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September 18, 2009

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44-07	9,23,09	8660

Mr. Allen Gaither
Solid Waste Permitting Section
Division of Waste Management
North Carolina Department of Environment and Natural Resources
2090 U.S. Highway 70
Swannanoa, North Carolina 28778

RE: Permit To Construct MSW Phase 3
Modifications for GCL Liner
White Oak MSW Landfill
Haywood County, North Carolina
Permit # 44-07

Dear Mr. Gaither:

Haywood County requests that the option of utilizing a geosynthetic clay liner (GCL) system in lieu of two (2)-feet of compacted clay material be available for the construction of the base liner system of MSW Phase 3. The enclosed information pertains to adding the GCL system to the Permit to Construct documentation. The following revisions were made to the approved Permit to Construct:

Section 3: Facility Plan

- Section 4.3, paragraph 2, includes the option of utilizing a GCL liner system.

Section 4: Engineering Plan

- Section 2.1, bullet point 4, includes the option of utilizing a GCL liner system;
- Section 3.2, bullet point 2, refers to the underlying clay requirements when using a GCL;
- Section 4.2, paragraphs 2 and 3, include materials and construction requirements for the GCL;
- Sections 6.2 and 6.3, refer to top of GCL elevations shown on Sheet 3B of the Plans.

McGill Associates, P.A. • P.O. Box 2259, Asheville, NC 28802 • 55 Broad Street, Asheville, NC 28801
828-252-0575 • Fax: 828-252-2518

Section 5: Construction Quality Assurance Plan

- Section 1.2.1, point #3, includes the option of a GCL system;
- Section 1.2.2, Construction Schedule, includes observing GCL installation;
- Section 5.8, Report Documentation to include construction of GCL, if used;
- Section 5.9.1, Report Table of Contents, Section 3.1 refers to GCL testing results;
- Section 5.9.2, list of drawings requirements for surveying for GCL liner;
- Section 5.10, bullet point 5, surveying requirements for GCL system;
- Added Appendix D for GCL.

Section 6: Operation Plan

- Introduction includes the option of utilizing a GCL system.

Section 7: Closure and Post-Closure Plan

- Section 1.2b, Clay Liner, bullet point 1 was revised to show option of GCL system in the base liner system of the landfill.

Section 8: Technical Specifications

Specification 2300, Compacted Clay Liner

- Section 2300.2, Pre-Construction Qualification Table was revised to include permeability requirements for underlying compacted clay used in a GCL system;
- Section 2300.3, Construction Testing Table was revised to include thickness requirements for underlying compacted clay used in a GCL system;
- Section 2300.3, Test Pads, was revised to show permeability and thickness requirements of compacted clay used in a GCL system;
- Section 2300.10, was revised to include permeability and thickness requirements of compacted clay used in a GCL system;
- Section 2300.14, was revised to include thickness of compacted clay utilized in a GCL system;
- Section 2300.16, was revised to include thickness of compacted clay utilized in a GCL system;
- Section 2300.18, still need to add interface angle between GCL and geomembrane.

Specification 02320, Geosynthetic Clay Liner

- Section 02320 includes the material and construction requirements for the GCL liner system. The requirements for the underlying 18 inches of compacted clay at a permeability no greater than 1.0×10^{-5} cm/sec are included in Technical Specification 2300, Compacted Clay Liner.

Section 13: Permit to Construct Drawings

- Sheet C3A, note added regarding subgrade when a GCL system is utilized;
- Sheets C22, C23, and C24 to include GCL Liner alternative;
- Sheet D1, details revised to show 18-inch thick clay layer when GCL is installed;
- Sheet D2, base liner details revised to include option of GCL liner with 18 inches of compacted clay at a maximum permeability of 1.0×10^{-5} cm/sec overlain by a GCL material;
- Sheet D3, base liner details revised to include option of GCL liner with 18 inches of compacted clay at a maximum permeability of 1.0×10^{-5} cm/sec overlain by a GCL material;
- Sheet D4, base liner details revised to include option of GCL liner with 18 inches of compacted clay at a maximum permeability of 1.0×10^{-5} cm/sec overlain by a GCL material;
- Sheet D5, base liner details revised to include option of GCL liner with 18 inches of compacted clay at a maximum permeability of 1.0×10^{-5} cm/sec overlain by a GCL material;
- Sheet D6, base liner details revised to include option of GCL liner with 18 inches of compacted clay at a maximum permeability of 1.0×10^{-5} cm/sec overlain by a GCL material;
- Sheet D7, base liner details revised to include option of GCL liner with 18 inches of compacted clay at a maximum permeability of 1.0×10^{-5} cm/sec overlain by a GCL material;
- Sheet D10, methane gas extraction well detail revised to include the option a GCL liner system.

Included in this revision to the Permit To Construct package is one hard copy and one digital copy of the following information:

Section 3:	Facility Plan
Section 4:	Engineering Plan
Section 5:	Construction Quality Assurance Plan
Section 6:	Operations Plan
Section 7:	Closure and Post-Closure Plan
Section 8:	Technical Specifications
Section 13:	Permit To Construct Drawings C3A, C22, C23, C24, D1, D2, D3, D4, D5, D6, D7, and D10

We look forward to working with you to obtain approval for a GCL liner system as part of the Permit To Construct for this project. As always, don't hesitate to contact us if you have any questions regarding this submittal or if you require additional information.

Sincerely,
McGILL ASSOCIATES, P.A.

JEFFREY R. BISHOP, P.E.
Senior Project Manager

Enclosures

cc: Ed Mussler, NCDENR Solid Waste Section, w/o enc
David Cotton, Haywood County Manager, w/o enc
Stephen King, Haywood County Director of Solid Waste, w/enc

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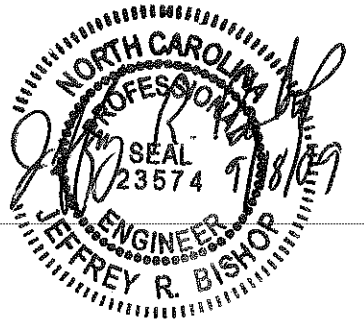
FACILITY PLAN

WHITE OAK MSW LANDFILL
PHASES 3 & 4
HAYWOOD COUNTY, NORTH CAROLINA

JEFFREY R. BISHOP, P.E.

McGill ASSOCIATES

Engineering • Planning • Finance
Asheville, North Carolina



September 2008
Revised February 2009
Revised Septmeber 2009

07518

FACILITY PLAN

White Oak MSW Landfill
Phases 3 & 4

1.0 Site Development

The Phases 3 & 4 Permit to Construct drawings for the Haywood County White Oak Landfill were developed in accordance with Section .1619 of the North Carolina Solid Waste Management Rules. The overall site plan (Sheet C1), indicates the area where Haywood County intends to construct the Phases 3 & 4 Expansion.

Figure 2 in Section 2 of the Permit To Construct report shows the property boundary survey performed by Edward M. Haynes, P.L.S. of Herron Surveying, dated February 9, 1990. A copy of the landfill property deeds have been enclosed in Section 2 of the Permit to Construct Report. Figure 1 is a summary of property information for the White Oak Landfill. Sheet C1 of the Permit drawings shows the existing topography of the site and was provided by McGill Associates in an aerial survey dated March 25, 2007, with additional ground survey of the existing Phase 2 waste area on March 26, 2008. The borings that were used to produce the Design Hyrdrological Report prepared by BLE, Inc. are shown on Sheet C2 of the permit drawings.

1.1 Landfill Units

Phase 3 will consist of approximately 8.8 acres and Phase 4 will contain approximately 6.7 acres of the White Oak Landfill property. Phase 3 will be constructed initially and Phase 4 will be brought online as Phase 3 reaches its capacity. Each Phase is designed as a side-slope fill against existing Phases 1 & 2. Phase 3 will provide approximately 5 years of landfill airspace. Approximately 1,150 linear feet of proposed liner edge of Phase 3 will connect to the existing liner edge at the western margin of existing Phases 1 & 2. The various Phases of the White Oak MSW Landfill are illustrated on the Overall Site Plan, Sheet C1 of the permit drawings. Phase 3 has an estimated maximum volume capacity of 686,000 CY (which excludes the 12" temporary cap). This results in an estimated life expectancy of 5 years. Capacity calculations for Phases 3 & 4 have been enclosed in Appendix A.

Filling of Phase 3 will begin at the access point in the southeast corner of the new phase. Filling will proceed to the north margin of the phase. Waste placement will continue in a phased manner in lifts ranging from 6 to 12 feet in height. Landfill Staff will cover the entire footprint of the new phase in its second year of accepting waste. A stormwater control liner will be utilized to segregate stormwater runoff from potential leachate. Additionally, temporary stormwater control berms will be utilized to separate stormwater from potential leachate to reduce the amount of active area in the phase at any one time. As the elevations of the phase increase, stormwater will be shed to periphery ditches to the north and west of

the new phase. Refer to Sheets C13 through C17 of the permit drawings for the five-year permitting period filling sequence.

1.1.1 Future Expansion

Once Phases 3 & 4 nears their operational capacity, Haywood County intends to expand the White Oak Facility to additional Phases to the south of Phases 3 & 4. Approximately 22.3 acres will be included in future Phases 5 and 6, with an expected operational capacity of 2.8 million cubic yards of airspace and an estimated life expectancy of 22 years beyond the life expectancy of Phases 3 & 4.

In addition to the MSW Phases 3 through 6, the County has site study approval for additional areas of the landfill property to the east of the existing active MSW area available for landfill airspace beyond the lifetime of Phases 3 through 6.

Existing, proposed, and future landfill facilities are illustrated on Sheet C1 of the Permit To Construct drawings.

Haywood County contracted with Municipal Engineering in 1998 to prepare the "White Oak Landfill, MSWLF Facility Site Study". The report included the identification of potential landfill sites in the County, the selection of alternative sites based on County criteria and regulatory criteria, the evaluation of three alternate sites as well as the existing White Oak MSW Landfill, a presentation of the socioeconomic and demographic data, and a recommendation to further pursue the development of the White Oak MSW Landfill property. Based on this report, the White Oak site was selected.

Haywood County is in the process of finalizing plans for the implementation of a methane gas collection and combustion system. Methane gas collection design is included in this Phases 3 & 4 submittal.

1.2 Buffer Zones

Sheet C1 shows the buffer requirements for the proposed Phases 3 & 4 expansion. The proposed waste limits are well away from any buffer requirements.

A 300-ft buffer is shown to the Right-of-Way for SR 1338 (Fines Creek Road) to the east of the landfill. A 300-ft buffer is shown between Phases 3 & 4 and the western and southern property lines.

There are not any existing private residences or water-supply wells located within 500 feet of the proposed Phases 3 & 4. A 500-ft buffer is shown between the Phases 3 & 4 expansion and private residences and wells on the western and southern margins of the project.

A minimum buffer distance of 50 feet is maintained between the adjacent streams north and west of Phase 3 and south of Phase 4. The installation of Phase 3 will impact 0.45 acres of wetlands and approximately 185 l.f. of stream. Permits for these impacts from the United States Army Corps of Engineers and North Carolina Department of Environment and Natural Resources are pending and will be provided to the Solid Waste Section prior to the issuance of a Permit to Construct.

The nearest 100-year flood plain is approximately 1,000 feet to the north of Phase 3 along the Pigeon River. No landfill facilities will be located in the flood plain.

Refer to the Phases 3 & 4 Design Hydrogeologic Report prepared by BLE, Inc for specific discussion and data pertaining to the hydrogeological characteristics of the site. There is a minimum separation of 6.0 feet between the seasonal high water elevations and 4.95 feet between bedrock elevations and the clay liner system for Phases 3 & 4.

1.3 Landfill Facilities

Haywood County currently has and will maintain the solid waste management facilities necessary for operating and maintaining the White Oak MSW Landfill. These facilities generally consist of a scalehouse, maintenance facility, MSW landfill, Land Clearing and Inert Debris Landfill, Construction and Demolition Landfill (C&DLF) (received final wastes June 30, 2008 and is in the process of being closed), leachate storage lagoon, a proposed small Type 2 Composting Facility, and a proposed Grinding and Mulching Treatment and Processing Facility. Future facilities planned include a methane gas collection system, power generation facility, a drop-off location for residential waste and recyclables, and a landfill office. Haulers of waste materials will be directed by the scale attendant at the scale house to the proper disposal area. Additionally, landfill personnel will be on hand per the requirements listed in the Operations Plan to inspect loads to ensure proper segregation of wastes. Also, on-site signage will direct waste haulers to the correct disposal area. With the closure of the C&DLF, the MSW landfill is now receiving C&D wastes.

2.0 Landfill Construction

The permit documents illustrate the proposed grading associated with construction and operation of Phases 3 & 4. These documents include, but are not limited to, the following:

- Limits of grading,
- Location of borrow and stockpile areas,
- Existing landfill facilities,
- Limits of Phases 3 & 4,
- Proposed base grades of Phases 3 & 4,
- Proposed drainage layer grades for Phases 3 & 4,
- Proposed final grades of Phases 3 & 4,

- Location of access roads,
- Location of leachate collection piping, leachate force main, and leachate storage lagoon,
- Location of sediment basins and drainage structures,
- Location of stormwater segregation features,
- Proposed transitional contours for each phase of development, and
- Proposed cap system
- Details of landfill development

2.1 Grading

Sheets C3 through C9 of the permit drawings show the grading limits for the proposed Phases 3 & 4 Expansion. Soil stockpile areas are shown on Sheet C1 and C11.

2.2 Phase Limits

Sheet C1 shows the limits of Phases 3 & 4. The footprint of Phase 3 is approximately 8.8 acres and is expected to provide disposal capacity until 2015. Phase 4 contains approximately 6.7 acres and will provide disposal airspace for approximately 5 years beyond the capacity of Phase 3.

