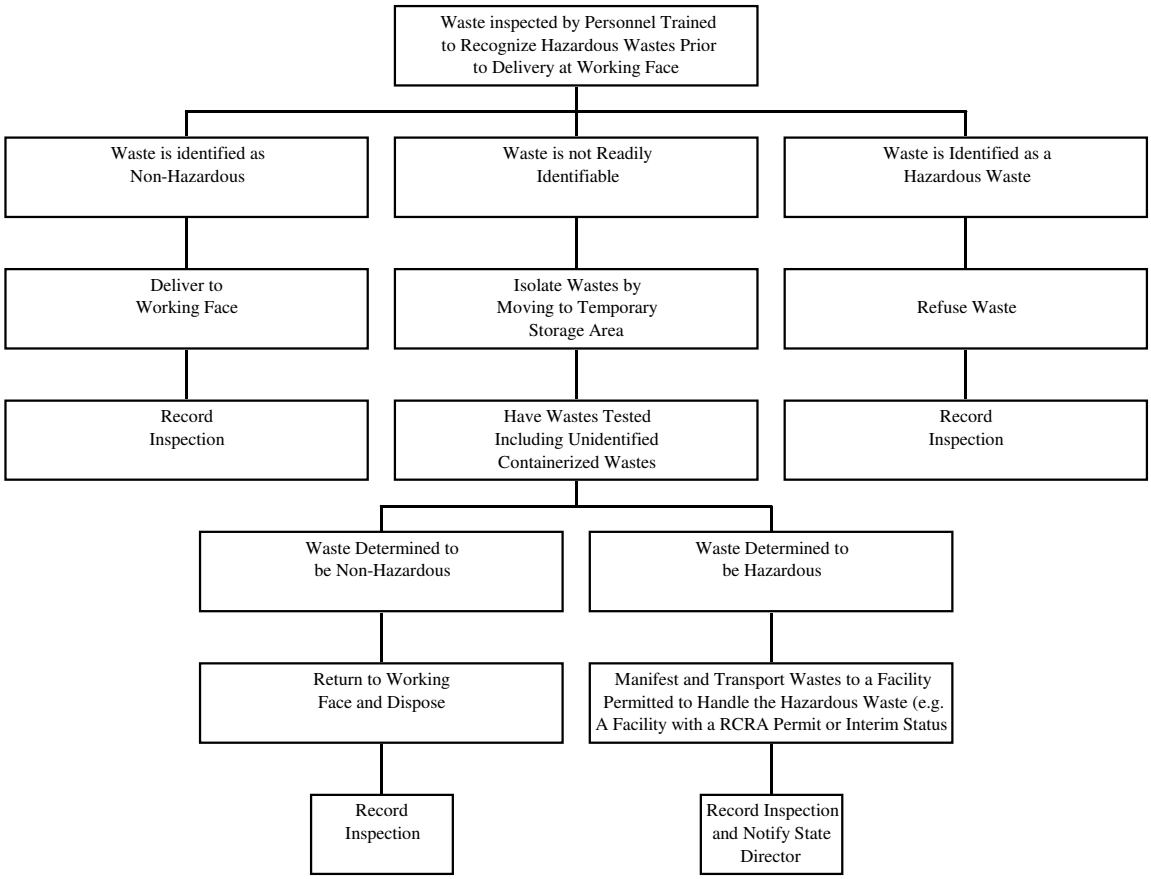

FIGURE 1
Hazardous Waste Inspection Decision Tree
Inspection Prior to Working Face

WASTE SCREENING CHECK LIST

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……..	_____	_____

CHECK ALL THAT APPLY

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

N.C. SOLID WASTE SECTION APPROVED ALERNATE 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, Surry 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 standpipe similar to a piezometer used for groundwater detection. A typical ten(10) foot permanent methane probe is detailed in the operation drawings. However, the probes will be constructed to a depth just above seasonal high water level. Where seasonal high water level depth are greater than thirty(30) vertical feet below land surface, clustered gas wells are required. For a ten(10) foot probe, typical dimensions will be as follows: A 6" diameter hole will contain a one (1) inch slotted PVC pipe. The bottom five (5) feet will be backfilled with non-carbonate pea gravel with a bentonite seal one (1) foot thick above it. The remaining four (4) 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 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 various depths of the monitoring probes are to ensure stable monitoring points. 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.

The gas can be detected by use of an instrument that reports the percent of lower explosive limit.

Quarterly, a County employee or consultant 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 the 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 V

COUNTY OF SURRY - TIRE COLLECTION PLAN

The Surry County Landfill will accept any tires generated within the limits of Surry County. No out of State tires are accepted. No tires still on rims will be accepted.

A disposer bringing five (5) or more tires must complete a NC scrap tire certification form. All disposers will cross the scales at the Scale house and a ticket will be generated and recorded noting the number of tires in their load.

Homeowners/tire dealers will be directed to the tire collection area located in fron of the maintenance shop. At the site, there are trailers where disposers are required to "lace" the tires to maximize air space.

Central Carolina Holdings provides delivery of trailers and pickup of tires under our current written agreement.

2.7 Appendix VI

COUNTY OF SURRY – WHITE GOODS MANAGEMENT PLAN

White Goods are accepted at the landfill. The white goods facility is located behind the recycling facility. Persons leaving white goods are directed to separate the items in the appropriated areas. Non-CFC units such as washers, dryers, stoves, ovens, water heaters, and dishwashers will be placed on the gravel pad. CFC white goods such as refrigerators, freezers, icemakers, and a/c units are placed on the concrete pad until CFC removal. The Freon is removed 3 or 4 times per year and a report of the quantity is sent to the County

The County will keep records of all outbound white goods and report these figures annually in accordance with GS 130A-309.85.

2.8 Engineering/Operation Drawings

2.8.1 Title Sheet
2.8.2 Index Sheet
2.8.3 Overall Facility Plan
2.8.4 Raining Fill Phase 2
2.8.5 1st Year Fill Plan
2.8.6 2nd Year Fill Plan
2.8.7 3rd Year Fill Plan
2.8.8 4th Year Fill Plan
2.8.9 Final Fill Plan
2.8.10 Final Fill with Methane Venting
2.8.11 Operation Details

SURRY COUNTY
MUNICIPAL SOLID WASTE
LANDFILL FACILITY

ENGINEERING/OPERATION PLAN
PHASE 3

PROJECT NUMBER: G14048

Permit Number:
8606-MSWLF-1998

Site Location:
237 Landfill Road
Mt. Airy, NC 27030

Applicant:
Surry County

Applicant's Address:
Surry County Landfill
237 Landfill Road
Mt. Airy, NC 27030

COMMISSIONERS

Eddie Harris - Chairman
Paul M. Johnson - Vice-Chairman
R.F. "Buck" Golding
Jimmy W. Miller
Larry Phillips

COUNTY MANAGER

Chris Knopf

DIRECTOR OF PUBLIC WORKS

Dennis Bledsoe

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

NORTH CAROLINA PROFESSIONAL SEAL 6282 ENGINEER JIMMY D. WOODIE

5/14/2014

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:	5/1/2014
DRWN. BY:	L. CRAWFORD
CHKD. BY:	J. WOODIE
PROJECT NUMBER	G14048
DRAWING NO.	T1
SHEET NO.	1 of 11

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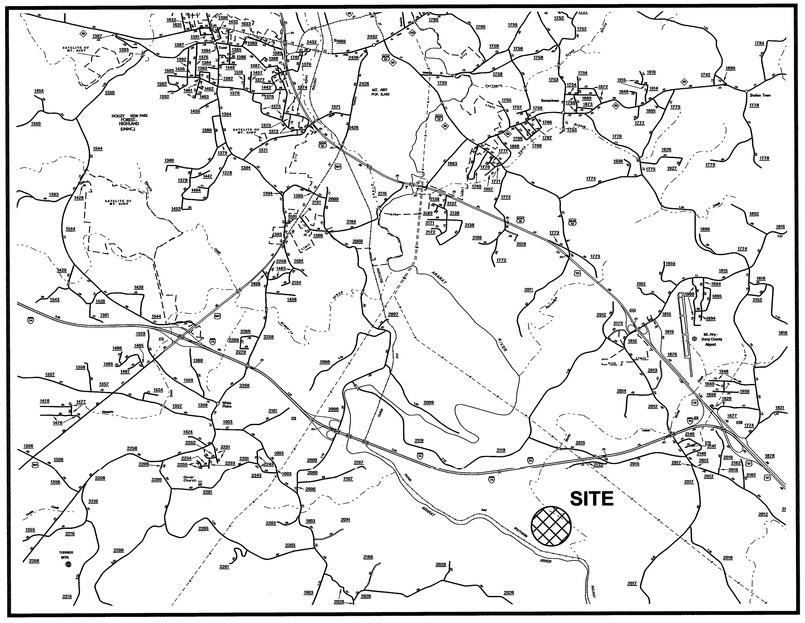
INDEX

SHEET NO.	DRAWING NO.	DESCRIPTION
1	T1	TITLE SHEET
2	T2	INDEX SHEET
3	F1	FACILITY MAP
4	E1	REMAINING FILL PHASE 2
5	E2	1st YEAR FILL PLAN
6	E3	2nd YEAR FILL PLAN
7	E4	3rd YEAR FILL PLAN
8	E5	4th YEAR FILL PLAN
9	E7	FINAL FILL PLAN
10	E8	FINAL FILL W/METHANE VENTING PLAN
11	E9	OPERATION DETAILS



VICINITY MAP

Municipal Engineering Services Company, P.A.
P.O. BOX 67 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
SURRY COUNTY NORTH CAROLINA