2.3.2 Base Grades of Phase

Sheets C3 and C7 show the proposed top of clay grades for Phases 3 and 4, respectively. The subgrade elevations are located two (2) feet below the clay grades. The average seasonal high water table is located at a minimum distance of eight feet below the proposed top of clay grades and thus six feet below the proposed base grades. This separation ensures that the post settlement bottom elevation of the base liner system meets or exceeds the vertical separation requirements described in section .1624 (b) of the Solid Waste Management Rules. The average seasonal groundwater levels are included on Sheets C3 and C7 and are described in detail in the Design Hydrogeologic Report prepared by BLE, Inc. The proposed separation will result in a minimum distance of ten feet between the ground water table and waste placed in the phase. The minimum slope of the phase floor will be 2.75 percent. The projected settlement rates are based on the estimates developed in the Design Hydrological Report and are shown on Sheet C21 of the permit drawings.

2.4 Access Roads

Access roads for Phases 3 & 4 will be composed of a compacted subgrade overlain by six (6) inches of railroad ballast and six (6) inches of CABC. The locations of the access roads are shown on Sheets C3 through C11 of the permit drawings. The roads will have shoulders on both sides, with a drainage ditch on the landfill side. The interior ditch is sized to carry run-off for Phases 3 & 4 at the peak development.

2.5 Sediment Basins

Sheets C5 and C11 of the permit drawings show the location of the the existing sediment basins and the four proposed additional sediment basins that will be utilized in the construction of Phases 3 & 4. Sheet C5 is the Phase 3 Erosion Control Plan and shows how stormwater runoff and sedimentation will be handled during construction of Phase 3. Sheet C11 is the Final Erosion Control Plan and shows how stormwater runoff will be dealt with when Phases 3 & 4 have reached full development. All of the sediment basins were sized for the fully-developed condition since the landfill has the greatest potential for producing runoff at the fully-developed condition when slopes are at their steepest. These basins will have the capacity to accommodate run-off from the 25-year, 24-hour storm event with excess capacity.

2.6 Leachate Force Main and Storage Lagoon

Sheets C4 and C18 of the permit drawings show the location of the existing leachate lagoon, existing leachate gravity sewers, the proposed Phase 3 leachate sump, pumping station, and force main that will be constructed during the development of Phase 3. The pump stations located at the sump areas (at the northern margin of Phase 3) will pump leachate through approximately 150 l.f. of dual-contained force main to a proposed gravity leachate sewer, then leachate will flow by gravity approximately 375 l.f. to a manhole located near the leachate storage lagoon, just north of Phase 1. Each leachate pump can pump 35 gpm when pumping alone, and a total of 44 gpm will be realized when both pumps are operating in parallel. The force main and gravity sewer can accommodate up to 1,009 gpm. The storage lagoon has an existing capacity of 642,000 gallons and will be expanded during the construction of Phase 3 to provide a total of 1,017,00 gallons of leachate storage. An additional HDPE liner will be added to the lagoon at this time.

2.7 Phase Closure

Sheet C10 of the permit drawings shows the proposed final grades for Phases 3 & 4. The ultimate cap grades for the phase will be dependent upon the design of adjacent phases. Temporary slopes within the Phases 3 & 4 area will range from five (5) to thirty-three (33) percent. Ultimate final cap grades will range from five (5) to twenty-five (25) percent. Components of the proposed closure cap, from bottom to top, will include a 12-inch thick intermediate soil cover, followed by an eighteen inch (18") thick clay layer with a permeability not greater than 1.0×10^{-5} cm/sec, a 40-mil textured HDPE geomembrane, a

double-sided, eight (8)-ounce geocomposite, and an twenty-four inch (24") thick vegetative/erosion layer.

3.0 Landfill Operation

Reducing the production of leachate is a primary concern for efficient, cost-effective operation. Efficient operation of the leachate collection and stormwater segregation systems is imperative. Transitioning between active and inactive portions of a phase can also drastically increase leachate production if not handled properly.

3.1 Leachate Collection System

Sheets C4 and C8 show the proposed location of the leachate sump area and the leachate collection pipes. The minimum slope of the phase floor will be 2.5 percent in order to maintain efficient drainage and reduce head heights on the HDPE liner. The grading of the phase floor will promote drainage to the sump areas. An eighteen (18)-inch HDPE pipe will be used for constructing each of the pump-housing side slope risers at the leachate pumping stations. There will be a leachate head test well located at each sump.

There is one sump proposed for the Phases 3 & 4 expansion, which includes two pumping stations. The sump is located at the northern margin of the Phase 3. Leachate collection piping will direct leachate to the sump and will provide complete coverage of the phase floor. The main collection lines will be constructed to a minimum slope of 2.7% and the lateral collection lines will be constructed to a minimum slope of 1.5%. The lateral leachate collectors and main headers will be placed in trenches, covered with washed stone, and surrounded with a geotextile to protect the pipes from clogging. The pipes will only be placed in trenches on the phase floor. (See details, Sheets D1-D11). The portion of the pipes where the cleanouts are located will lie on the side slopes will be covered with stone and protected with geotextile, but the pipes will lay flat against the side slopes. No trenching will be performed on the side slopes. Cleanout risers will be provided for all of the leachate piping where physically possible. The leachate that collects in the sump areas will be pumped through the dual-contained force main to the leachate storage lagoon located north of Phase 1.

3.2 Stormwater Segregation Features

Phases 3 & 4 waste area will be covered with a synthetic stormwater cover. The waste area will be divided by a temporary stormwater control berm adjacent to the working face. The berm will be constructed on top of the drainage layer and be covered by the synthetic stormwater control liner. The location of the temporary stormwater control berm is shown on the filling sequence drawings, Sheets C13 through C17 of the Permit to Construct. This berm will direct stormwater runoff away from the working face to the low point in the cell, where a stormwater pump will pump the runoff over the northern Phase 3 perimeter berm. As waste placement continues, the elevation of the active area of the phase will reach the point where stormwater runoff can be directed over the perimeter berms on the north and west sides to ditches leading to sediment basins west and north of Phases 3 & 4.

3.3 Transition Between Active and Inactive Areas of the Phase

Placement of waste at Phases 3 & 4 will generally proceed from south to north. Prior to entering an inactive portion of the phase, the stormwater control liner will be partially removed. Where necessary, a temporary berm will be utilized to assure that stormwater and leachate remain separated. As the working face moves to the north, the stormwater control liner will remain in place as long as possible. See the detail sheets D1-D11 for a detail of the temporary gravel berm.

4.0 Facility Report

4.1 Waste Stream

Haywood County currently classifies their waste stream as industrial, commercial, municipal, or residential. Regulated hazardous waste, out-of-county waste, and hazardous liquid wastes are prohibited at the White Oak Landfill. This is the classification for the waste currently being disposed of at the White Oak site. The waste stream for Phases 3 & 4 will maintain the current classification.

The service area for the White Oak Landfill will include businesses and municipalities located within Haywood County. Waste from other counties will not be accepted at the facility. The current waste stream is approximately 5,000 tons per month. The average waste stream expected for Phases 3 & 4 is estimated to be 6,600 tons per month over the life of the area. These quantities assume an annual population growth of 1.0%, but the waste stream could vary as much as 15 percent based on past occurrences of fluctuations and population changes.

The county will operate Phases 3 & 4 using basically the same equipment available to them at this time. This equipment includes a compactor, one excavator, one motor grader, and one

front-end loader. This equipment should be sufficient for operating the landfill under its current waste stream. Haywood County budgets for new equipment needed for landfill operations on an annual basis.

4.2 Landfill Capacity

Phase 3 has a projected operating capacity of 686,000 cubic yards of air space to the bottom of the cap elevations shown on Sheet C13 of the permit drawings. This equates to an estimated life expectancy of approximately 5 years. This volume includes air space that is available for placing waste and operational daily cover. Phase 4 has a projected operating capacity of 631,000 cubic yards, which will provide disposal airspace for an additional 5 years after Phase 3 reaches capacity. A summary of projected MSW tonnages and required airspace is included in Appendix A.

The following nominal construction quantities for Phases 3 & 4 have been estimated:

	Phase 3	**Phase 4**
Cut Materials	300,000 cy	325,000 cy
Fill Materials	80,000 cy	60,000 cy
Clay Liner	35,000 cy	25,000 cy
Gravel drainage layer	35,000 cy	25,000 cy

Soil cover volumes were calculated assuming a soil to waste ratio of one (1) to five (5). Phases 3 & 4 expansion will require an average of 25,000 cubic yards of cover soils each year, based on a one (1) to five (5) soil to waste ratio. Approximately 5,000 cubic yards of soil would be needed each year for intermediate cover. Therefore, a total of 30,000 cubic yards of soil will be needed on an annual basis. The closure soil quantities needed for constructing the final cap for Phases 3 & 4 will include 30,000 cubic yards of intermediate cover soils, 45,000 cubic yards of clay liner material, and 60,000 cubic yards of vegetation-supportive soil. Soils needed for construction and operation of Phases 3 & 4 will be taken from the borrow areas indicated on Sheets C1 and C11. Preliminary soil borings performed on the site indicate that earthen materials which meet the project specifications for the compacted clay liner are available in sufficient quantities.

4.3 Environmental Control System

The North Carolina Solid Waste Management Rules, Section .1600, entitled "Requirements For Municipal Solid Waste Landfill Facilities", were adhered to throughout the design of Phases 3 & 4.

The major component of the Environmental Control System will consist of a primary composite base liner constructed of either a 24-inch, low-permeability clay layer with a permeability not greater than 1.0×10^{-7} cm/sec or a geosynthetic clay liner (GCL), which consists of an 18-inch, low-permeability clay layer with a permeability not greater than 1.0×10^{-5} overlain with a GCL material with a demonstrated hydraulic conductivity of not more than 5×10^{-9} cm/sec under the anticipated confining pressure. The 24-inch clay layer or 18-inch GCL shall be overlain by a 60-mil HDPE geomembrane. Once a protective 16-ounce geotextile is placed on the primary HDPE geomembrane, a two (2)-foot gravel drainage layer including leachate collection piping will be placed on top of the composite base liner system. The composite base liner will provide a redundant system for assuring that leachate is contained within the phase and does not affect local hydrogeology. The high hydraulic conductivity of the drainage layer will assure quick and efficient removal of leachate from the phase floor to the sump areas and will reduce the leak potential by reducing the driving head on the geomembrane. Once leachate reaches the sump area, it will be transported to the leachate storage lagoon through a dual-contained leachate force main and gravity sewer. Leachate pumps located in the sump will be activated by head heights of less than twelve (12) inches. Disposal of leachate from the leachate storage lagoon is discussed in detail in the Operations Plan.

Stormwater in Phase 3 that does not come into contact with waste will initially be collected on top of the proposed stormwater control liner and then pumped to a pipe that discharges into the unnamed branch north of the Phase. As the landfill increases in height, stormwater will be directed to periphery ditches that lead to permanent sediment basins prior to discharge to the nearby unnamed branch. Refer to sheet C5 of the permit drawings.

4.4 Leachate Generation

The amount of leachate that Phases 3 & 4 will generate was estimated by using the HELP Model analysis included in Section 10 of the Permit to Construct and by examining landfill records for the past six years. See Section 11 of the Permit to Construct for landfill leachate records for the past six years. The HELP model analyzed ten stages of landfill development during the lifetime of Phases 3 & 4. Each stage of development was comprised of cross-sections of landfill construction, which included clay barrier soils, flexible membrane liners, gravel drainage layers and layers of compacted MSW wastes and cover soils. The stages of development varied from the first, which analyzed the landfill with only a small portion active with relatively thin layers of compacted waste, to the tenth, which analyzed the landfill after the final cap was installed. Stages 1 through 5 occurred during the development of

MSW Phase 3 and stages 6 through 10 occurred during the development of MSW Phase 4. The HELP model estimates that average monthly leachate production will reach 596,400 gallons/month during the initial stages of Phase 4 development. Landfill records over the past six years show an average monthly leachate generation of approximately 220,000 gallons per month, and 323,500 gallons/month for F.Y. 2005, the wettest year during the past six years. The highest total leachate production for a calendar month was 486,000 gallons in September 2004, although during a 30 day period in September and October of that year, 600,000 gallons of leachate were removed. The monthly average calculated by the HELP model for 15.5 acres of lined landfill was the same as the greatest actual observed leachate production for a 21.5 acre area of lined landfill. During the six-year time period, there were only 4 months where leachate generation exceeded 400,000 gallons (for 21.5 acres). The HELP Model analysis is a conservative estimate of leachate production and will continue to be considered when designing improvements to the landfill leachate system; however, leachate production records will be utilized as well. The leachate collection system must be prepared to handle extreme events as well as function efficiently at average production levels.

4.5 Average Leachate Production Flows and Pumping

Utilizing the existing leachate production information included in Section 11 of the Permit to Construct, and pro-rating those quantities over the 15.5-acre footprint of Phases 3 and 4, it is estimated that Phases 3 and 4 will produce leachate at an average monthly rate of 250,000 gallons. Applying a 1.5 safety factor to this quantity results in an average rate of 375,000 gallons per month. To remove the leachate from the phase, assume that on average each pump will operate for 8 hours per day, which requires that the pumps remove leachate at an average flow of 13 gpm. Applying a peaking factor of 2 to the flow calculations, it is necessary for each pump to remove leachate at the rate of 26 gpm. An additional safety factor will be built in to the pumping system; therefore, each pump will be designed to pump 35 gpm at 25.5 feet total dynamic head (TDH). The pumps will utilize a 3"x 6" dual-contained force main located along the northern margin of Phase 3, which will run for approximately 150 l.f. to a point where the force main discharges into proposed leachate collection system gravity sewer manhole #2. The gravity sewer will flow approximately 375 l.f. where it will discharge to proposed leachate collection system gravity manhole #1, just upstream of the leachate storage lagoon. See Sheet C18 for proposed leachate force main and gravity sewer piping. The leachate storage lagoon located north of Phase 1 has a total storage volume of 642,000 gallons. Refer to Appendix B for force main calculations and Appendix C for correspondence between the Town of Waynesville concerning disposal of leachate.

4.6 Contingency Plan For Peak Flow Conditions And Leachate System Disruption

In the event of an extreme rainfall event, the HELP model projects a peak leachate production of 30,950 cubic feet/day, or approximately 231,000 gal/day. This peak event would be seen at Stage II of landfill development within the first two years of operation of Phase 3. Over time, the effects of an intense storm event would be greatly dampened due to the increase in the length of time that it would take stormwater to percolate through the layers of waste and daily cover. The available storage volume below the perimeter liner edge elevation of 2515 is approximately 2,200,000 gallons. During the peak event as described by the HELP model, the landfill can contain leachate for approximately 10 days of peak discharge intensity. It is unlikely that the HELP model 1-day peak intensity rate would continue for 10 days. Therefore it is highly unlikely for the landfill to produce more leachate than the pumps can transport to the leachate lagoon. In the event of extreme conditions, the discharge from the County's stormwater removal pump may be diverted to proposed manhole 2 of the leachate gravity system, which will allow leachate to be pumped to the storage lagoon at approximately 300 gpm.

Under average operating conditions, in the event that there was a temporary failure with any of the leachate removal and storage equipment, the geometry of the landfill would allow for the landfill to contain the leachate for a period of several months. However, the system should never be out of operation for more than a few hours, and then only under extreme circumstances. Due to the conservative design of the leachate removal and storage equipment and the geometry of the landfill, the possibility of leachate buildup overflowing the perimeter berm is very low.

In conjunction with the development of Phase 3, the existing leachate lagoon will be raised and a new liner will be installed on top of the existing liner. Currently, the lagoon has a storage capacity of 642,000 gallons. The lagoon will be raised by approximately 3.25' in order to provide an additional 375,000 gallons of storage volume. During the construction of the additional storage volume, a new 60-mil textured HDPE liner will be installed over the existing liner. A double-sided geocomposite will be installed between the existing liner and the proposed liner. The final volume of the lagoon will be approximately 1,017,000 gallons. Leachate will be pumped directly to the leachate tanker truck during the period of the lagoon expansion, which will take several days. Pumping will occur from proposed leachate manhole #1, which will be located just outside the limits of the lagoon. Depending on weather conditions at the time of construction, the County must make provisions to transport leachate on a 24-hour basis. During the summer months of the drought in 2007 and 2008, the 6,000 gallon tanker truck was filled every 3 or 4 days, or longer. However, if wet weather is encountered during the time of the construction project, it will be necessary for the County to rent an additional tanker truck and make provisions for 24 hours of operation.

Section .1624 (2)(A)(ii) of the Solid Waste Management Rules states that "the geometry of the landfill shall be designed to control and contain the volume of the leachate generated by the 24-hour, 25-year storm." The input parameters of the HELP model included maintaining

a minimum head of one (1) foot on the geomembrane liner, and the additional calculations have been done to assure that rule .1624 (2)(A)(ii) was met.

4.7 Soil Resources

Phase 3 is scheduled to begin construction in early 2009. It is estimated that Phase 3 will require 300,000 cubic yards of cut and 80,000 cubic yards of fill material resulting in the need to stockpile approximately 220,000 cubic yards of soil. Phase 4 is scheduled to begin construction in 2014 and will require approximately 325,000 cy of cut and 60,000 cy of fill material resulting in the need to stockpile 265,000 cy of soil.

The total soil requirements for Phase 3 & 4 construction will include 50,000 cubic yards of soil liner material. The soil stockpile area consists of materials suitable for structural fill as well as clay liner material. On-site borrow areas are located south and west of existing Phase 2 as shown on sheet C1 of the permit drawings.

The County has enough soil available to complete construction of Phases 3 & 4 and to operate the new phases prior to Phase 5 beginning operation in 2019.

APPENDIX A

Phases 3 & 4 Capacity Calculations

APPENDIX B

Leachate Pump Calculations

APPENDIX C

Leachate Acceptance Permit from Town of Waynesville WWTF

FACILITY PLAN

White Oak MSW Landfill
Phases 3 & 4

1.0 Site Development

The Phases 3 & 4 Permit to Construct drawings for the Haywood County White Oak Landfill were developed in accordance with Section .1619 of the North Carolina Solid Waste Management Rules. The overall site plan (Sheet C1), indicates the area where Haywood County intends to construct the Phases 3 & 4 Expansion.

Figure 2 in Section 2 of the Permit To Construct report shows the property boundary survey performed by Edward M. Haynes, P.L.S. of Herron Surveying, dated February 9, 1990. A copy of the landfill property deeds have been enclosed in Section 2 of the Permit to Construct Report. Figure 1 is a summary of property information for the White Oak Landfill. Sheet C1 of the Permit drawings shows the existing topography of the site and was provided by McGill Associates in an aerial survey dated March 25, 2007, with additional ground survey of the existing Phase 2 waste area on March 26, 2008. The borings that were used to produce the Design Hyrdrological Report prepared by BLE, Inc. are shown on Sheet C2 of the permit drawings.

1.1 Landfill Units

Phase 3 will consist of approximately 8.8 acres and Phase 4 will contain approximately 6.7 acres of the White Oak Landfill property. Phase 3 will be constructed initially and Phase 4 will be brought online as Phase 3 reaches its capacity. Each Phase is designed as a side-slope fill against existing Phases 1 & 2. Phase 3 will provide approximately 5 years of landfill airspace. Approximately 1,150 linear feet of proposed liner edge of Phase 3 will connect to the existing liner edge at the western margin of existing Phases 1 & 2. The various Phases of the White Oak MSW Landfill are illustrated on the Overall Site Plan, Sheet C1 of the permit drawings. Phase 3 has an estimated maximum volume capacity of 686,000 CY (which excludes the 12" temporary cap). This results in an estimated life expectancy of 5 years. Capacity calculations for Phases 3 & 4 have been enclosed in Appendix A.

Filling of Phase 3 will begin at the access point in the southeast corner of the new phase. Filling will proceed to the north margin of the phase. Waste placement will continue in a phased manner in lifts ranging from 6 to 12 feet in height. Landfill Staff will cover the entire footprint of the new phase in its second year of accepting waste. A stormwater control liner will be utilized to segregate stormwater runoff from potential leachate. Additionally, temporary stormwater control berms will be utilized to separate stormwater from potential leachate to reduce the amount of active area in the phase at any one time. As the elevations of the phase increase, stormwater will be shed to periphery ditches to the north and west of

the new phase. Refer to Sheets C13 through C17 of the permit drawings for the five-year permitting period filling sequence.

1.1.1 Future Expansion

Once Phases 3 & 4 nears their operational capacity, Haywood County intends to expand the White Oak Facility to additional Phases to the south of Phases 3 & 4. Approximately 22.3 acres will be included in future Phases 5 and 6, with an expected operational capacity of 2.8 million cubic yards of airspace and an estimated life expectancy of 22 years beyond the life expectancy of Phases 3 & 4.

In addition to the MSW Phases 3 through 6, the County has site study approval for additional areas of the landfill property to the east of the existing active MSW area available for landfill airspace beyond the lifetime of Phases 3 through 6.

Existing, proposed, and future landfill facilities are illustrated on Sheet C1 of the Permit To Construct drawings.

Haywood County contracted with Municipal Engineering in 1998 to prepare the "White Oak Landfill, MSWLF Facility Site Study". The report included the identification of potential landfill sites in the County, the selection of alternative sites based on County criteria and regulatory criteria, the evaluation of three alternate sites as well as the existing White Oak MSW Landfill, a presentation of the socioeconomic and demographic data, and a recommendation to further pursue the development of the White Oak MSW Landfill property. Based on this report, the White Oak site was selected.

Haywood County is in the process of finalizing plans for the implementation of a methane gas collection and combustion system. Methane gas collection design is included in this Phases 3 & 4 submittal.

1.2 Buffer Zones

Sheet C1 shows the buffer requirements for the proposed Phases 3 & 4 expansion. The proposed waste limits are well away from any buffer requirements.

A 300-ft buffer is shown to the Right-of-Way for SR 1338 (Fines Creek Road) to the east of the landfill. A 300-ft buffer is shown between Phases 3 & 4 and the western and southern property lines.

There are not any existing private residences or water-supply wells located within 500 feet of the proposed Phases 3 & 4. A 500-ft buffer is shown between the Phases 3 & 4 expansion and private residences and wells on the western and southern margins of the project.

A minimum buffer distance of 50 feet is maintained between the adjacent streams north and west of Phase 3 and south of Phase 4. The installation of Phase 3 will impact 0.45 acres of wetlands and approximately 185 l.f. of stream. Permits for these impacts from the United States Army Corps of Engineers and North Carolina Department of Environment and Natural Resources are pending and will be provided to the Solid Waste Section prior to the issuance of a Permit to Construct.

The nearest 100-year flood plain is approximately 1,000 feet to the north of Phase 3 along the Pigeon River. No landfill facilities will be located in the flood plain.

Refer to the Phases 3 & 4 Design Hydrogeologic Report prepared by BLE, Inc for specific discussion and data pertaining to the hydrogeological characteristics of the site. There is a minimum separation of 6.0 feet between the seasonal high water elevations and 4.95 feet between bedrock elevations and the clay liner system for Phases 3 & 4.

1.3 Landfill Facilities

Haywood County currently has and will maintain the solid waste management facilities necessary for operating and maintaining the White Oak MSW Landfill. These facilities generally consist of a scalehouse, maintenance facility, MSW landfill, Land Clearing and Inert Debris Landfill, Construction and Demolition Landfill (C&DLF) (received final wastes June 30, 2008 and is in the process of being closed), leachate storage lagoon, a proposed small Type 2 Composting Facility, and a proposed Grinding and Mulching Treatment and Processing Facility. Future facilities planned include a methane gas collection system, power generation facility, a drop-off location for residential waste and recyclables, and a landfill office. Haulers of waste materials will be directed by the scale attendant at the scale house to the proper disposal area. Additionally, landfill personnel will be on hand per the requirements listed in the Operations Plan to inspect loads to ensure proper segregation of wastes. Also, on-site signage will direct waste haulers to the correct disposal area. With the closure of the C&DLF, the MSW landfill is now receiving C&D wastes.

2.0 Landfill Construction

The permit documents illustrate the proposed grading associated with construction and operation of Phases 3 & 4. These documents include, but are not limited to, the following:

- Limits of grading,
- Location of borrow and stockpile areas,
- Existing landfill facilities,
- Limits of Phases 3 & 4,
- Proposed base grades of Phases 3 & 4,
- Proposed drainage layer grades for Phases 3 & 4,
- Proposed final grades of Phases 3 & 4,

- Location of access roads,
- Location of leachate collection piping, leachate force main, and leachate storage lagoon,
- Location of sediment basins and drainage structures,
- Location of stormwater segregation features,
- Proposed transitional contours for each phase of development, and
- Proposed cap system
- Details of landfill development

2.1 Grading

Sheets C3 through C9 of the permit drawings show the grading limits for the proposed Phases 3 & 4 Expansion. Soil stockpile areas are shown on Sheet C1 and C11.

2.2 Phase Limits

Sheet C1 shows the limits of Phases 3 & 4. The footprint of Phase 3 is approximately 8.8 acres and is expected to provide disposal capacity until 2015. Phase 4 contains approximately 6.7 acres and will provide disposal airspace for approximately 5 years beyond the capacity of Phase 3.

2.3.2 Base Grades of Phase

Sheets C3 and C7 show the proposed top of clay grades for Phases 3 and 4, respectively. The subgrade elevations are located two (2) feet below the clay grades. The average seasonal high water table is located at a minimum distance of eight feet below the proposed top of clay grades and thus six feet below the proposed base grades. This separation ensures that the post settlement bottom elevation of the base liner system meets or exceeds the vertical separation requirements described in section .1624 (b) of the Solid Waste Management Rules. The average seasonal groundwater levels are included on Sheets C3 and C7 and are described in detail in the Design Hydrogeologic Report prepared by BLE, Inc. The proposed separation will result in a minimum distance of ten feet between the ground water table and waste placed in the phase. The minimum slope of the phase floor will be 2.75 percent. The projected settlement rates are based on the estimates developed in the Design Hydrological Report and are shown on Sheet C21 of the permit drawings.

2.4 Access Roads

Access roads for Phases 3 & 4 will be composed of a compacted subgrade overlain by six (6) inches of railroad ballast and six (6) inches of CABC. The locations of the access roads are shown on Sheets C3 through C11 of the permit drawings. The roads will have shoulders on both sides, with a drainage ditch on the landfill side. The interior ditch is sized to carry run-off for Phases 3 & 4 at the peak development.

2.5 Sediment Basins

Sheets C5 and C11 of the permit drawings show the location of the the existing sediment basins and the four proposed additional sediment basins that will be utilized in the construction of Phases 3 & 4. Sheet C5 is the Phase 3 Erosion Control Plan and shows how stormwater runoff and sedimentation will be handled during construction of Phase 3. Sheet C11 is the Final Erosion Control Plan and shows how stormwater runoff will be dealt with when Phases 3 & 4 have reached full development. All of the sediment basins were sized for the fully-developed condition since the landfill has the greatest potential for producing runoff at the fully-developed condition when slopes are at their steepest. These basins will have the capacity to accommodate run-off from the 25-year, 24-hour storm event with excess capacity.