DATE	BY	REV.	DESCRIPTION

ENGINEERING/OPERATION PLAN–PHASE 3
INDEX AND VICINITY MAP

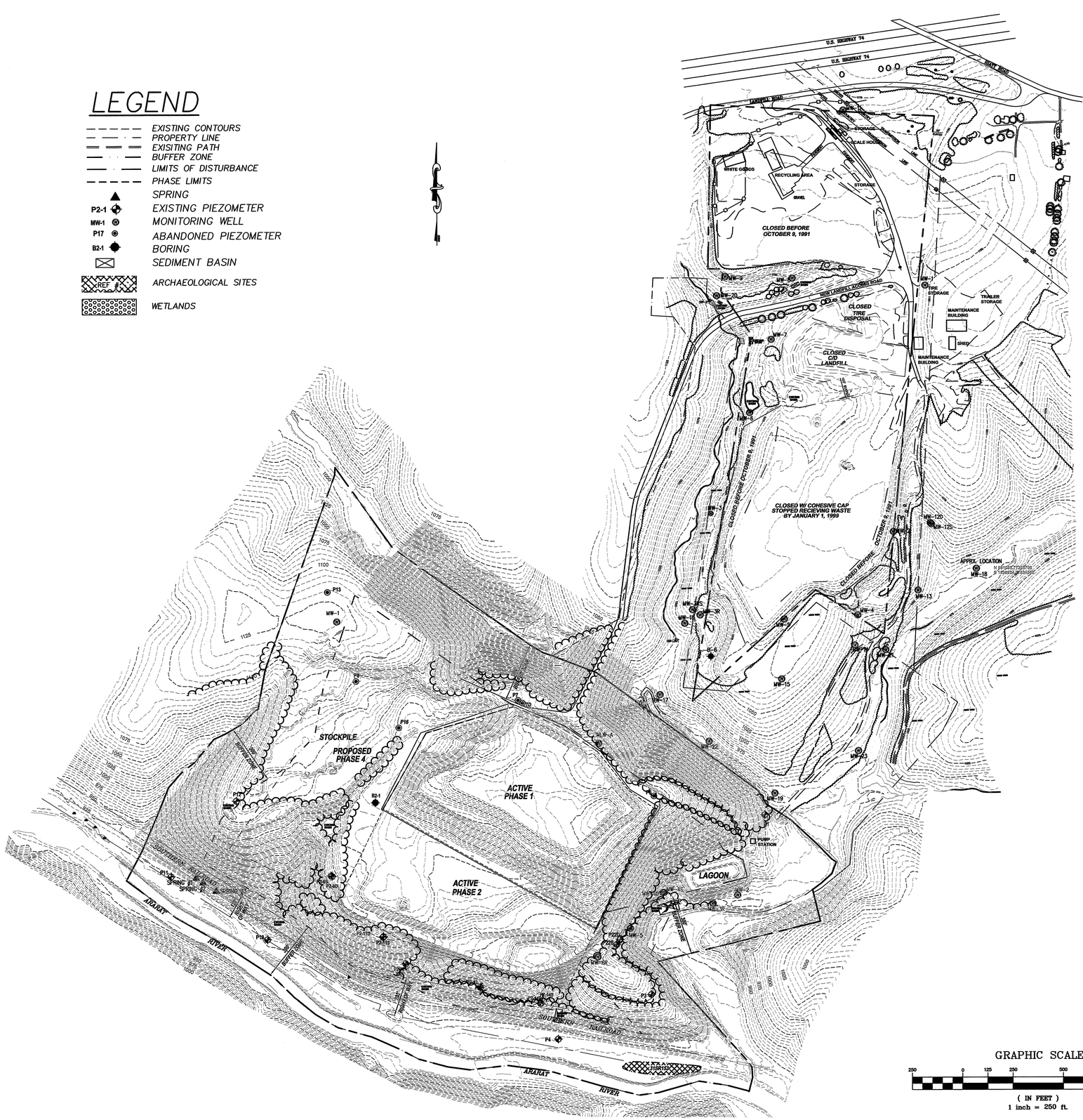
NORTH CAROLINA PROFESSIONAL SEAL 6782 ENGINEER JIMMY D. WOODIE
5/14/2014

SCALE:	1:1
DATE:	5/1/2014
DRWN. BY:	L. CRAWFORD
CHKD. BY:	J. WOODIE
PROJECT NUMBER	G14048
DRAWING NO.	T2
SHEET NO.	2 OF 11

P:\SolidWaste\G14048-Surry Phase 3 Permit Amendment\dwg\Eng-Op\G14048E-02.DWG, 5/9/2014 7:29:49 AM, Inc/hc

LEGEND

- EXISTING CONTOURS
- PROPERTY LINE
- EXISTING PATH
- BUFFER ZONE
- LIMITS OF DISTURBANCE
- PHASE LIMITS
- SPRING
- P2-1 EXISTING PIEZOMETER
- MW-1 MONITORING WELL
- P17 ABANDONED PIEZOMETER
- B2-1 BORING
- SEDIMENT BASIN
- HREF ARCHAEOLOGICAL SITES
- WETLANDS



GRAPHIC SCALE

250 0 125 250 500 1000

(IN FEET)
1 inch = 250 ft.

NORTH CAROLINA PROFESSIONAL SEAL 22182 ENGINEER TIMMY D. WOODIE
5/19/2014

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

MUNICIPAL SOLID WASTE
LANDFILL FACILITY
SURRY COUNTY
NORTH CAROLINA

DATE	BY	REV.	DESCRIPTION

ENGINEERING/OPERATION PLAN–PHASE 3
FACILITY MAP

SCALE:	1" = 250'
DATE:	5/1/2014
DRWN. BY:	L. CRAWFORD
CHKD. BY:	J. WOODIE
PROJECT NUMBER	G14048
DRAWING NO.	F1
SHEET NO.	3 OF 11

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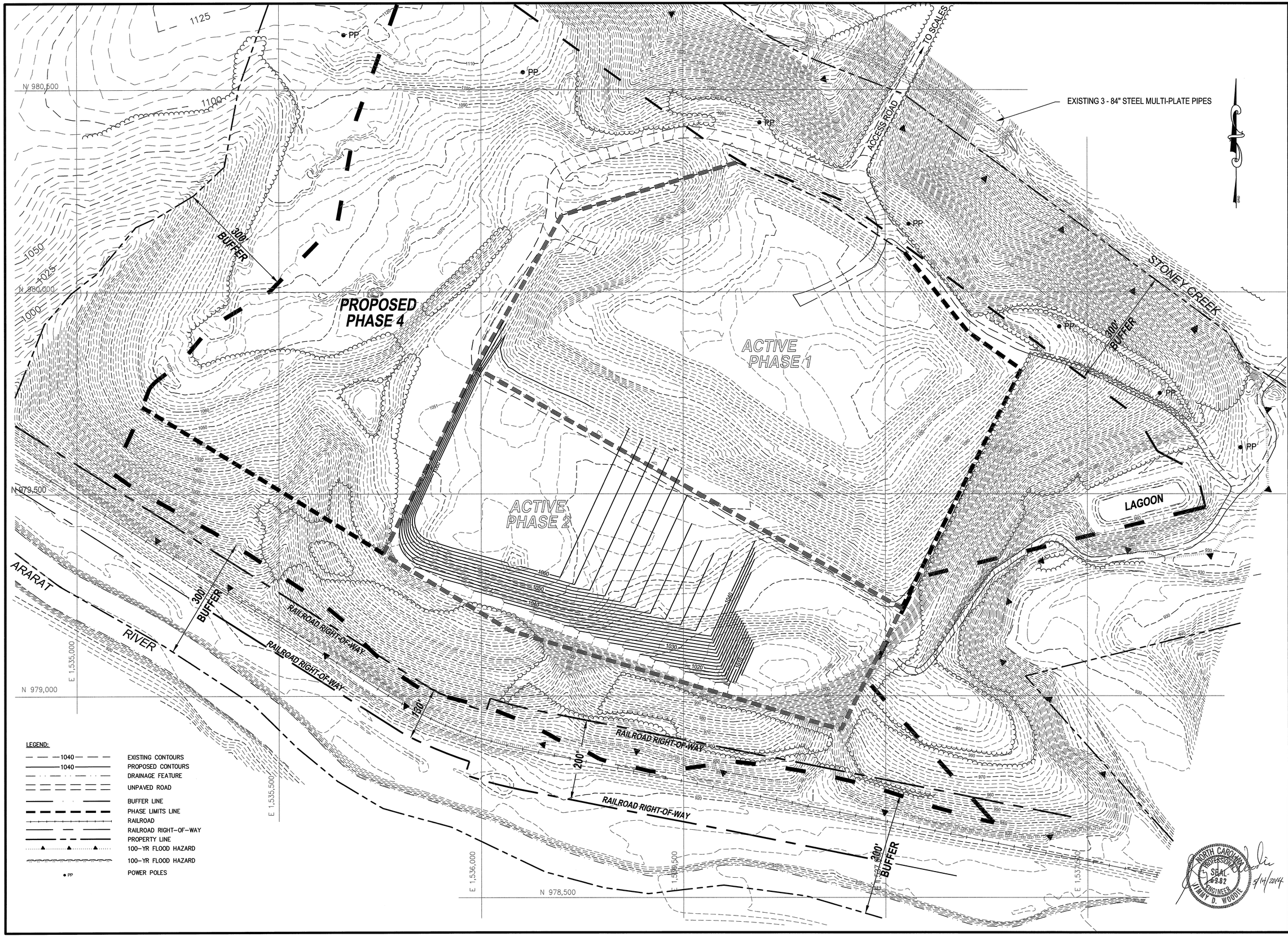

Municipal Engineering Services Company, P.A.
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P.O. BOX 349 BOONE, N.C. 28607 (828) 262-1767
LICENSE NUMBER: C-0281