2.6 Leachate Force Main and Storage Lagoon

Sheets C4 and C18 of the permit drawings show the location of the existing leachate lagoon, existing leachate gravity sewers, the proposed Phase 3 leachate sump, pumping station, and force main that will be constructed during the development of Phase 3. The pump stations located at the sump areas (at the northern margin of Phase 3) will pump leachate through approximately 150 l.f. of dual-contained force main to a proposed gravity leachate sewer, then leachate will flow by gravity approximately 375 l.f. to a manhole located near the leachate storage lagoon, just north of Phase 1. Each leachate pump can pump 35 gpm when pumping alone, and a total of 44 gpm will be realized when both pumps are operating in parallel. The force main and gravity sewer can accommodate up to 1,009 gpm. The storage lagoon has an existing capacity of 642,000 gallons and will be expanded during the construction of Phase 3 to provide a total of 1,017,00 gallons of leachate storage. An additional HDPE liner will be added to the lagoon at this time.

2.7 Phase Closure

Sheet C10 of the permit drawings shows the proposed final grades for Phases 3 & 4. The ultimate cap grades for the phase will be dependent upon the design of adjacent phases. Temporary slopes within the Phases 3 & 4 area will range from five (5) to thirty-three (33) percent. Ultimate final cap grades will range from five (5) to twenty-five (25) percent. Components of the proposed closure cap, from bottom to top, will include a 12-inch thick intermediate soil cover, followed by an eighteen inch (18") thick clay layer with a permeability not greater than 1.0×10^{-5} cm/sec, a 40-mil textured HDPE geomembrane, a

double-sided, eight (8)-ounce geocomposite, and an twenty-four inch (24") thick vegetative/erosion layer.

3.0 Landfill Operation

Reducing the production of leachate is a primary concern for efficient, cost-effective operation. Efficient operation of the leachate collection and stormwater segregation systems is imperative. Transitioning between active and inactive portions of a phase can also drastically increase leachate production if not handled properly.

3.1 Leachate Collection System

Sheets C4 and C8 show the proposed location of the leachate sump area and the leachate collection pipes. The minimum slope of the phase floor will be 2.5 percent in order to maintain efficient drainage and reduce head heights on the HDPE liner. The grading of the phase floor will promote drainage to the sump areas. An eighteen (18)-inch HDPE pipe will be used for constructing each of the pump-housing side slope risers at the leachate pumping stations. There will be a leachate head test well located at each sump.

There is one sump proposed for the Phases 3 & 4 expansion, which includes two pumping stations. The sump is located at the northern margin of the Phase 3. Leachate collection piping will direct leachate to the sump and will provide complete coverage of the phase floor. The main collection lines will be constructed to a minimum slope of 2.7% and the lateral collection lines will be constructed to a minimum slope of 1.5%. The lateral leachate collectors and main headers will be placed in trenches, covered with washed stone, and surrounded with a geotextile to protect the pipes from clogging. The pipes will only be placed in trenches on the phase floor. (See details, Sheets D1-D11). The portion of the pipes where the cleanouts are located will lie on the side slopes will be covered with stone and protected with geotextile, but the pipes will lay flat against the side slopes. No trenching will be performed on the side slopes. Cleanout risers will be provided for all of the leachate piping where physically possible. The leachate that collects in the sump areas will be pumped through the dual-contained force main to the leachate storage lagoon located north of Phase 1.

3.2 Stormwater Segregation Features

Phases 3 & 4 waste area will be covered with a synthetic stormwater cover. The waste area will be divided by a temporary stormwater control berm adjacent to the working face. The berm will be constructed on top of the drainage layer and be covered by the synthetic stormwater control liner. The location of the temporary stormwater control berm is shown on the filling sequence drawings, Sheets C13 through C17 of the Permit to Construct. This berm will direct stormwater runoff away from the working face to the low point in the cell, where a stormwater pump will pump the runoff over the northern Phase 3 perimeter berm. As waste placement continues, the elevation of the active area of the phase will reach the point where stormwater runoff can be directed over the perimeter berms on the north and west sides to ditches leading to sediment basins west and north of Phases 3 & 4.

3.3 Transition Between Active and Inactive Areas of the Phase

Placement of waste at Phases 3 & 4 will generally proceed from south to north. Prior to entering an inactive portion of the phase, the stormwater control liner will be partially removed. Where necessary, a temporary berm will be utilized to assure that stormwater and leachate remain separated. As the working face moves to the north, the stormwater control liner will remain in place as long as possible. See the detail sheets D1-D11 for a detail of the temporary gravel berm.

4.0 Facility Report

4.1 Waste Stream

Haywood County currently classifies their waste stream as industrial, commercial, municipal, or residential. Regulated hazardous waste, out-of-county waste, and hazardous liquid wastes are prohibited at the White Oak Landfill. This is the classification for the waste currently being disposed of at the White Oak site. The waste stream for Phases 3 & 4 will maintain the current classification.

The service area for the White Oak Landfill will include businesses and municipalities located within Haywood County. Waste from other counties will not be accepted at the facility. The current waste stream is approximately 5,000 tons per month. The average waste stream expected for Phases 3 & 4 is estimated to be 6,600 tons per month over the life of the area. These quantities assume an annual population growth of 1.0%, but the waste stream could vary as much as 15 percent based on past occurrences of fluctuations and population changes.

The county will operate Phases 3 & 4 using basically the same equipment available to them at this time. This equipment includes a compactor, one excavator, one motor grader, and one

front-end loader. This equipment should be sufficient for operating the landfill under its current waste stream. Haywood County budgets for new equipment needed for landfill operations on an annual basis.

4.2 Landfill Capacity

Phase 3 has a projected operating capacity of 686,000 cubic yards of air space to the bottom of the cap elevations shown on Sheet C13 of the permit drawings. This equates to an estimated life expectancy of approximately 5 years. This volume includes air space that is available for placing waste and operational daily cover. Phase 4 has a projected operating capacity of 631,000 cubic yards, which will provide disposal airspace for an additional 5 years after Phase 3 reaches capacity. A summary of projected MSW tonnages and required airspace is included in Appendix A.

The following nominal construction quantities for Phases 3 & 4 have been estimated:

	Phase 3	**Phase 4**
Cut Materials	300,000 cy	325,000 cy
Fill Materials	80,000 cy	60,000 cy
Clay Liner	35,000 cy	25,000 cy
Gravel drainage layer	35,000 cy	25,000 cy

Soil cover volumes were calculated assuming a soil to waste ratio of one (1) to five (5). Phases 3 & 4 expansion will require an average of 25,000 cubic yards of cover soils each year, based on a one (1) to five (5) soil to waste ratio. Approximately 5,000 cubic yards of soil would be needed each year for intermediate cover. Therefore, a total of 30,000 cubic yards of soil will be needed on an annual basis. The closure soil quantities needed for constructing the final cap for Phases 3 & 4 will include 30,000 cubic yards of intermediate cover soils, 45,000 cubic yards of clay liner material, and 60,000 cubic yards of vegetation-supportive soil. Soils needed for construction and operation of Phases 3 & 4 will be taken from the borrow areas indicated on Sheets C1 and C11. Preliminary soil borings performed on the site indicate that earthen materials which meet the project specifications for the compacted clay liner are available in sufficient quantities.

4.3 Environmental Control System

The North Carolina Solid Waste Management Rules, Section .1600, entitled "Requirements For Municipal Solid Waste Landfill Facilities", were adhered to throughout the design of Phases 3 & 4.

The major component of the Environmental Control System will consist of a primary composite base liner constructed of either a 24-inch, low-permeability clay layer with a permeability not greater than 1.0×10^{-7} cm/sec or a geosynthetic clay liner (GCL), which consists of an 18-inch, low-permeability clay layer with a permeability not greater than 1.0×10^{-5} overlain with a GCL material with a demonstrated hydraulic conductivity of not more than 5×10^{-9} cm/sec under the anticipated confining pressure. The 24-inch clay layer or 18-inch GCL shall be overlain by a 60-mil HDPE geomembrane. Once a protective 16-ounce geotextile is placed on the primary HDPE geomembrane, a two (2)-foot gravel drainage layer including leachate collection piping will be placed on top of the composite base liner system. The composite base liner will provide a redundant system for assuring that leachate is contained within the phase and does not affect local hydrogeology. The high hydraulic conductivity of the drainage layer will assure quick and efficient removal of leachate from the phase floor to the sump areas and will reduce the leak potential by reducing the driving head on the geomembrane. Once leachate reaches the sump area, it will be transported to the leachate storage lagoon through a dual-contained leachate force main and gravity sewer. Leachate pumps located in the sump will be activated by head heights of less than twelve (12) inches. Disposal of leachate from the leachate storage lagoon is discussed in detail in the Operations Plan.

Stormwater in Phase 3 that does not come into contact with waste will initially be collected on top of the proposed stormwater control liner and then pumped to a pipe that discharges into the unnamed branch north of the Phase. As the landfill increases in height, stormwater will be directed to periphery ditches that lead to permanent sediment basins prior to discharge to the nearby unnamed branch. Refer to sheet C5 of the permit drawings.

4.4 Leachate Generation

The amount of leachate that Phases 3 & 4 will generate was estimated by using the HELP Model analysis included in Section 10 of the Permit to Construct and by examining landfill records for the past six years. See Section 11 of the Permit to Construct for landfill leachate records for the past six years. The HELP model analyzed ten stages of landfill development during the lifetime of Phases 3 & 4. Each stage of development was comprised of cross-sections of landfill construction, which included clay barrier soils, flexible membrane liners, gravel drainage layers and layers of compacted MSW wastes and cover soils. The stages of development varied from the first, which analyzed the landfill with only a small portion active with relatively thin layers of compacted waste, to the tenth, which analyzed the landfill after the final cap was installed. Stages 1 through 5 occurred during the development of

MSW Phase 3 and stages 6 through 10 occurred during the development of MSW Phase 4. The HELP model estimates that average monthly leachate production will reach 596,400 gallons/month during the initial stages of Phase 4 development. Landfill records over the past six years show an average monthly leachate generation of approximately 220,000 gallons per month, and 323,500 gallons/month for F.Y. 2005, the wettest year during the past six years. The highest total leachate production for a calendar month was 486,000 gallons in September 2004, although during a 30 day period in September and October of that year, 600,000 gallons of leachate were removed. The monthly average calculated by the HELP model for 15.5 acres of lined landfill was the same as the greatest actual observed leachate production for a 21.5 acre area of lined landfill. During the six-year time period, there were only 4 months where leachate generation exceeded 400,000 gallons (for 21.5 acres). The HELP Model analysis is a conservative estimate of leachate production and will continue to be considered when designing improvements to the landfill leachate system; however, leachate production records will be utilized as well. The leachate collection system must be prepared to handle extreme events as well as function efficiently at average production levels.

4.5 Average Leachate Production Flows and Pumping

Utilizing the existing leachate production information included in Section 11 of the Permit to Construct, and pro-rating those quantities over the 15.5-acre footprint of Phases 3 and 4, it is estimated that Phases 3 and 4 will produce leachate at an average monthly rate of 250,000 gallons. Applying a 1.5 safety factor to this quantity results in an average rate of 375,000 gallons per month. To remove the leachate from the phase, assume that on average each pump will operate for 8 hours per day, which requires that the pumps remove leachate at an average flow of 13 gpm. Applying a peaking factor of 2 to the flow calculations, it is necessary for each pump to remove leachate at the rate of 26 gpm. An additional safety factor will be built in to the pumping system; therefore, each pump will be designed to pump 35 gpm at 25.5 feet total dynamic head (TDH). The pumps will utilize a 3"x 6" dual-contained force main located along the northern margin of Phase 3, which will run for approximately 150 l.f. to a point where the force main discharges into proposed leachate collection system gravity sewer manhole #2. The gravity sewer will flow approximately 375 l.f. where it will discharge to proposed leachate collection system gravity manhole #1, just upstream of the leachate storage lagoon. See Sheet C18 for proposed leachate force main and gravity sewer piping. The leachate storage lagoon located north of Phase 1 has a total storage volume of 642,000 gallons. Refer to Appendix B for force main calculations and Appendix C for correspondence between the Town of Waynesville concerning disposal of leachate.

4.6 Contingency Plan For Peak Flow Conditions And Leachate System Disruption

In the event of an extreme rainfall event, the HELP model projects a peak leachate production of 30,950 cubic feet/day, or approximately 231,000 gal/day. This peak event would be seen at Stage II of landfill development within the first two years of operation of Phase 3. Over time, the effects of an intense storm event would be greatly dampened due to the increase in the length of time that it would take stormwater to percolate through the layers of waste and daily cover. The available storage volume below the perimeter liner edge elevation of 2515 is approximately 2,200,000 gallons. During the peak event as described by the HELP model, the landfill can contain leachate for approximately 10 days of peak discharge intensity. It is unlikely that the HELP model 1-day peak intensity rate would continue for 10 days. Therefore it is highly unlikely for the landfill to produce more leachate than the pumps can transport to the leachate lagoon. In the event of extreme conditions, the discharge from the County's stormwater removal pump may be diverted to proposed manhole 2 of the leachate gravity system, which will allow leachate to be pumped to the storage lagoon at approximately 300 gpm.

Under average operating conditions, in the event that there was a temporary failure with any of the leachate removal and storage equipment, the geometry of the landfill would allow for the landfill to contain the leachate for a period of several months. However, the system should never be out of operation for more than a few hours, and then only under extreme circumstances. Due to the conservative design of the leachate removal and storage equipment and the geometry of the landfill, the possibility of leachate buildup overflowing the perimeter berm is very low.