MUNICIPAL SOLID WASTE LANDFILL FACILITY
SURRY COUNTY NORTH CAROLINA

DATE	BY	REV.	DESCRIPTION

ENGINEERING/OPERATION PLAN–PHASE 3 REMAINING FILL PHASE 2

NORTH CAROLINA PROFESSIONAL SEAL 6282 ENGINEER JIMMY D. WOODIE

5/14/2014

SCALE:	1" = 100'
DATE:	5/1/2014
DRWN. BY:	L. CRAWFORD
CHKD. BY:	J. WOODIE
PROJECT NUMBER	G14048
DRAWING NO.	E1
SHEET NO.	4 OF 11

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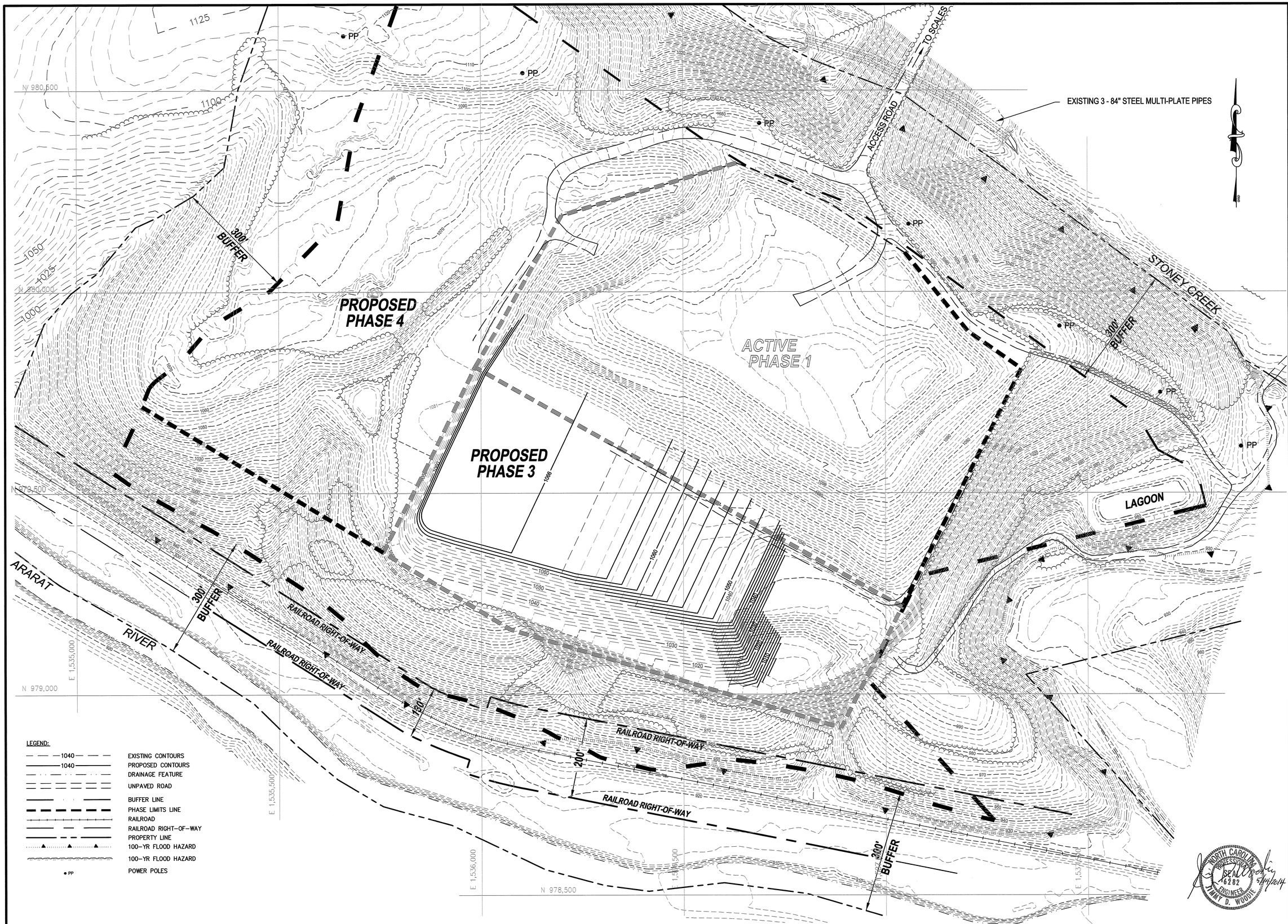

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P.O. BOX 349 BOONE, N.C. 28607 (828) 262-1767
LICENSE NUMBER: C-0281

MUNICIPAL SOLID WASTE LANDFILL FACILITY
SURRY COUNTY NORTH CAROLINA

NO.	DESCRIPTION	REV.	BY	DATE

ENGINEERING/OPERATION PLAN–PHASE 3
1st YEAR FILL PLAN

SCALE:	1" = 100'
DATE:	5/1/2014
DRWN. BY:	L. CRAWFORD
CHKD. BY:	J. WOODIE
PROJECT NUMBER	G14048
DRAWING NO.	E2
SHEET NO.	5 OF 11

NORTH CAROLINA PROFESSIONAL SEAL 16282 ENGINEER TIMMY D. WOODIE 5/9/2014

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EXISTING 3 - 84" STEEL MULTI-PLATE PIPES

TO SCALES

ACCESS ROAD

STONEY CREEK

300' BUFFER

PROPOSED PHASE 4

ACTIVE PHASE 1

PROPOSED PHASE 3

LAGOON

ARARAT RIVER

300' BUFFER

RAILROAD RIGHT-OF-WAY

RAILROAD RIGHT-OF-WAY

250'

200'

RAILROAD RIGHT-OF-WAY

300' BUFFER

N 980,500

N 980,000

N 979,500

N 979,000

N 978,500

E 1,535,000

E 1,535,500

E 1,536,000

E 1,536,500

E 1,537,000

PP

LEGEND:

- 1040 — EXISTING CONTOURS
- 1040 — PROPOSED CONTOURS
- DRAINAGE FEATURE
- UNPAVED ROAD
- BUFFER LINE
- PHASE LIMITS LINE
- RAILROAD
- RAILROAD RIGHT-OF-WAY
- PROPERTY LINE
- 100-YR FLOOD HAZARD
- 100-YR FLOOD HAZARD
- PP POWER POLES

NORTH CAROLINA PROFESSIONAL SEAL 24182 ENGINEER JIMMY D. WOODIE

5/14/2014

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

MUNICIPAL SOLID WASTE LANDFILL FACILITY
SURRY COUNTY
NORTH CAROLINA

DATE	BY	REV.	DESCRIPTION

ENGINEERING/OPERATION PLAN–PHASE 3
2nd YEAR FILL PLAN

SCALE:	1" = 100'
DATE:	5/1/2014
DRWN. BY:	L. CRAWFORD
CHKD. BY:	J. WOODIE
PROJECT NUMBER	G14048
DRAWING NO.	E3
SHEET NO.	6 OF 11

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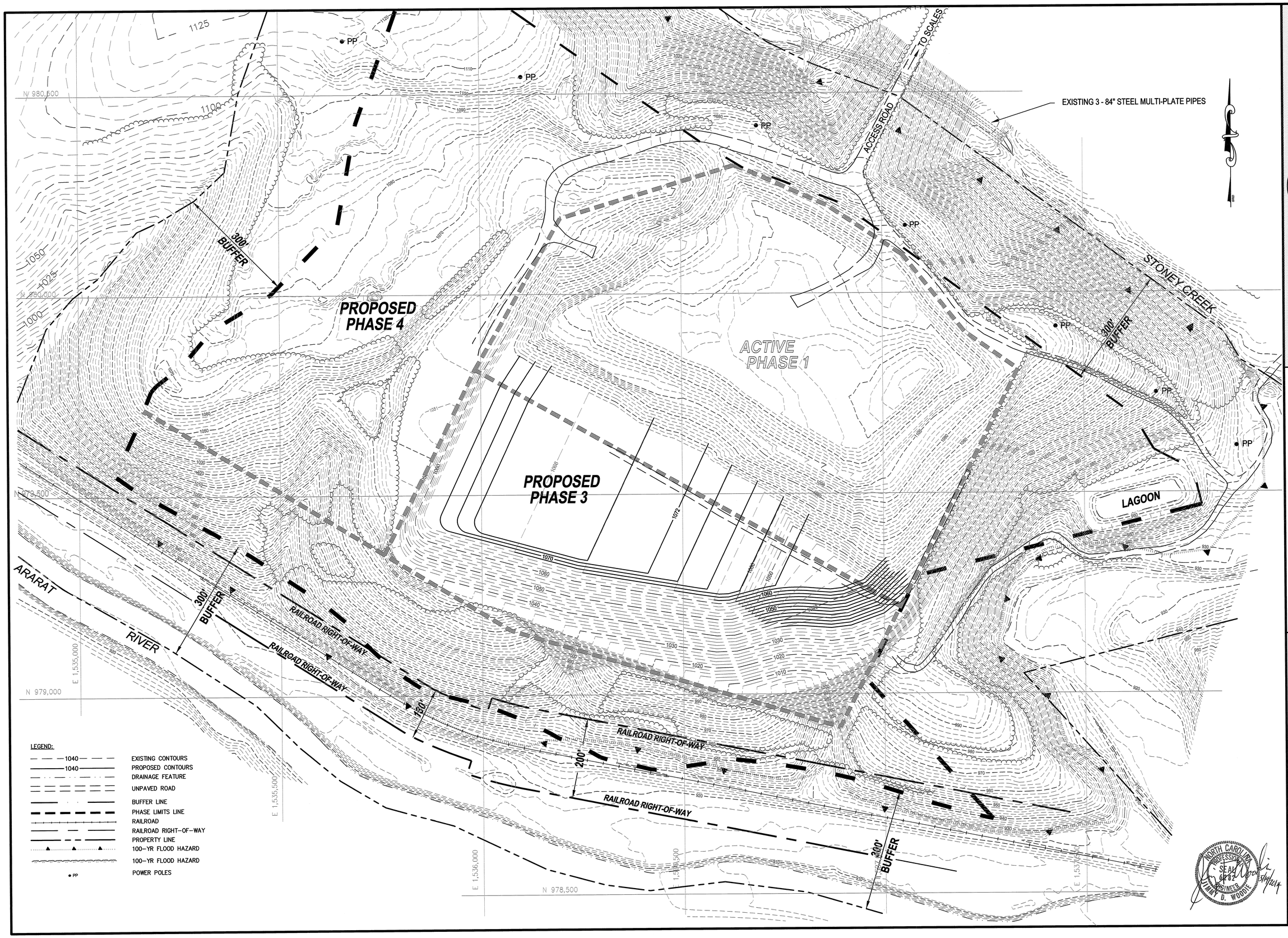

Municipal Engineering Services Company, P.A.

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
SURRY COUNTY
NORTH CAROLINA

DATE	BY	REV.	DESCRIPTION

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

SCALE:	1" = 100'
DATE:	5/1/2014
DRWN. BY:	L. CRAWFORD
CHKD. BY:	J. WOODIE
PROJECT NUMBER	G14048
DRAWING NO.	E4
SHEET NO.	7 OF 11

NORTH CAROLINA PROFESSIONAL SEAL 6282 ENGINEER JIMMY D. WOODIE

5/14/2014

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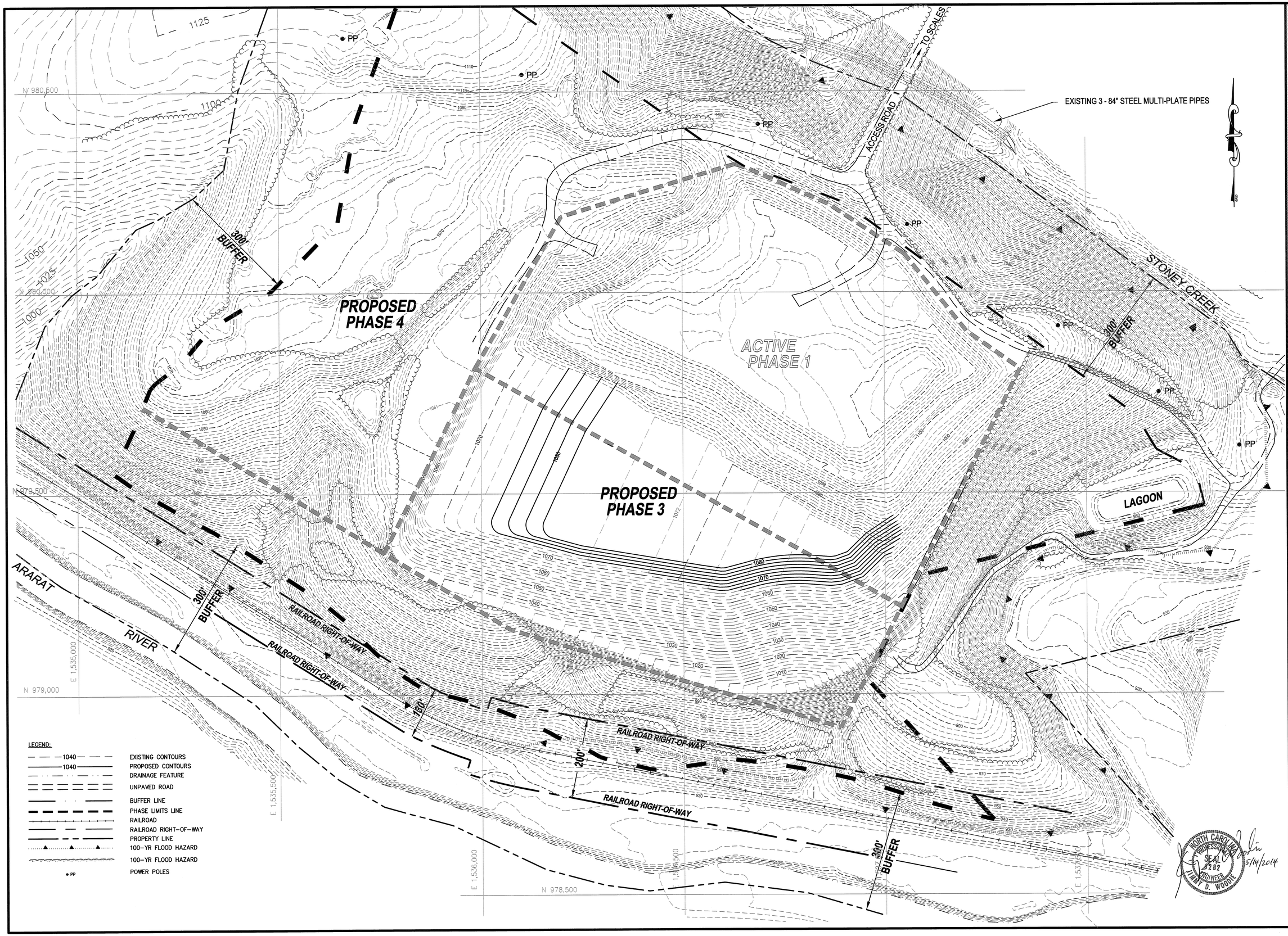

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LICENSE NUMBER: C-0281

MUNICIPAL SOLID WASTE LANDFILL FACILITY
SURRY COUNTY NORTH CAROLINA

DATE	BY	REV.	DESCRIPTION

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

NORTH CAROLINA PROFESSIONAL SEAL 32282 ENGINEER JIMMY D. WOODIE
5/14/2014

SCALE:	1" = 100'
DATE:	5/1/2014
DRWN. BY:	L. CRAWFORD
CHKD. BY:	J. WOODIE
PROJECT NUMBER	G14048
DRAWING NO.	E5
SHEET NO.	8 OF 11

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EXISTING 3 - 84" STEEL MULTI-PLATE PIPES

TO SCALES

ACCESS ROAD

STONEY CREEK

300' BUFFER

PROPOSED PHASE 4

ACTIVE PHASE 1

PROPOSED PHASE 3

LAGOON

ARARAT RIVER

300' BUFFER

RAILROAD RIGHT-OF-WAY

150'

200'

RAILROAD RIGHT-OF-WAY

RAILROAD RIGHT-OF-WAY

300' BUFFER

N 980,500

N 980,000

N 979,500

N 979,000

N 978,500

E 1,535,000

E 1,535,500

E 1,536,000

E 1,536,500

E 1,537,000

LEGEND:

1040	EXISTING CONTOURS
1040	PROPOSED CONTOURS
	DRAINAGE FEATURE
	UNPAVED ROAD
	BUFFER LINE
	PHASE LIMITS LINE
	RAILROAD
	RAILROAD RIGHT-OF-WAY
	PROPERTY LINE
	100-YR FLOOD HAZARD
	100-YR FLOOD HAZARD
PP	POWER POLES

NORTH CAROLINA PROFESSIONAL SEAL 4282 ENGINEER JIMMY D. WOODIE

5/14/2014

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
SURRY COUNTY
NORTH CAROLINA

DATE	BY	REV.	DESCRIPTION

ENGINEERING/OPERATION PLAN–PHASE 3
FINAL FILL PLAN

SCALE:	1" = 100'
DATE:	5/1/2014
DRWN. BY:	L. CRAWFORD
CHKD. BY:	J. WOODIE
PROJECT NUMBER	G14048
DRAWING NO.	E6
SHEET NO.	9 OF 11

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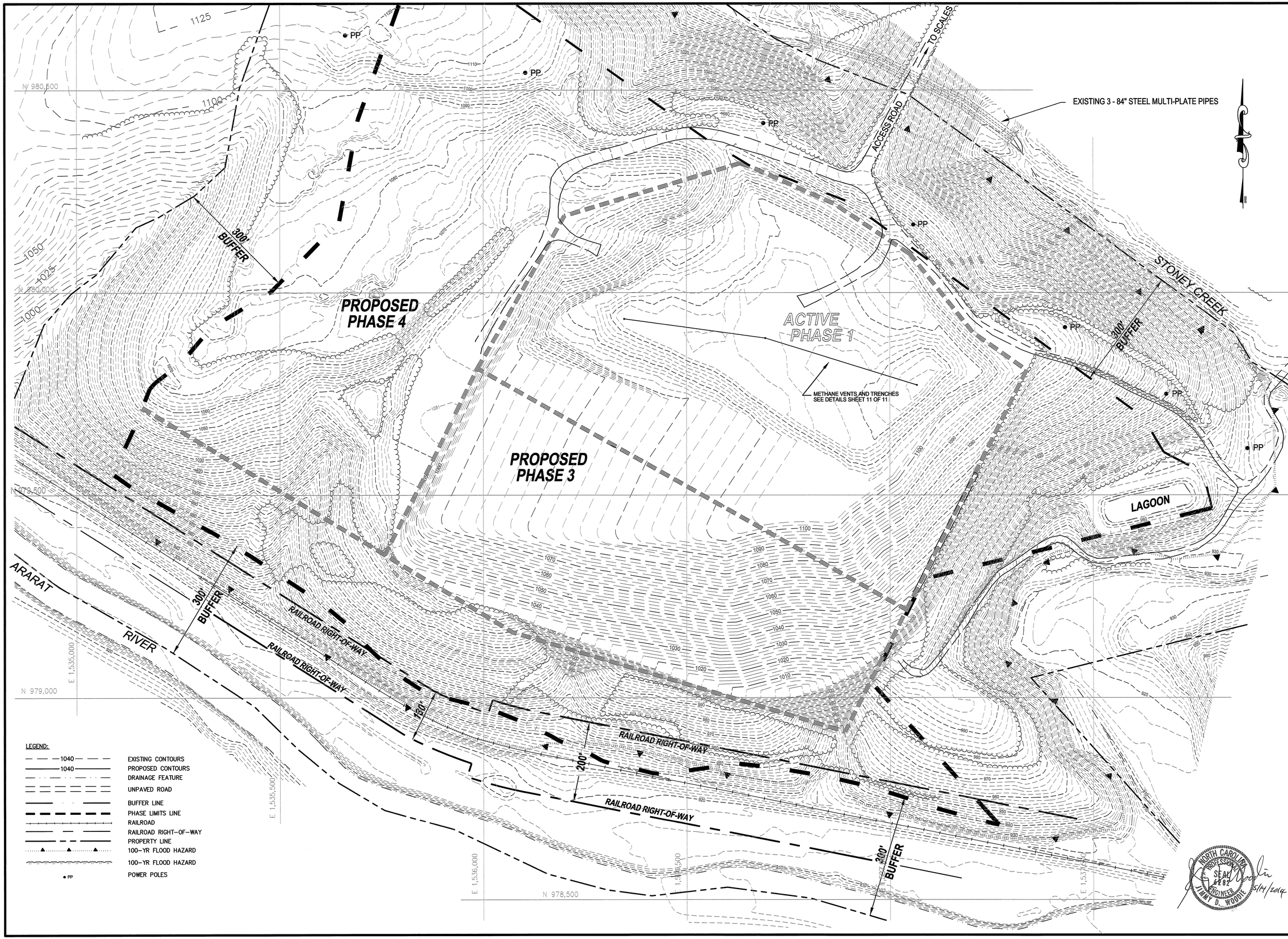