In conjunction with the development of Phase 3, the existing leachate lagoon will be raised and a new liner will be installed on top of the existing liner. Currently, the lagoon has a storage capacity of 642,000 gallons. The lagoon will be raised by approximately 3.25' in order to provide an additional 375,000 gallons of storage volume. During the construction of the additional storage volume, a new 60-mil textured HDPE liner will be installed over the existing liner. A double-sided geocomposite will be installed between the existing liner and the proposed liner. The final volume of the lagoon will be approximately 1,017,000 gallons. Leachate will be pumped directly to the leachate tanker truck during the period of the lagoon expansion, which will take several days. Pumping will occur from proposed leachate manhole #1, which will be located just outside the limits of the lagoon. Depending on weather conditions at the time of construction, the County must make provisions to transport leachate on a 24-hour basis. During the summer months of the drought in 2007 and 2008, the 6,000 gallon tanker truck was filled every 3 or 4 days, or longer. However, if wet weather is encountered during the time of the construction project, it will be necessary for the County to rent an additional tanker truck and make provisions for 24 hours of operation.

Section .1624 (2)(A)(ii) of the Solid Waste Management Rules states that "the geometry of the landfill shall be designed to control and contain the volume of the leachate generated by the 24-hour, 25-year storm." The input parameters of the HELP model included maintaining

a minimum head of one (1) foot on the geomembrane liner, and the additional calculations have been done to assure that rule .1624 (2)(A)(ii) was met.

4.7 Soil Resources

Phase 3 is scheduled to begin construction in early 2009. It is estimated that Phase 3 will require 300,000 cubic yards of cut and 80,000 cubic yards of fill material resulting in the need to stockpile approximately 220,000 cubic yards of soil. Phase 4 is scheduled to begin construction in 2014 and will require approximately 325,000 cy of cut and 60,000 cy of fill material resulting in the need to stockpile 265,000 cy of soil.

The total soil requirements for Phase 3 & 4 construction will include 50,000 cubic yards of soil liner material. The soil stockpile area consists of materials suitable for structural fill as well as clay liner material. On-site borrow areas are located south and west of existing Phase 2 as shown on sheet C1 of the permit drawings.

The County has enough soil available to complete construction of Phases 3 & 4 and to operate the new phases prior to Phase 5 beginning operation in 2019.

APPENDIX A

Phases 3 & 4 Capacity Calculations

APPENDIX B

Leachate Pump Calculations

APPENDIX C

Leachate Acceptance Permit from Town of Waynesville WWTF

APPENDIX A

Phases 3 & 4 Capacity Calculations

Haywood County
White Oak Landfill

Projected MSW Volumes and Required Airspace

Fiscal Year	Population[1]	Projected Waste[2] (tons)	Annual Air Space Required[3] (CY)	Cumulative Air Space Required (CY)	Operational Soil Requirements[4] (CY)
2008	57,530	61,793	117,432	117,432	19,611
2009	60,407	64,882	123,303	240,735	20,592
2010	63,427	68,126	129,468	370,203	21,621
2011	66,598	71,533	135,942	506,145	22,702
2012	69,928	75,109	142,739	648,884	23,837
2013	73,424	78,865	149,876	798,759	25,029
2014	77,096	82,808	157,370	956,129	26,281
2015	80,950	86,948	165,238	1,121,367	27,595
2016	84,998	91,296	173,500	1,294,867	28,974
2017	89,248	95,860	182,175	1,477,042	30,423
2018	93,710	100,653	191,284	1,668,326	31,944
2019	98,396	105,686	200,848	1,869,173	33,542
2020	103,316	110,970	210,890	2,080,064	35,219
2021	108,481	116,519	221,435	2,301,498	36,980
2022	113,905	122,345	232,507	2,534,005	38,829
2023	119,601	128,462	244,132	2,778,137	40,770
2024	125,581	134,885	256,338	3,034,475	42,809
2025	131,860	141,630	269,155	3,303,631	44,949
2026	138,453	148,711	282,613	3,586,244	47,196
2027	145,375	156,147	296,744	3,882,987	49,556
2028	152,644	163,954	311,581	4,194,568	52,034

1 Population projections use U.S. Census year 2000 population for Haywood County of 54,033 and a 1.0% yearly increase.

2 Projected waste tonnage estimates assume a 1.0% yearly increase in the waste stream. This estimate combines MSW and C&D wastes, which will all be disposed in the lined landfill. Waste totals for FY 2007 were 58,850 tons.

3 Annual air space requirements assume a capaction rate of 0.5262 tons/cy (or 1,052.4 lbs/cy).

4 Operational soil requirements are based on a 5:1 waste to soil ratio by volume.

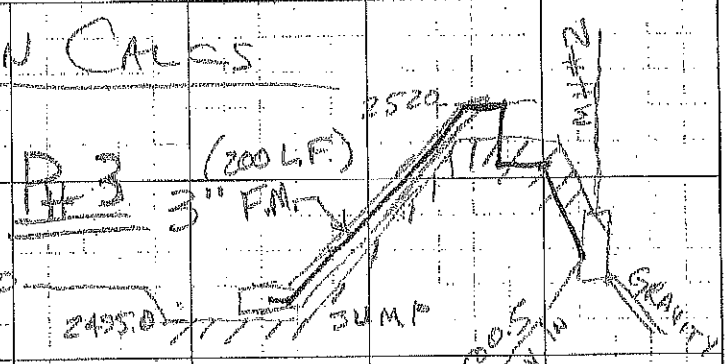
APPENDIX B

Leachate Pump Calculations

McGill ASSOCIATES
Engineering • Planning • Finance
McGill Associates, P.A. P.O. Box 2259, Asheville, NC 28802
55 Broad Street, Asheville, NC 28801 828-252-0575 Fax 828-252-2518

PROJECT: W.O.L.F. – PH 3 & 4
PROJECT NO.: 07578
DESCRIPTION:
CALCULATED BY: DP CHECKED BY:
DATE: 8/25/08 SHEET NO. OF

FORCE MAIN CALCS



STATIC HEAD

2520 – 2495.5 = 24.5'

PUMP ON: 2496.0
PUMP OFF: 2495.5
BOTH PUMPS ON: 2496.5

FRICTION LOSSES

FROM FIG 26, USE 0.35 Loss/100', OR TOTAL OF 0.70'
(C = 130) (V = 2 FT/SEC)
ASSUME FITTINGS Loss ≈ 0.3'
TOTAL FRICTION = 1'

EACH PUMP @ 26 GPM @ 25.5' T.D.H.

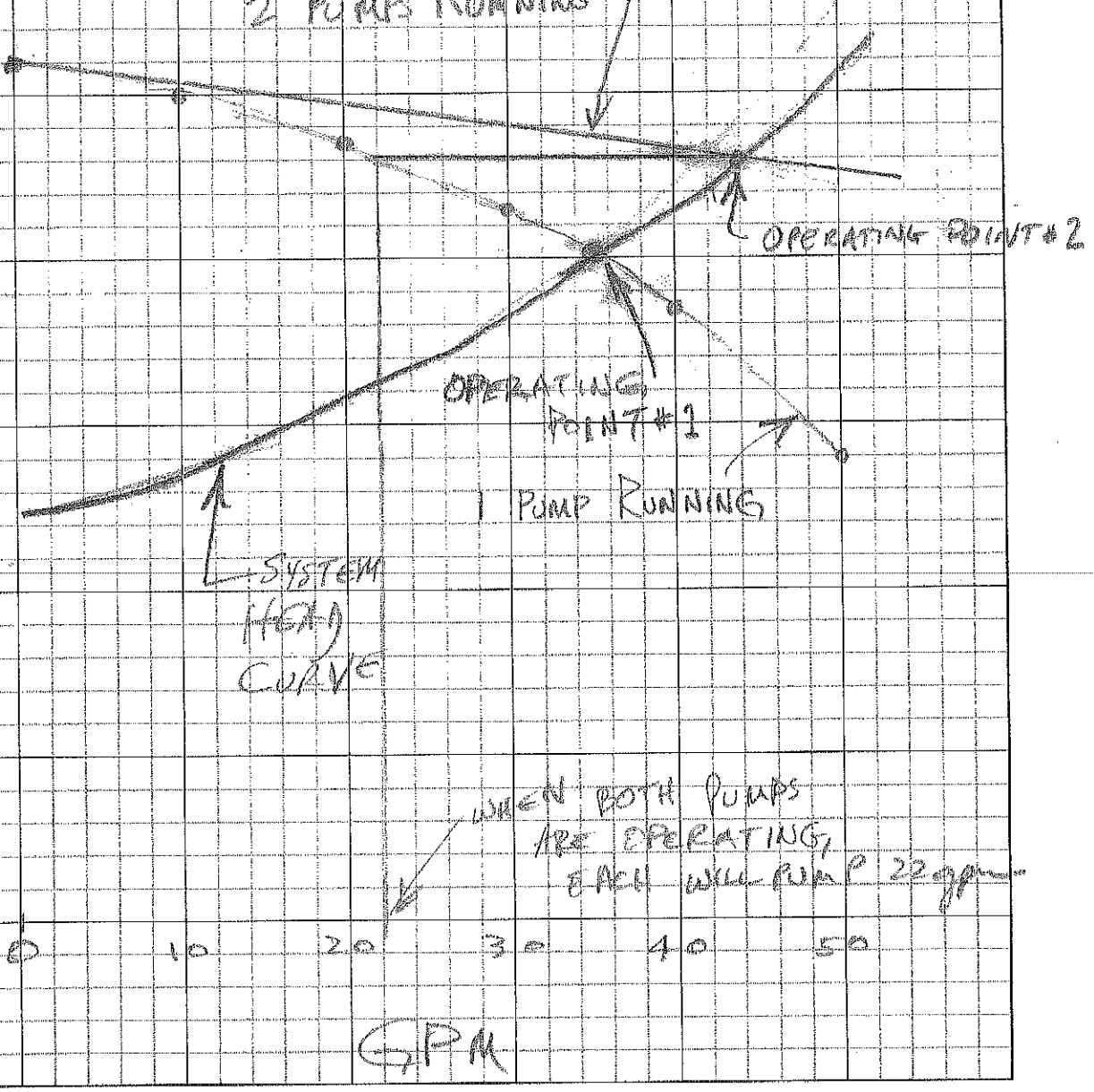
USE 35 GPM (REVISED 2/27/09)

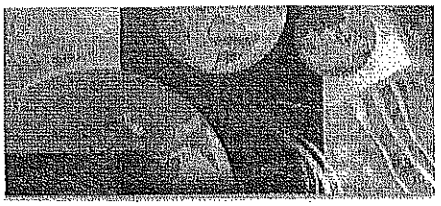
McGill ASSOCIATES
Engineering • Planning • Finance
McGill Associates, P.A. P.O. Box 2259, Asheville, NC 28802
55 Broad Street, Asheville, NC 28801 828-252-0575 Fax 828-252-2518

PROJECT: _____
PROJECT NO.: _____
DESCRIPTION: _____
CALCULATED BY: DP CHECKED BY: _____
DATE: 12/27/09 SHEET NO. ____ OF _____

PUMP CALCS

NOTE: EPG SERIES 8 SUBMERSIBLE PUMP MODEL 8-2, 0.75 h.p.
USED FOR PUMP CURVE. PUMPS ARE IDENTICAL.





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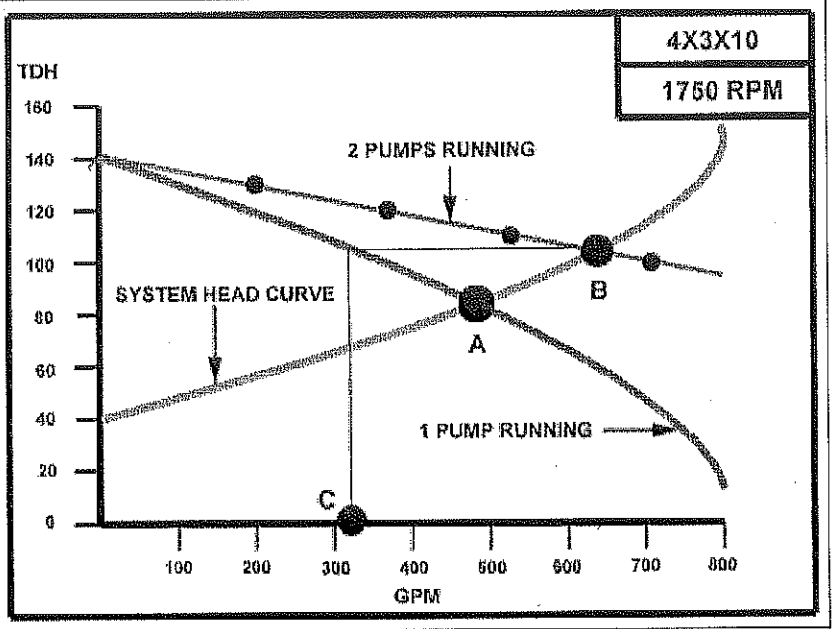
Identical Pumps
Different Pumps

Identical Pumps

Identical Pumps

Operating two identical pumps in parallel the assumption is made that the flow will double. This however is not the case. In order to calculate the additional flow realized by running two identical pumps in parallel the following calculations must be made.



First let's look at the pump curve and system head curve with one pump running.

TDH	FLOW
130'	100 GPM
120'	190 GPM
110'	280 GPM
100	360 GPM
OPERATING POINT (A)	
85'	470 GPM

Second let's look at the pump curve and system head curve with two pumps running.