Municipal Engineering Services Company, P.A.

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

LICENSE NUMBER: C-0281

MUNICIPAL SOLID WASTE LANDFILL FACILITY
SURRY COUNTY NORTH CAROLINA

DATE	BY	REV.	DESCRIPTION

ENGINEERING/OPERATION PLAN–PHASE 3
FINAL FILL PLAN WITH METHANE VENTING

SCALE:	1" = 100'
DATE:	5/1/2014
DRWN. BY:	L. CRAWFORD
CHKD. BY:	J. WOODIE
PROJECT NUMBER	G14048
DRAWING NO.	E7
SHEET NO.	10 OF 11

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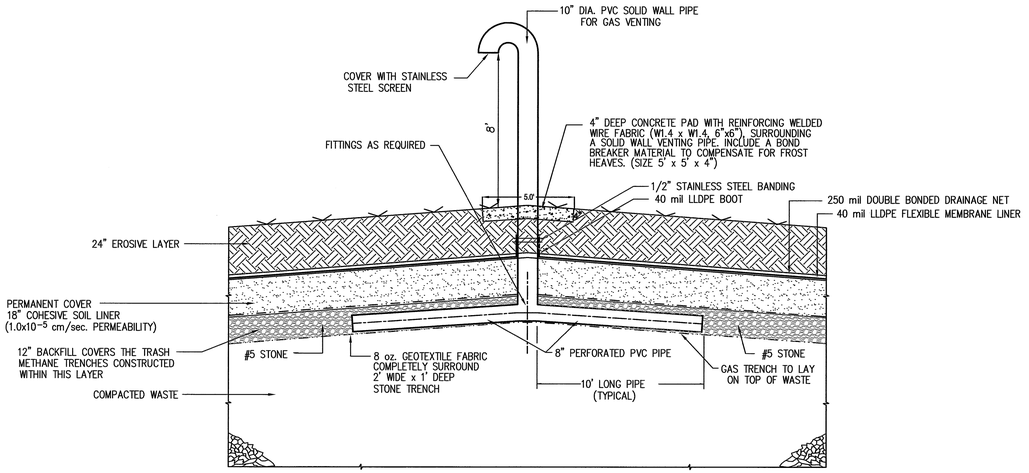

TYPICAL METHANE GAS COLLECTION TRENCH AND CAP CLOSURE DETAIL

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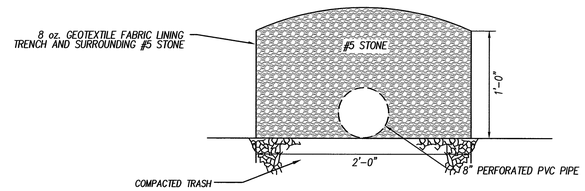
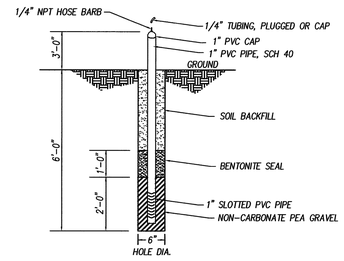


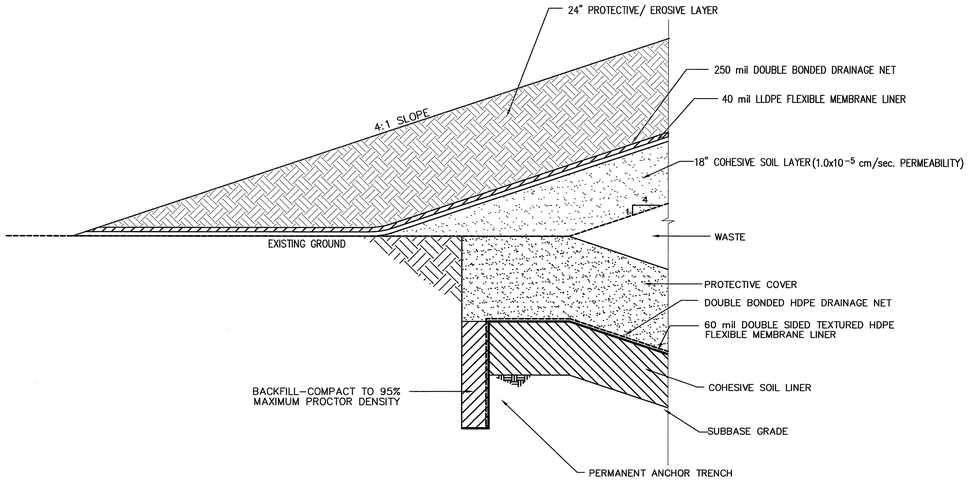
PERMANENT METHANE TRENCH DETAIL

N.T.S.



METHANE GAS MONITORING PROBE

N.T.S.



TYPICAL CAP CLOSURE DETAIL

N.T.S.

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

MUNICIPAL SOLID WASTE LANDFILL FACILITY
SURRY COUNTY
NORTH CAROLINA

DATE	BY	REV.	DESCRIPTION

ENGINEERING/OPERATION PLAN—PHASE 3
OPERATION DETAILS

NORTH CAROLINA PROFESSIONAL SEAL 24282 ENGINEER JIMMY D. WOODIE

5/14/2014

SCALE:	1:1
DATE:	5/1/2014
DRWN. BY:	L. CRAWFORD
CHKD. BY:	J. WOODIE
PROJECT NUMBER	G14048
DRAWING NO.	E8
SHEET NO.	11 OF 11

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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 with membrane boots 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 32 acres.

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 30 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.

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 Phase 1 and 2 (32 Ac.). The estimated costs shown below are only for Phase 1 and 2. Post Closure will be 30 years after closure.

Closure Costs:
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 32 acres:

   Total yardage + 15% = 89,056 yd^3 @ a cost of \$9.39/yd^3
   ∴ Cost = \$836,236

2. 40 Mil LLDPE Liner and Drainage net for 32 acres

   Total Footage + 15% = 1,603,008 ft^2 @ a cost of \$1.05/ft^2
   ∴ Cost = \$1,362,557

3. Erosion Control devices

   Estimated costs @ \$75,000
   ∴ Cost = \$75,000

4. 24" Erosive soil layer for 32 acres.

   Total yardage + 15% = 118,741 yd^3 @ a cost of \$7.70/yd^3
   ∴ Cost = \$914,306

5. Seeding and Mulching for 32 acres.

   Estimated cost of \$2,000/acre = 2,000(32 ac.)=
   ∴ Cost = \$64,000

6. Mobilization/Demobilization.

   Estimated cost of \$175,000

7. Labor Costs.

   Estimated cost of \$200,000
   ∴ Cost = \$200,000

8. Stone for methane gas collection.

Total estimated linear feet = 741 ft.
Total estimated volume for a 2'x1' trench = 1,482 ft^3
with a density of 120 lbs/ft^3 total weight =89 tons @ a cost of $25.00/ton
$\therefore$ Cost = $2,225

9. Geotextile for methane gas collection.

Total estimated linear feet = 741 ft.
Total estimated perimeter for a 2'x1' trench = (741 ft $\times$ 6 ft)@ a cost of $0.20/ ft^2
$\therefore$ Cost = $890

10. Vent pipes for methane gas collection.

Estimated cost @ $600.00 each (3).
$\therefore$ Cost = $1,800

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

Estimated cost = $400,000
$\therefore$ Cost = $400,000

Total of Estimated Phase 1and 2 Closure Costs:

1.	$ 836,236
2.	$ 1,362,557
3.	$ 75,000
4.	$ 914,306
5.	$ 64,000
6.	$ 175,000
7.	$ 200,000
8.	$ 2,225
9.	$ 890
10.	$ 1,800
11.	$ 400,000
Total:	$ 4,032,014

SECTION 4.0

POST-CLOSURE PLAN

4.1 Introduction

CONTACTS:

Name:	Chris Knopf
Title:	County Manager
Phone No.:	(336) 401-8201
Email Address:	knopfc@co.Surry.nc.us
Address:	188 Hamby Rd. Dobson, NC 27017

DESCRIPTION OF USE:

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

DESCRIPTION OF MAINTENANCE ACTIVITIES:

Surry 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:

Surry County Landfill 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

Surry 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 Phase 1 and 2 (32 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(15 wells + 5 surface) = 40 samples/year
   Estimated cost = 30 years x 40 samples/year x $840.00/sample = $1,008,000

   ∴ Cost = $1,008,000

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 $100,000 for the 30 years.