TDH	FLOW

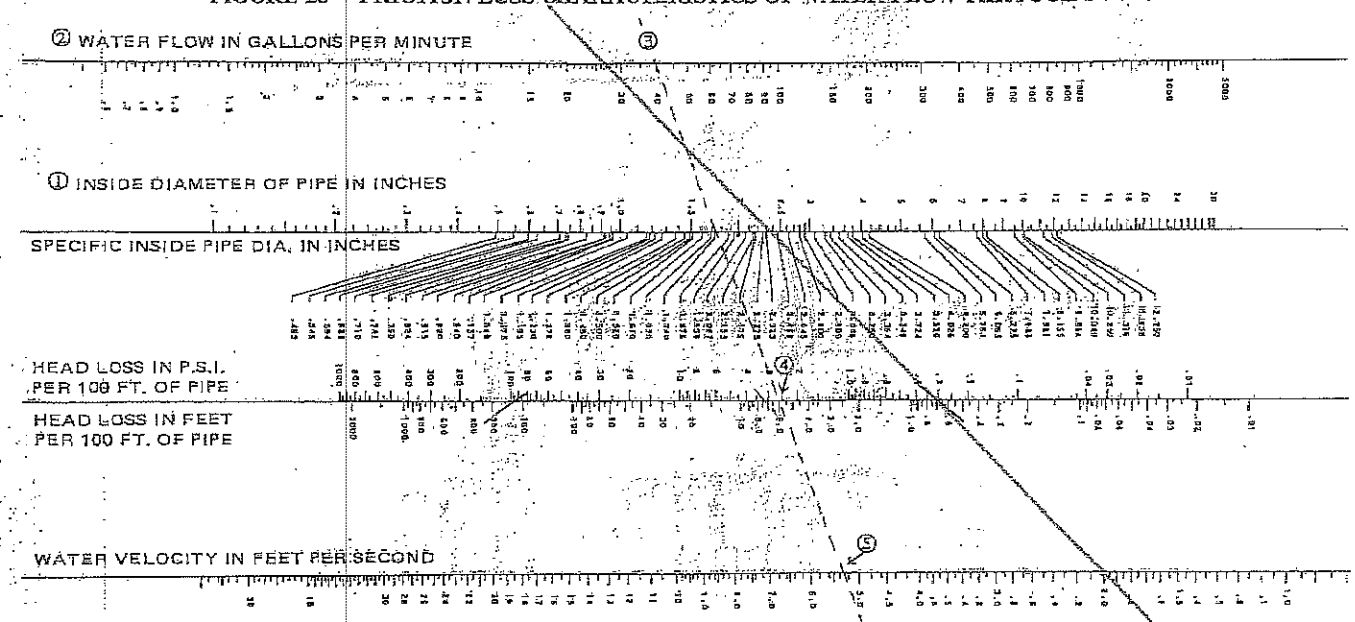
130'	200 GPM
120'	380 GPM
110'	560 GPM
100	720 GPM
OPERATING POINT (B)	
105'	660 GPM

The addition of the second identical pump produces and extra 190 GPM and does not double the flow. Point C is the flow produced by each pump when both pumps are running.

Up Next

32989 Scenic Cove
Millsboro, DE 19966

FIGURE 26 – FRICTION LOSS CHARACTERISTICS OF WATER FLOW THROUGH PVC PIPE



HOW TO USE THIS GRAPH:

1. Select the desired pipe size (inside diameter).
2. Determine the amount of water to flow through the pipe.
3. Place a straight-edge on these two points.
4. The point at which the straight-edge intersects the head-loss line and the velocity line give these two values under the given conditions.

EXAMPLE:

1½" schedule A pipe (I.D. = 1.740") ①
40 gallon per minute service ②

1. Line up these points with a straight-edge ③
2. Read 2.6 psi (or 6 ft.) from the head-loss line ④
3. Read 6.38 ft. per second from the velocity line ⑤

THE VALUES ON THIS GRAPH ARE BASED ON THE WILLIAMS AND HAZEN FORMULA:

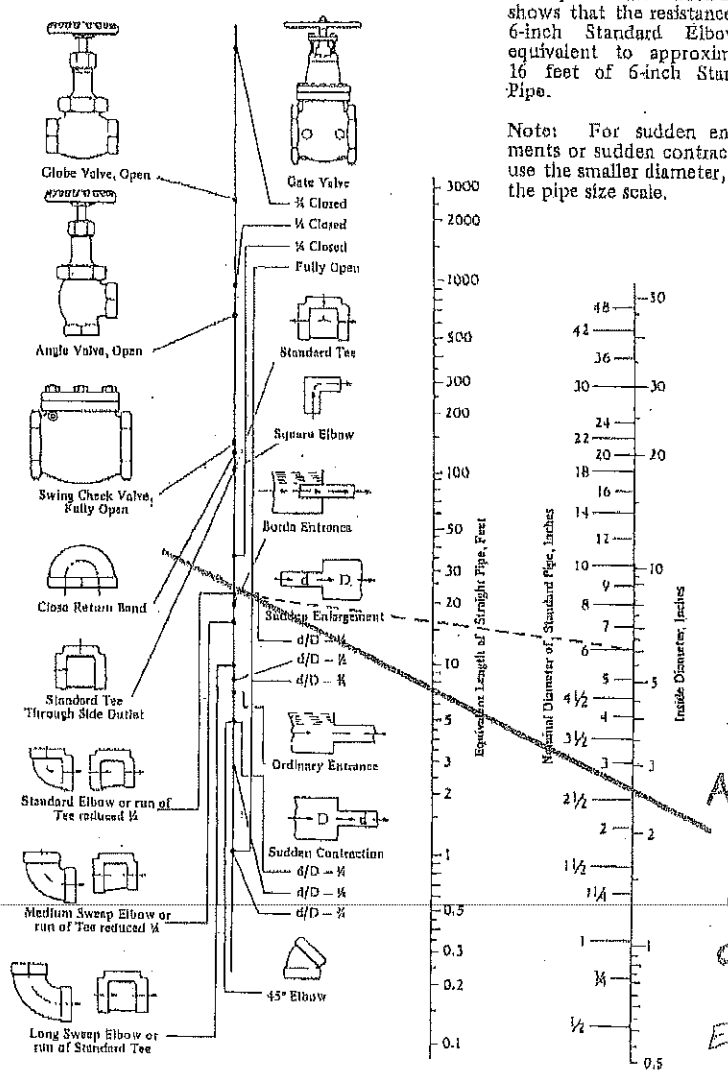
(EQUATION 80) $f = .2083 \left(\frac{100}{C}\right)^{1.85} \times \frac{Q^{1.852}}{d_i^{4.8655}}$

WHERE:

f = friction head in feet of water per 100 feet of pipe
d_i = inside diameter of pipe in inches
Q = Flow in gallons per minute
C = Constant for inside roughness of pipe (150 for PVC)

FIGURE 27 – RESISTANCE OF VALVES AND FITTINGS TO FLOW OF FLUIDS

Note: Head loss through check valves varies with types manufactured. Consult manufacturer for correct values.



Example: The dotted line shows that the resistance of a 6-inch Standard Elbow is equivalent to approximately 16 feet of 6-inch Standard Pipe.

Note: For sudden enlargements or sudden contractions, use the smaller diameter, d, on the pipe size scale.

ASSUME 6 TOTAL ELBOWS OR 8'x6 EQ LENGTH = 50'

(EQUATION 80) $f = .2083 \left(\frac{100}{C}\right) \times \frac{Q}{d_i^{2.625}}$

WHERE:
- f = friction head in feet of water per 100 feet of pipe
- d_i = inside diameter of pipe in inches
- Q = Flow in gallons per minute
- C = Constant for inside roughness of pipe (150 for PVC)

diameter).
2. Determine the amount of water to flow through the pipe.
3. Place a straight-edge on these two points.
4. The point at which the straight-edge intersects the head-loss line and the velocity line give these two values under the given conditions.

1. Line up these points with a straight-edge (3)
2. Read 2.6 psi (or 6 ft.) from the head-loss line (4)
3. Read 5.38 ft. per second from the velocity line (5)

APPENDIX C

Leachate Acceptance Permit from Town of Waynesville WWTF

Town of Waynesville

January 19, 2005

Mr. Bobby Cogdill
Solid Waste Director
Haywood County Solid Waste Management
278 Recycle Road
Clyde, NC 28721

Re: Transmittal Letter for IUP Permit No. 0003
White Oak Sanitary Landfill

Dear Mr. Cogdill:

Your Industrial User Pretreatment Permit (I. U. P. #0003) is enclosed. This permit renewal is issued in response to your Industrial User Wastewater Survey and Application which was dated January 7, 2005.

This permit is issued pursuant to the requirements of North Carolina General Statute 143-215.1 and the local Sewer Use Ordinance.

Please read this permit carefully.

If any parts, measurement frequencies, or sampling requirements contained in this permit are unacceptable to you, you have the right to an adjudicatory hearing upon written request within thirty (30) days following receipt of this letter. Unless such demand is made, this decision shall be final and binding.

Sincerely,

Frederick L. Baker, P.E.
Director of Public Works

FLB:fr

cc: Waynesville Waste Water Treatment Plant

Enclosure: IUP #0003

POB 100, 16 SOUTH MAIN ST., WAYNESVILLE, NC 28786 • PHONE (828) 456-3515 • FAX (828) 456-2000

Town of Waynesville

December 20, 2004

Mr. Bobby Cogdill
Haywood County Solid Waste Management
278 Recycle Road
Clyde, NC 28721

Re: IUP 0003, White Oak Sanitary Landfill

Dear Mr. Cogdill:

Just a couple of reminders. The referenced permit expires June 30, 2005. Get your annual leachate monitoring report submitted for metals and VOCs, pH, TSS, BOD, Ammonia, Sulfide and COD. File for your permit reissuance in January using the attached application. The application fee is $200.

The user fee for hauled wastewater from White Oak is $1.82/gallon or $109.20 per load for the 6,000 gallon tanker capacity. I anticipate that after June 30, 2005 the FY 06 budget ordinance will include a five percent (5%) increase to $114.66/load. Please plan accordingly during your budget preparations.

Thank you. We appreciate your business.

Sincerely,

Frederick L. Baker, P.E.
Public Works Director

FLB:pm

Attachment

POB 100, 16 SOUTH MAIN ST., WAYNESVILLE, NC 28786 • PHONE (828) 456-3515 • FAX (828) 456-2000

Town of Waynesville

WAYNESVILLE WASTEWATER TREATMENT PLANT

NON S.I.U.
INDUSTRIAL USER PRETREATMENT PERMIT (IUP)
To Discharge Wastewater Under The
Industrial Pretreatment Program

Effective Date: July 1, 2005 Permit No. 0003

Expiration Date: June 30, 2010

In compliance with the provisions of the Town of Waynesville Sewer User Ordinance, North Carolina General Statute 143-215.1, other lawful standards and regulations promulgated and adopted by the North Carolina Environmental Management Commission, and the Town of Waynesville, the following Industry, hereafter referred to by name or as the permittee:

Haywood County Solid Waste Management
278 Recycle Road
Clyde, NC 28721

White Oak Sanitary Landfill
White Oak Road
Fines Creek, NC

is hereby granted permission to:

1) Discharge hauled wastewater from the leachate from the White Oak Landfill into the Town of Waynesville WWTP NPDES No. NC 0025321 in accordance with the effluent limitations, monitoring requirements and all other conditions set forth in Parts I, II and III of this Industrial User Pretreatment Permit (IUP).

2) Continue operation of the existing pretreatment facility consisting of flow equalization storage and collection pond located at the White Oak site.

3) After receiving authorization to construct from the Town of Waynesville, construct and operate additional pretreatment units as needed to meet permit requirements.

DATE: 1/19/05

Frederick L. Baker, P.E.
Director of Public Works

PART I - EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1. Description of IUP Discharge

Pipe	Description
001	The sewer tap for the Recycle Road, Materials Recovery Facility is pipe 001. Hauled wastewater from the leachate pond for the White Oak Landfill, a lined, baled municipal solid waste landfill is discharged only at the MRF.

2. Effluent Limits and Monitoring Requirements

Effective immediately and lasting to the expiration date of this permit, the permittee may discharge from pipe 001 according to these specific effluent limits and monitoring requirements.

Limited Parameter	Effluent Limitation Daily Max. Lbs.day	Monthly Avg.	Sample Type	Monitoring Frequency Permittee
Flow	30,000 gpd	25,000 gpd	Influent Waste Tracking Log	Every Truckload
pH	*SU		Grab	Quarterly
BOD	**		Composite	Annual
TSS	**		Composite	Annual
Ammonia	**		Composite	Annual
Sulfide	**		Composite	Annual
COD	**		Composite	Annual
***Metals	**		Composite	Annual
****Volatile Organics	**		Composite	Annual

*	pH shall be greater than 6.0 and less than 9.0
**	not currently limited, monitoring only
***	15 metals listed in Appendix I, 40 CFR Part 258
****	47 volatile organics listed in Appendix I, 40 CFR 258

3. Definition of Terms

A) A "composite" sample, for monitoring requirements is defined as a minimum of four (4) grab samples collected at equally spaced two (2) hour intervals and proportioned according to flow.

B) A "grab" sample, for monitoring requirements, is defined as a single "dip and take" sample collected at a representative point in the discharge stream.

C) A "daily" monitoring frequency shall mean each day a discharge occurs.

PART II - GENERAL CONDITIONS

1. **Representative Sampling**

Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge. All samples shall be taken at the monitoring points specified in this permit and, unless otherwise specified, before the effluent joins or is diluted by any other wastestream, body of water, or substance. Monitoring points shall not be changed without notification to, and approval by, the POTW Director.

2. **Reporting**

A) Monitoring results obtained by the permittee shall be reported on forms specified by the Town, postmarked no later than the twentieth day of the month following the month in which the samples were taken. If no discharge occurs during a reporting period (herein defined as each calendar month) in which a sampling event was to have occurred, a form with the phrase " no discharge" shall be submitted. Copies of these and all other reports required herein shall be submitted to the Town of Waynesville at the following address: Town of Waynesville Industrial Pretreatment Program, Post Office Box 100, Waynesville, NC 28786.

B) If the sampling performed by the permittee indicates a violation, the permittee shall notify the Town within 24 hours of becoming aware of the violation. The permittee shall also repeat the sampling and analysis and submit the results of the repeat analysis to the Town within 30 days after becoming aware of the violation.

3. **Test Procedures**

Test Procedures for the analysis of pollutants shall be performed in accordance with the techniques prescribed in 40 CFR part 136 and amendments thereto unless specified otherwise in the monitoring conditions of this permit.

4. **Additional Monitoring by Permittee**

If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved analytical methods as specified above, the results of such monitoring shall be submitted to the Town. The Town may require more frequent monitoring of the monitoring of other pollutants not required in this permit by written notification.

5. **Duty to Comply**

The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Town of Waynesville Sewer Use Ordinance and is grounds for possible enforcement action.

6. **Duty to Mitigate - Prevention of Adverse Impact**

The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this permit which has a reasonable likelihood of adversely affecting human health, the POTW, the waters receiving the POW' s discharge, or the environment.

7. **Facilities Operation, Bypass**

The permittee shall at all times maintain in good working order and operate as efficiently as possible, all control facilities or systems installed or used by the permittee to achieve compliance with the terms and conditions of this permit. Bypass of treatment facilities is prohibited except when approved in advance by the Town. Bypass approval shall be given only when such bypass is in compliance with 40 CFR 403.17.

8. **Removed Substances**

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall be disposed of in a manner such as to prevent any pollutants from such materials from entering the sewer system. The permittee is responsible for assuring its compliance with any requirements regarding the generation, treatment, storage and/or disposal of "Hazardous waste" as defined under the Federal Resource Conservation and Recovery Act.

9. **Upset Conditions**

An "upset" means an exceptional incident in which there is an unintentional and temporary noncompliance with the effluent limitations of this permit because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed or inadequate treatment facilities, lack of preventative maintenance, or careless or improper operations.

An upset may constitute an affirmative defense for action brought for the noncompliance. The permittee has the burden of proof to provide evidence and demonstrate that none of the factors specifically listed above were responsible for the noncompliance.

10. **Right of Entry**

The permittee shall allow the staff of the State of North Carolina Department of Environment, Health, and Natural Resources, Division of Environmental Management, the Regional Administration of the Environmental Protection Agency, the Town of Waynesville, and /or their authorized representatives, upon the presentation of credentials:

A) To enter upon the permittee's premises where a real or potential discharge is located or in which records are required to be kept under the terms and conditions of this permit; and

B) At reasonable times to have access to and copy records required to be kept under the terms and conditions of this permit; to inspect any monitoring equipment or monitoring method required in this permit; and to sample any discharge of pollutants.

11. Availability of Records and Reports

The permittee shall retain records of all monitoring information, including all calibration and maintenance records as well as copies of reports and information used to complete the application for this permit for at least three years. All records that pertain to matters that are subject to any type of enforcement action shall be retained and preserved by the permittee until all enforcement activities have concluded and all periods of limitation with respect to any and all appeals have expired.

Except for data determined to be confidential under the Sewer Use Ordinance, all reports prepared in accordance with terms of this permit shall be available for public inspection at Town Hall. As required by the Sewer Use Ordinance, effluent data shall not be considered confidential.

12. Duty to Provide Information

The permittee shall furnish to the Director of Public Works or his/her designees, within a reasonable time, any information which the Director, his/her designee, or the Division of Environmental Management may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The permittee shall also furnish, upon request, copies of records required to be kept by this permit.

13. Signatory Requirements

All reports or information submitted pursuant to the requirements of this permit must be signed and certified by a ranking official or duly authorized agent of the permittee.

14. Toxic Pollutants

If a toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307(a) of the Federal Clean Water Act for a toxic pollutant which is present in the discharge and such standard or prohibition is more stringent than any limitation for such pollutant in this permit, this permit may be revised or modified in accordance with the toxic effluent standard or prohibition and the permittee so notified.

15. Civil and Criminal Liability

Nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance.

16. Federal and/or State Laws

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable Federal and/or State law or regulation.

17. Penalties

The Sewer Use Ordinance of the Town of Waynesville provides that any person who violates a permit condition is subject to a civil penalty not to exceed $10,000 dollars per day of such violation.

Under state law, (NCGS 143-215.6B), under certain circumstances it is a crime to violate terms, conditions, or requirements of pretreatment permits. It is a crime to knowingly make any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance. These crimes are enforced at the prosecutorial discretion of the local District Attorney.

18. Need to Halt or Reduce not a Defense

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity to maintain compliance with the conditions of the permit.

19. Transferability

This permit shall not be reassigned or transferred or sold to a new owner, new user, different premises, or a new or changed operation without approval of the Town.

20. Property Rights

This permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.

21. Severability

The provisions of this permit are severable and, if any provision of this permit or the application of any provision of this permit to any circumstance is held invalid, the application of such provision to other circumstances and the remainder of this permit shall not be affected thereby.

22. **Permit Modification, Revocation, Termination**

This permit may be modified, revoked and reissued or terminated with cause in accordance to the requirements of the Town of Waynesville Sewer Use Ordinance and North Carolina General Statute or implementing regulations.

23. **Re-Application for Permit Renewal**

The permittee is responsible for filing an application for reissuance of this permit at least 180 days prior to its expiration date.

24. **Dilution Prohibition**

The permittee shall not increase the use of potable or process water or in any other way attempt to dilute the discharge as a partial or complete substitute for adequate treatment to achieve compliance with the limitations contained in this permit.

25. **Reports of Changed Conditions**

The permittee shall give notice to the Town of any planned significant changes to the permittee's operations or system which might alter the nature, quality, or volume of its wastewater at least 180 days before the change.

26. **Construction**

No construction of pretreatment facilities or additions thereto shall be begun until Final Plans and Specifications have been submitted to the Town and written approval and an Authorization to Construct (A to C) have been issued.

27. **Reopener**

The permittee shall be modified or, alternatively, revoked and reissued to comply with any applicable effluent standard or limitation for the control of any pollutant shown to contribute to toxicity of the WWTP effluent or any pollutant that is otherwise limited by the POTW discharge permit. The permit as modified or reissued under this paragraph may also contain any other requirements of State or Federal pretreatment regulations then applicable.

28. **Categorical Reopener**

This permit shall be modified, or alternatively, revoked and reissued, to comply with any applicable effluent standard or limitation issued or approved under Sections 302(b)(2)(C) and (D), 304(b)(2), and 307(a)(2) of the Clean Water Act, if the effluent standard or limitation so issued or approved:

A) contains different conditions or is otherwise more stringent than any effluent limitation in this permit; or

B) controls any pollutant not limited in this permit.

This permit as modified or reissued under this paragraph shall also contain any other requirements of the Act then applicable.

29. **General Prohibitive Standards**

The permittee shall comply with the general prohibitive discharge standards in 40 CFR 403.5(a) and (b) of the Federal pretreatment regulations.

30. **Reports of Potential Problems**

The permittee shall notify by telephone the POTW Superintendent, (828) 452-4685, immediately of all discharges that could cause problems to the POTW including any slug loadings as defined by 40 CFR 403.5(b). If the permittee experiences such a discharge, they shall inform the POTW Superintendent immediately upon the first awareness of the commencement of the discharge. Notifications shall include location of the discharge, type of waste, concentration and volume if known and corrective actions taken by the permittee. A written follow-up report thereof shall be filed by the permittee within five (5) days, unless waived by the Town.

Part III – SPECIAL CONDITIONS

1. **Hauled Industrial Waste, Waste Tracking Form**

In accordance with Section 2.9 of the Town's SUO, Industrial Waste Haulers must provide a wastetracking form for every load. Participation in the user charge system will be on the basis of a fee per load (currently $1.82/gallon of tanker capacity or as modified by the schedule of fees and charges adopted in the Town's annual budget ordinance) paid monthly based on the waste tracking form log.

2. **Local Permit (NON SIU)**

This permit is classified non significant industrial use (non-SIU) because flows are less than 25,000 gpd and no pollutants of concerns exceed 5% of the MAIL (maximum allowable industrial loading.)

Part IV – PERMIT MODIFICATION HISTORY

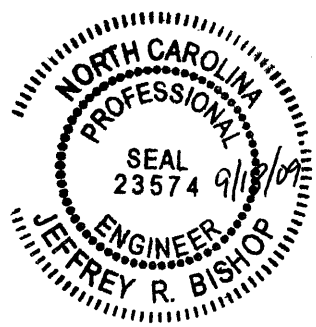
1. The original permit was issued in 1995 and renewed in 2000.

2. In January 2005, the permit is renewed for five years effective July 1, 2005. The daily maximum flow is increased to 30,000 gpd (from 25,000) to accommodate five (5) truckloads per day of leachate. The monthly average limitation for flow increased to 25,000 gpd (from 18,000 gpd). Ph monitoring frequency is reduced to quarterly (from monthly). This local permit uses an annual scan type analysis suited for solid waste leachate and priority pollutants. All pollutants of concern remain well below 5% of MAIL.

ENGINEERING PLAN

White Oak MSW Landfill
Phases 3 & 4

This Engineering Plan incorporates the plans and specifications relative to detailed design and performance of the Phases 3 & 4 Expansion at the White Oak MSW Landfill. This certifies that the plan was developed in accordance with Section .1620 of the Solid Waste management Rules (15 NCAC 13B). Sections .1624 (Construction Requirements for MSWLF Facilities) and .1627 (Closure and Post-Closure Requirements for MSWLF Facilities) were also closely referenced during the development of this plan. This Engineering Plan discusses the engineering and design of MSW Phase 3 of the Phases 3 & 4 expansion. Phase 3 has an estimated life expectancy of five (5) years.



Jeffrey R. Bishop, P.E.
Project Engineer
McGill Associates, P.A.
North Carolina P.E. Registration #23574

ENGINEERING PLAN

WHITE OAK MSW LANDFILL
PHASES 3 & 4
HAYWOOD COUNTY, NORTH CAROLINA

JEFFREY R. BISHOP, P.E.

McGill ASSOCIATES

Engineering • Planning • Finance
Asheville, North Carolina

September 2008
Revised February 2009
Revised September 2009

07518

ENGINEERING PLAN

White Oak MSW Landfill
Phases 3 & 4

1.0 Introduction

The Engineering Plan incorporates the plans and specifications relative to detailed design and performance of the Phases 3 & 4 Expansion at the White Oak MSW Landfill. This plan was developed in accordance with Section .1620 of the Solid Waste management Rules (15 NCAC 13B). Sections .1624 (Construction Requirements for MSWLF Facilities) and .1627 (Closure and Post-Closure Requirements for MSWLF Facilities) were also closely referenced during the development of this plan. This Engineering Plan discusses the engineering and design of Phase 3 of the Phases 3 & 4 expansion. Phase 3 has an estimated life expectancy of five (5) years.

2.0 Engineering Report

2.1 Composite Base Liner and Leachate Collection System

The Phases 3 & 4 Expansion has the following: clay layer, HDPE liner and Leachate Collection System (LCS) design characteristics (from bottom to top):

- A minimum eight (8)-foot vertical buffer between the average seasonal high water table and the top of the composite liner,
- A minimum 6.5-foot vertical buffer between bedrock and the top of the composite liner.
- A compacted select backfill layer
- A two (2)-foot thick, compacted clay liner with a maximum permeability of 1.0×10^{-7} cm/sec., or an eighteen (18)-inch thick compacted clay liner with a maximum permeability of 1.0×10^{-5} cm/sec overlain with a geosynthetic clay liner (GCL) material with a demonstrated hydraulic conductivity of not more than 5×10^{-9} cm/sec under the anticipated confining pressure,
- A primary sixty (60)-mil, high density polyethylene (HDPE) geomembrane liner, smooth on the floor and textured on the slopes,
- A sixteen (16)-once geotextile cushion on the floor and side slopes, and
- A two (2)-foot thick leachate collection layer constructed of washed stone, and also including leachate collection and transfer piping constructed of HDPE.

2.2 Cap System

The Phases 3 & 4 Expansion will have the following cap system design characteristics (from bottom to top):

- A one (1)-foot thick layer of compacted intermediate cover directly on top of the waste,
- An eighteen (18)-inch thick compacted clay layer, with maximum permeability of 1.0×10^{-5} cm/sec
- A forty (40)-mil textured HDPE geomembrane,
- A double-sided, eight (8)-ounce geocomposite, and
- A twenty-four -inch (24") thick vegetative\erosion layer

2.3 Leachate Collection

The Phases 3 & 4 leachate collection lines consist of eight (8)-inch perforated HDPE main collector lines which run from south to north near the center of the phase, and a series of six (6)-inch, perforated, HDPE lateral collectors that connect to the main lines. The main collection lines will be constructed with a minimum slope of 2.5%. The lateral collectors are spaced approximately 110 feet apart and maintain a minimum grade of 2.8%. See Sheet C4 of the Permit Drawings for the layout of the leachate collection piping for Phase 3, and Sheet C8 for Phase 4.

Phases 3 & 4 will be constructed with two (2) leachate collection sumps and pumping stations. Both sumps are located at the lowest point in the phase along the northern margin of Phase 3. Two (2) pumping stations are designed in order to provide redundancy and to increase the safety factor against a pump failure and leachate spill. The proposed sump area will be an eight (8)-foot by sixty (60)-foot recessed area and will be double-lined with HDPE geomembrane. The pumping stations will utilize a side-slope riser with a submersible pump.