   ∴ Cost = $100,000

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.

   ∴ Cost = $30,000

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

   ∴ Cost = $60,000

Total of Estimated Phase 1 and 2 Post Closure Costs:

1.	$1,008,000
2.	$ 72,000
3.	$ 100,000
4.	$ 24,000
5.	$ 300,000
6.	$ 30,000
7.	$ 60,000
Total:	$ 1,594,000

4.3 Potential Assessment and Corrective Action (PACA) Estimate

Approved PACA Cost Estimate = **$2,071,770.00**

FINANCIAL ASSURANCES

TO BE SUBMITTED AT A LATER DATE

APPENDIX A

REVISED FACILITY DRAWINGS

SURRY COUNTY MUNICIPAL SOLID WASTE LANDFILL FACILITY

REVISED FACILITY PLAN

OWNER: SURRY COUNTY

PROJECT NO. G14048

COMMISSIONERS

Eddie Harris - Chairman
Paul M. Johnson - Vice-Chairman
R.F. "Buck" Golding
Jimmy W. Miller
Larry Phillips

COUNTY MANAGER

Chris Knopf

DIRECTOR OF PUBLIC WORKS

Dennis Bledsoe

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

NORTH CAROLINA PROFESSIONAL SEAL 6382 ENGINEER JIMMY D. WOODIE

5/14/2014

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:	5/1/2014
DRWN. BY:	L. CRAWFORD
CHKD. BY:	J. WOODIE
PROJECT NUMBER	G14048
DRAWING NO.	T1
SHEET NO.	1 of 10

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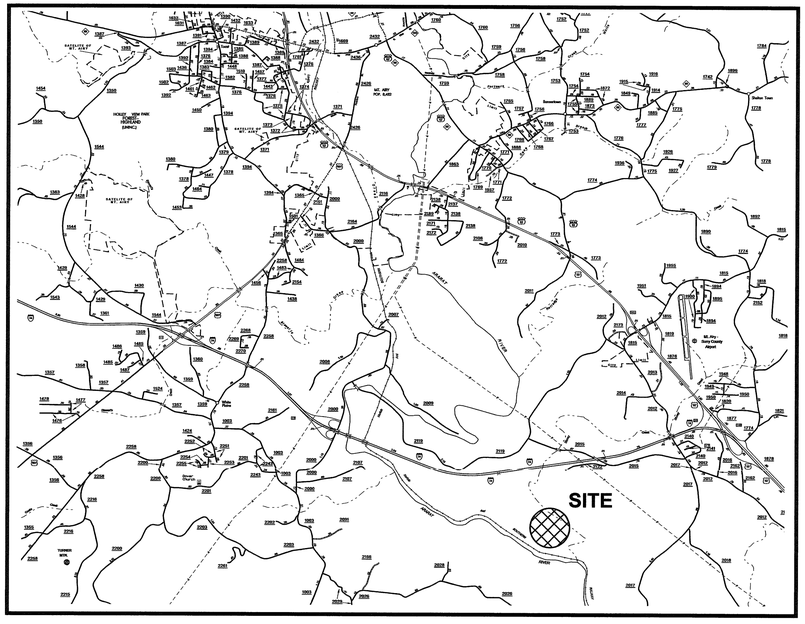
INDEX

SHEET NO.	DRAWING NO.	DESCRIPTION
1	T1	TITLE SHEET
2	T2	INDEX SHEET
3	F1	FACILITY MAP
4	F2	PROPOSED SUBGRADE
5	F3	LEACHATE COLLECTION SYSTEM
6	F4	FILL SEQUENCE 1
7	F5	FILL SEQUENCE 2
8	F6	FILL SEQUENCE 3
9	F7	FILL SEQUENCE 4
10	F8	FINAL FILL SEQUENCE



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
SURRY COUNTY
NORTH CAROLINA

DATE	BY	REV.	DESCRIPTION

INDEX AND VICINITY MAP

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 42702 JIMMY D. WOODIE

5/14/2014

SCALE:	1:1
DATE:	4/17/2014
DRWN. BY:	L. CRAWFORD
CHKD. BY:	J. WOODIE
PROJECT NUMBER	G14048
DRAWING NO.	T2
SHEET NO.	2 OF 10

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LEGEND

- EXISTING CONTOURS
- PROPERTY LINE
- EXISITING PATH
- BUFFER ZONE
- LIMITS OF DISTURBANCE
- PHASE LIMITS
- SPRING
- P2-1 EXISTING PIEZOMETER
- MW-1 MONITORING WELL
- P17 ABANDONED PIEZOMETER
- B2-1 BORING
- SEDIMENT BASIN
- REF # ARCHAEOLOGICAL SITES
- WETLANDS

GRAPHIC SCALE

250 0 125 250 500 1000

(IN FEET)
1 inch = 250 ft.

NORTH CAROLINA PROFESSIONAL SEAL 6282 ENGINEER JIMMY D. WOODIE

5/14/2014

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
SURRY COUNTY
NORTH CAROLINA

DATE	BY	REV.	DESCRIPTION

REVISED FACILITY PLAN
FACILITY MAP

SCALE:	1" = 250'
DATE:	5/1/2014
DRWN. BY:	L. CRAWFORD
CHKD. BY:	J. WOODIE
PROJECT NUMBER	G14048
DRAWING NO. F1	SHEET NO. 3 OF 10

LEGEND:

- EXISTING CONTOURS
- PROPOSED CONTOURS
- DRAINAGE FEATURE
- UNPAVED ROAD
- BUFFER LINE
- PHASE LIMITS LINE
- RAILROAD
- RAILROAD RIGHT-OF-WAY
- PROPERTY LINE
- 100-YR FLOOD HAZARD
- 100-YR FLOOD HAZARD
- WETLANDS
- ARCHAEOLOGICAL SITE
- WETLANDS REPLACEMENT AREA
- POWER POLES

PROPOSED PHASE 4

ACTIVE PHASE 1

PROPOSED PHASE 3

ACTIVE PHASE 2

EXISTING 3 - 84" STEEL MULTI-PLATE PIPES

ACCESS ROAD

TO SCALES

STONEY CREEK

LAGOON

ARARAT RIVER

300' BUFFER

200' BUFFER

RAILROAD RIGHT-OF-WAY

N 981,000
N 980,500
N 980,000
N 979,500
N 979,000
N 978,500
E 1,535,000
E 1,535,500
E 1,536,000
E 1,536,500
E 1,537,000
E 1,538,000

Municipal Engineering Services Company, P.A.
P.O. BOX 87 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
SURRY COUNTY NORTH CAROLINA

DATE	BY	REV.	DESCRIPTION
			REVISED FACILITY PLAN PROPOSED SUBGRADE

NORTH CAROLINA PROFESSIONAL SEAL 6282 ENGINEER JIMMY D. WOODIE
5/14/2014

SCALE:	1" = 120'
DATE:	5/1/2014
DRWN. BY:	L. CRAWFORD
CHKD. BY:	J. WOODIE
PROJECT NUMBER	G14048
DRAWING NO.	F2
SHEET NO.	4 OF 10

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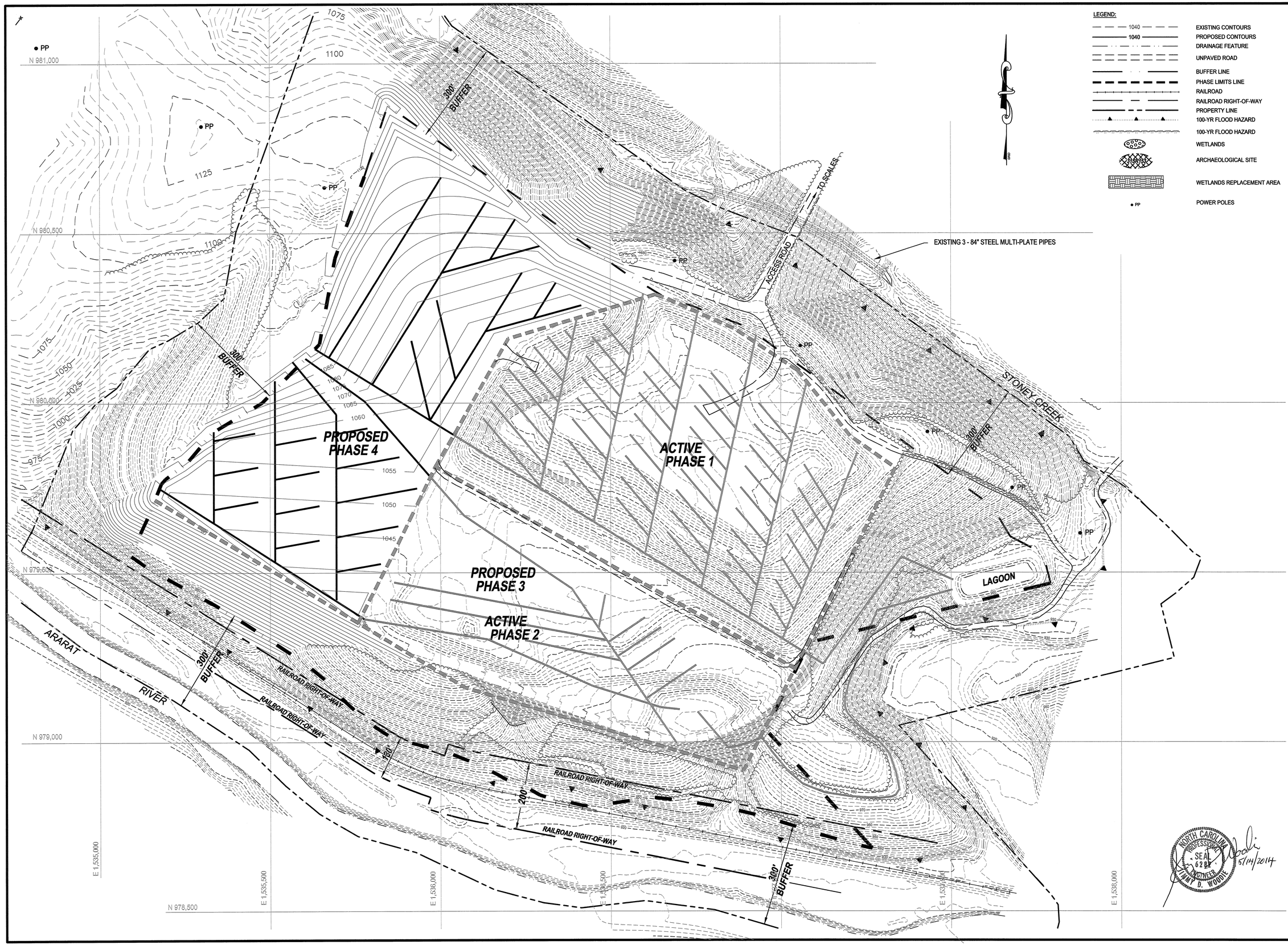

Municipal Engineering Services Company, P.A.
P.O. BOX 97 GARNER, N.C. 27529 (919) 772-5393
P.O. BOX 349 BOONE, N.C. 28607 (828) 262-1767
LICENSE NUMBER: C-0281

MUNICIPAL SOLID WASTE LANDFILL FACILITY
SURRY COUNTY
NORTH CAROLINA

DATE	BY	REV.	DESCRIPTION

REVISED FACILITY PLAN
PROPOSED LEACHATE COLLECTION SYSTEM

NORTH CAROLINA PROFESSIONAL SEAL 6282 ENGINEER JIMMY D. WOODIE
5/14/2014

SCALE:	1" = 120'
DATE:	5/1/2014
DRWN. BY:	L. CRAWFORD
CHKD. BY:	J. WOODIE
PROJECT NUMBER	G14048
DRAWING NO.	F3
SHEET NO.	5 OF 10

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LEGEND:

- EXISTING CONTOURS
- PROPOSED CONTOURS
- DRAINAGE FEATURE
- UNPAVED ROAD
- BUFFER LINE
- PHASE LIMITS LINE
- RAILROAD
- RAILROAD RIGHT-OF-WAY
- PROPERTY LINE
- 100-YR FLOOD HAZARD
- 100-YR FLOOD HAZARD
- POWER POLES

N 981,000
N 980,500
N 980,000
N 979,500
N 979,000
N 978,500
E 1,535,000
E 1,535,500
E 1,536,000
E 1,536,500
E 1,537,000
E 1,537,500
E 1,538,000

PROPOSED PHASE 4
PROPOSED PHASE 3
ACTIVE PHASE 1
ACTIVE PHASE 2

300' BUFFER
200'
ACCESS ROAD
TO SCALES
EXISTING 3 - 84" STEEL MULTI-PLATE PIPES
STONEY CREEK
LAGOON
ARARAT RIVER
RAILROAD RIGHT-OF-WAY

NORTH CAROLINA PROFESSIONAL SEAL 042182 ENGINEER JIMMY D. WOODIE 5/14/2014

Municipal Engineering Services Company, P.A.
P.O. BOX 97 GARNER, N.C. 27529 (919) 772-5393
P.O. BOX 3449 BOONE, N.C. 28607 (828) 262-1767
LICENSE NUMBER: C-0281

MUNICIPAL SOLID WASTE LANDFILL FACILITY
SURRY COUNTY NORTH CAROLINA

DATE	BY	REV.	DESCRIPTION

REVISED FACILITY PLAN
FILL SEQUENCE 1

SCALE:	1" = 120'
DATE:	5/1/2014
DRWN. BY:	L. CRAWFORD
CHKD. BY:	J. WOODIE
PROJECT NUMBER	G14048
DRAWING NO.	F4
SHEET NO.	6 OF 10

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LEGEND:

- EXISTING CONTOURS
- PROPOSED CONTOURS
- DRAINAGE FEATURE
- UNPAVED ROAD
- BUFFER LINE
- PHASE LIMITS LINE
- RAILROAD
- RAILROAD RIGHT-OF-WAY
- PROPERTY LINE
- 100-YR FLOOD HAZARD
- 100-YR FLOOD HAZARD
- WETLANDS
- ARCHAEOLOGICAL SITE
- WETLANDS REPLACEMENT AREA
- POWER POLES

PROPOSED PHASE 4

ACTIVE PHASE 1

ACTIVE PHASE 2

EXISTING 3 - 84" STEEL MULTI-PLATE PIPES

ACCESS ROAD

TO SCALES

STONEY CREEK

LAGOON

ARARAT RIVER

300' BUFFER

310' BUFFER

RAILROAD RIGHT-OF-WAY

130'

210'

N 981,000

N 980,500

N 980,000

N 979,500

N 979,000

N 978,500

E 1,535,000

E 1,535,500

E 1,536,000

E 1,536,500

E 1,537,000

E 1,538,000

NORTH CAROLINA PROFESSIONAL SEAL 5242 ENGINEER JIMMY D. WOODIE

5/14/2014

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 SURRY COUNTY NORTH CAROLINA

REVISED FACILITY PLAN FILL SEQUENCE 2

DATE	BY	REV.	DESCRIPTION

SCALE:	1" = 120'
DATE:	5/1/2014
DRWN. BY:	L. CRAWFORD
CHKD. BY:	J. WOODIE
PROJECT NUMBER	G14048
DRAWING NO.	F5
SHEET NO.	7 OF 10

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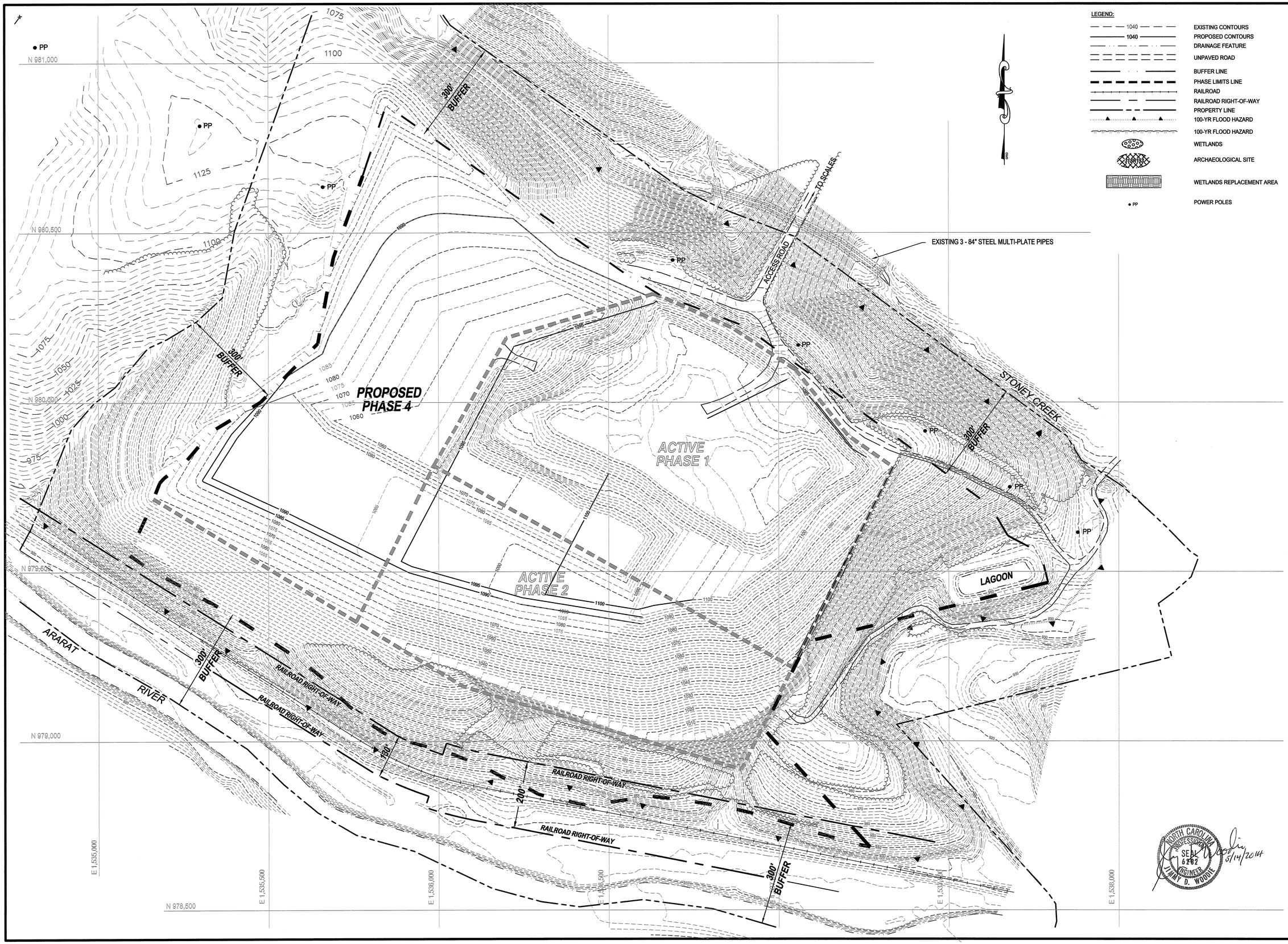

Municipal Engineering Services Company, P.A.
P.O. BOX 97 GARNER, N.C. 27529 (919) 772-5393
P.O. BOX 349 BOONE, N.C. 28607 (828) 262-1767
LICENSE NUMBER: C-0281

MUNICIPAL SOLID WASTE LANDFILL FACILITY SURRY COUNTY NORTH CAROLINA

REVISED FACILITY PLAN
FILL SEQUENCE 3

DATE	BY	REV.	DESCRIPTION

NORTH CAROLINA PROFESSIONAL SEAL 6282 ENGINEER JIMMY D. WOODIE
5/14/2014

SCALE:	1" = 120'
DATE:	5/1/2014
DRWN. BY:	L. CRAWFORD
CHKD. BY:	J. WOODIE
PROJECT NUMBER	G14048
DRAWING NO.	F6
SHEET NO.	8 OF 10

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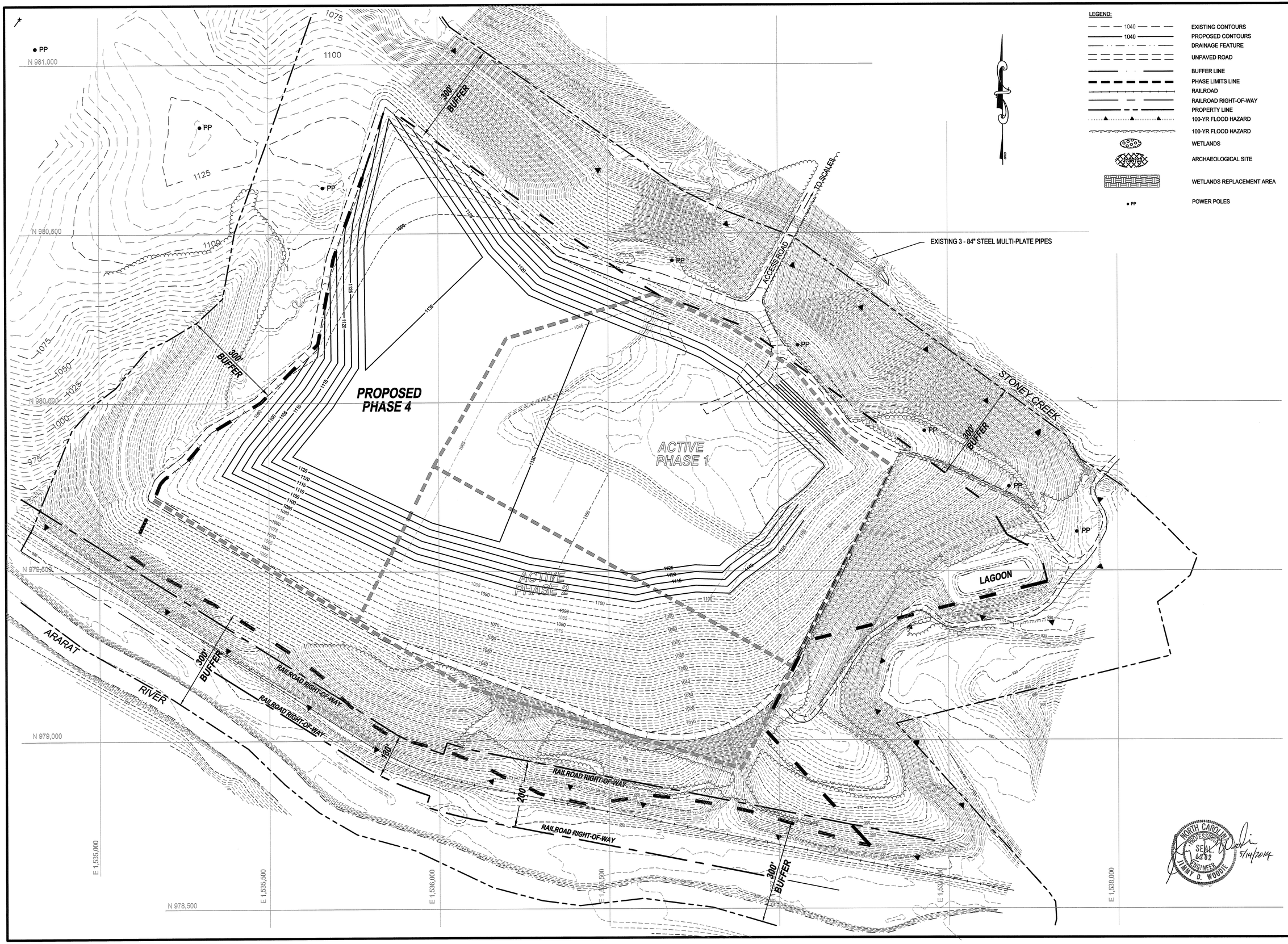

Municipal Engineering Services Company, P.A.
P.O. BOX 97 GARNER, N.C. 27529 (919) 772-5393
P.O. BOX 349 BOONE, N.C. 28607 (828) 262-1767
LICENSE NUMBER: C-0281

MUNICIPAL SOLID WASTE LANDFILL FACILITY SURRY COUNTY NORTH CAROLINA

NORTH CAROLINA PROFESSIONAL SEAL 6202 ENGINEER JIMMY D. WOODIE 5/14/2014

DATE	BY	REV.	DESCRIPTION

REVISED FACILITY PLAN FILL SEQUENCE 4

SCALE:	1" = 120'
DATE:	5/1/2014
DRWN. BY:	L. CRAWFORD
CHKD. BY:	J. WOODIE
PROJECT NUMBER	G14048
DRAWING NO.	F7
SHEET NO.	9 OF 10

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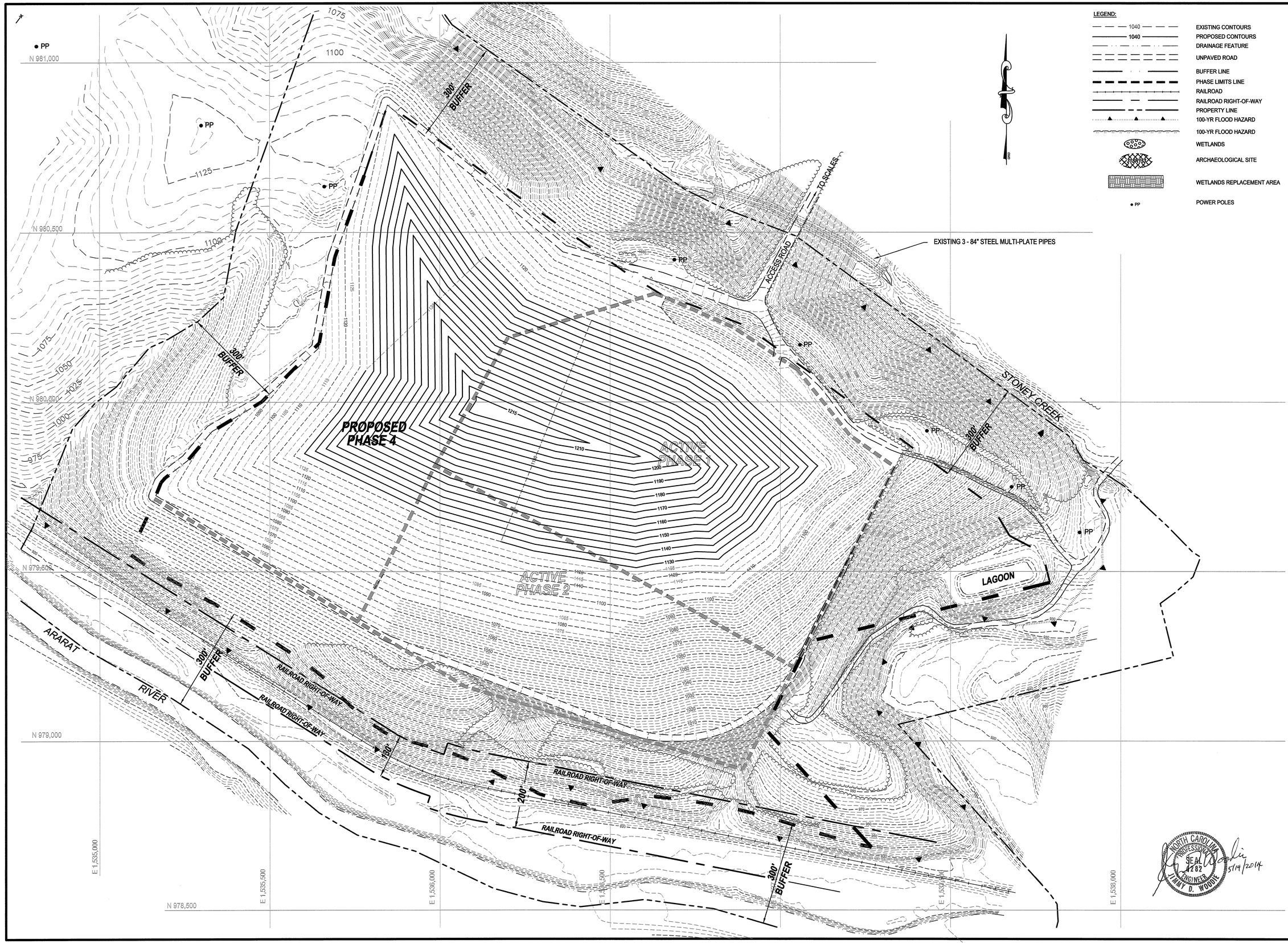

Municipal Engineering Services Company, P.A.
P.O. BOX 87 GARNER, N.C. 27529 (919) 772-5393
P.O. BOX 3349 BOONE, N.C. 28607 (828) 262-1767
LICENSE NUMBER: C-0281

MUNICIPAL SOLID WASTE LANDFILL FACILITY
SURRY COUNTY
NORTH CAROLINA

DATE	BY	REV.	DESCRIPTION
			REVISED FACILITY PLAN FINAL FILL SEQUENCE

NORTH CAROLINA PROFESSIONAL SEAL 4202 ENGINEER TIMMY D. WOODIE 5/14/2014

SCALE:	1" = 120'
DATE:	5/1/2014
DRWN. BY:	L. CRAWFORD
CHKD. BY:	J. WOODIE
PROJECT NUMBER	G14048
DRAWING NO.	F8
SHEET NO.	10 OF 10

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