The sump area will contain a section of eighteen (18)-inch perforated HDPE pipe that will house the submersible leachate pump. The submersible pump will be lowered into the leachate collection sump through the side-slope riser by means of a steel cable and a rolling carriage. The side-slope riser rests on the 16-ounce geotextile cushion along the slope and lies between the sump and the top of the perimeter berm.

2.4 Leachate Generation

The amount of leachate that Phases 3 & 4 will generate was estimated by using the HELP Model analysis included in Section 10 of the Permit to Construct and by examining landfill records for the past six years. See Section 11 of the Permit to Construct for landfill leachate records for the past six years. The HELP model analyzed ten stages of

landfill development during the lifetime of Phases 3 & 4. Each stage of development was comprised of cross-sections of landfill construction, which included clay barrier soils, flexible membrane liners, gravel drainage layers and layers of compacted MSW wastes and cover soils. The stages of development varied from the first, which analyzed the landfill with only a small portion active with relatively thin layers of compacted waste, to the tenth, which analyzed the landfill after the final cap was installed. Stages 1 through 5 occurred during the development of MSW Phase 3 and stages 6 through 10 occurred during the development of MSW Phase 4. The HELP model estimates that average monthly leachate production will reach 596,400 gallons/month during the initial stages of Phase 4 development. Landfill records over the past six years show an average monthly leachate generation of approximately 220,000 gallons per month, and 323,500 gallons/month for F.Y. 2005, the wettest year during the past six years. The highest total leachate production for a calendar month was 486,000 gallons in September 2004, although during a 30 day period in September and October of that year, 600,000 gallons of leachate were removed. The monthly average calculated by the HELP model for 15.5 acres of lined landfill was the same as the greatest actual observed leachate production for a 21.5 acre area of lined landfill. During the six-year time period, there were only 4 months where leachate generation exceeded 400,000 gallons (for 21.5 acres). The HELP Model analysis is a conservative estimate of leachate production and will continue to be considered when designing improvements to the landfill leachate system; however, leachate production records will be utilized as well. The leachate collection system must be prepared to handle extreme events as well as function efficiently at average production levels.

2.5 Average Leachate Production Flows and Pumping

Utilizing the existing leachate production information included in Section 11 of the Permit to Construct, and pro-rating those quantities over the 15.5-acre footprint of Phases 3 and 4, it is estimated that Phases 3 and 4 will produce leachate at an average monthly rate of 250,000 gallons. Applying a 1.5 safety factor to this quantity results in an average rate of 375,000 gallons per month. To remove the leachate from the phase, assume that on average each pump will operate for 8 hours per day, which requires that the pumps remove leachate at an average flow of 13 gpm. Applying a peaking factor of 2 to the flow calculations, it is necessary for each pump to remove leachate at the rate of 26 gpm. Therefore, each pump will be designed to pump 26 gpm at a total dynamic head (TDH) of 25.5 feet. An additional safety factor will be built in to the pumping system; therefore, each pump will be designed to pump 35 gpm at 25.5 feet total dynamic head (TDH). The pumps will utilize a 3" x 6" dual-contained force main located along the northern margin of Phase 3, which will run for approximately 150 l.f. to a point where the force main discharges into proposed leachate collection system gravity sewer manhole #2. The gravity sewer will flow approximately 375 l.f. where it will discharge to proposed leachate collection system gravity manhole #1, just upstream of the leachate storage lagoon. See Sheet C18 for proposed leachate force main and gravity sewer piping. The force main will accommodate a minimum flow of 35 gpm flow with a minimum velocity

of 2 feet per second. The leachate storage lagoon located north of Phase 1 has a total storage volume of 642,000 gallons.

2.6 Contingency Plan For Peak Flow Conditions And Leachate System Disruption

In the event of an extreme rainfall event, the HELP model projects a peak leachate production of 30,950 cubic feet/day, or approximately 231,000 gal/day. This peak event would be seen at Stage II of landfill development within the first two years of operation of Phase 3. Over time, the effects of an intense storm event would be greatly dampened due to the increase in the length of time that it would take stormwater to percolate through the layers of waste and daily cover. The available storage volume below the perimeter liner edge elevation of 2515 is approximately 2,200,000 gallons. During the peak event as described by the HELP model, the landfill can contain leachate for 10 days of peak discharge intensity. It is unlikely that the HELP model 1-day peak intensity rate would continue for 10 days. Therefore it is highly unlikely for the landfill to produce more leachate than the pumps can transport to the leachate lagoon. In the event of extreme conditions, the discharge from the County's stormwater removal pump may be diverted to proposed manhole 2 of the leachate gravity system, which will allow leachate to be pumped to the storage lagoon at approximately 300 gpm.

Under average operating conditions, in the event that there was a temporary failure with any of the leachate removal and storage equipment, the geometry of the landfill would allow for the landfill to contain the leachate for a period of several months. However, the system should never be out of operation for more than a few hours, and then only under extreme circumstances. Due to the conservative design of the leachate removal and storage equipment and the geometry of the landfill, the possibility of leachate buildup overflowing the perimeter berm is very low.

In conjunction with the development of Phase 3, the existing leachate lagoon will be raised and a new liner will be installed on top of the existing liner. Currently, the lagoon has a storage capacity of 642,000 gallons. The lagoon will be raised by approximately 3.25' in order to provide an additional 375,000 gallons of storage volume. During the construction of the additional storage volume, a new 60-mil textured HDPE liner will be installed over the existing liner. A double-sided geocomposite will be installed between the existing liner and the proposed liner. The final volume of the lagoon will be approximately 1,017,000 gallons. Leachate will be pumped directly to the leachate tanker truck during the period of the lagoon expansion, which will take several days. Pumping will occur from proposed leachate manhole #1, which will be located just outside the limits of the lagoon. Depending on weather conditions at the time of construction, the County must make provisions to transport leachate on a 24-hour basis. During the summer months of the drought in 2007 and 2008, the 6,000 gallon tanker truck was filled every 3 or 4 days, or longer. However, if wet weather is encountered

during the time of the construction project, it will be necessary for the County to rent an additional tanker truck and make provisions for 24 hours of operation.

Section .1624 (2)(A)(ii) of the Solid Waste Management Rules states that "the geometry of the landfill shall be designed to control and contain the volume of the leachate generated by the 24-hour, 25-year storm." The input parameters of the HELP model included maintaining a minimum head of one (1) foot on the geomembrane liner, and the additional calculations have been done to assure that rule .1624 (2)(A)(ii) was met.

2.7 Existing Dual-Contained Gravity Sewer Connection Beneath Phase 3

A portion of Phase 3 will be constructed over the existing dual-contained gravity sewer that services the sump areas of existing Phase 2 and existing Phase 1, Cell 4. The existing dual-contained gravity sewer will be replaced with new dual-contained gravity sewer to ensure that there is a minimum 4' separation between the bottom of the proposed Phase 3 clay liner and the top of the new sewer. The dual-contained gravity sewer will daylight into a new HDPE manhole located outside of the Phase 3 liner limits along the proposed access road to Phase 3. The new gravity sewer will connect to the existing leachate gravity system near the north margin of the Phase 1 cell, which flows to the existing leachate lagoon.

3.0 DESIGN SUMMARY

3.1 Analytical Methods Used for Design Evaluation

3.1.1 Liner Components.

Review of EPA literature, NCDENR regulations, and Geomembrane liner manufacturer data.

3.1.2 Leachate collection system

The leachate collection system is designed to handle leachate production flows as determined by evaluation of documented leachate generation rates. Pipe spacing is based upon HELP Model and Manning Equation analysis.

3.1.3 Leachate Production

Volumes – Documented leachate generation rates, and HELP Model
Storage Facilities - HELP Model during Phases 3 & 4

3.1.4 Gas Collection System

EPA design manual and assumption that gas well radius of influence = 100-125 feet.

3.2 Definition of Critical Conditions and Assumptions Made

Critical components

Phases 3 & 4 will connect to the existing Phases 1 and 2 liner edge and waste will piggyback over the existing Phases 1 and 2 MSW waste areas.

Base liner system separation of four (4) feet above average seasonal high water table

- Maximize use of existing property
- Existing soils may require amendment to get 1.0 x 10^{-7} permeability, or off-site borrow sources may have to be utilized, or a GCL composite liner with 1.0 x 10^{-5} permeability compacted clay soils overlain with a GCL material with a demonstrated hydraulic conductivity of not more than 5 x 10^{-9} cm/sec under the anticipated confining pressure may be utilized.
- Constructed with washed stone leachate collection drainage layer to minimize potential of clogging
- Proposed base liner system and proposed final cap system in accordance with current regulations

3.3 Technical References Used

- EPA 530-R-93-017 "Solid waste disposal facility criteria, technical manual"
- NC Regulations (15A NCAC 13B)
- Federal Regulations
- HELP Model
- Geomembrane liner manufacturer literature
- "Subtitle D technical training manual"
- EPA/625/R-94/008 Seminar publication "Design, operation, and closure of municipal soil waste landfill"
- EPA/600/R-94/168a "Hydraulic evaluation of landfill performance (HELP) Model user's guide for version3"
- Bagchi, Amalendu. (1994). Design, Construction, and Monitoring of Landfills, John Wiley and Sons, Inc., New York, NY.

3.4 Location Restrictions

The Phases 3 & 4 expansion complies with all location restrictions given in Section .1622 of the Solid Waste Management Rules (15A NCAC 13B).

3.4.1 Airports

There are no Public Use Airports within the two-mile perimeter of the White Oak Landfill. The closest airport is located just over nine miles north of the Facility.

3.4.2 Water Supply

There are two public water supply wells located within a two-mile perimeter of the White Oak Landfill, at the Fines Creek Methodist Church and the Panther Creek Baptist Church. No water supply wells are located within 500' of the proposed Phases 3 & 4 landfill expansion. Private water supply wells located near the White Oak Landfill are illustrated on Sheet C1 of the Permit to Construct Plans.

3.4.3 Zoning

The area of the Phases 3 & 4 landfill expansion at the White Oak Landfill is not located within a zoned area.

3.4.4 Contamination Sources

The White Oak Landfill is the only known potential source of contamination in the area, with the exception of agricultural activities in the area.

3.4.5 Historical Sites

Six historical sites on the White Oak Landfill property were identified and examined during the preparation of the "MSWLF Facility Site Study, White Oak Landfill", prepared by Municipal Engineering and dated November 4, 1998. Four of the sites are prehistoric and two are historic. Three of the sites will be impacted during the construction of the Phases 3 & 4 expansion. None of the sites are recommended as eligible for inclusion on the National Register of Historic Places. The Site Study report concludes that no additional work is necessary at the sites. For an extensive discussion of Cultural Resources in the vicinity of the White Oak Landfill, see Section 4.7 of the "MSWLF Facility Site Study, White Oak Landfill".

3.4.6 Floodplains

Portions of the White Oak property along the Pigeon River are located in the 100-year floodplain; however, the extent of the floodplain is located over 1,000 feet horizontally and 150 feet vertically downgradient of the Phases 3 & 4 expansion. No area of the expansion is located within a 100-year floodplain.

3.4.7 Wetlands and Streams

A wetlands area and a stream are present in the area of the Phase 3 development. See Sheet C2 of the permit drawings for the location of the wetlands and stream. A jurisdictional delineation was performed by ClearWater Environmental and a representative of the U.S. Army Corps of Engineers (USCOE) conducted a field verification of the delineation. Approximately 0.45 acres of wetlands and 185 linear feet of stream will be impacted by the construction of Phase 3. An application for the wetlands and stream impact has been submitted to the USCOE and the NCDENR-Division of Water Quality for 404/401 permitting. A copy of the 404/401 permits will be submitted to the NCDENR-Solid Waste Section prior to the issuance of a Permit To Construct Phase 3. Beyond the areas of the stream/wetlands impact, the Phases 3 & 4 Expansion will not have detrimental effects on fish and wildlife. All of the following will be conformed to:

- Endangered Species Act of 1973
- Marine Protection, Research, and Sanctuaries Act of 1972
- Section 404 of the Clean Water Act

3.4.8 Seismic Design

See the Design Hydrogeologic Report prepared by Bunnell-Lammons, Inc.

3.4.9 Fault Areas

See the Design Hydrogeologic Report prepared by Bunnell-Lammons, Inc.

3.4.10 Unstable Areas

See the Design Hydrogeologic Report prepared by Bunnell-Lammons, Inc.

4.0 MATERIALS AND CONSTRUCTION PRACTICES

All materials and methods used for constructing the Phases 3 & 4 Expansion will meet the requirements set forth in Section .1624 of the Solid Waste Management Rules (15A NCAC 13B).

4.1 Subgrade

The landfill subgrade will be adequately free of organic materials and will consist of on-site soils or select fill material previously approved by the Division. The subgrade will be graded according to plans approved by the Division. The landfill operator may be required to notify the Division's hydrogeologist for inspection of the subgrade once excavation is complete. This notification would be indicated in the Permit To Construct.

Before construction of the liner system, the Project Engineer will visually inspect the subgrade. The Project Engineer will evaluate the integrity of the surface and document proper preparation and elevations according to plans approved by the Division. The subgrade will be proof-rolled using procedures specified by the technical specifications. The subgrade will be tested for moisture and density requirements at the minimum frequency given in the Division approved technical specifications and the Site Specific Construction Quality Assurance Plan.

4.2 Clay Liner and Geosyntheic Clay Liner (GCL)

The materials used to construct the compacted clay liner will consist of native on-site materials. The on-site materials may require bentonite admixture in order to meet the requirements of the technical specifications. If a bentonite admixture is required, the material will be mixed and stockpiled according to methods approved by the technical specifications and the Project Engineer. Off-site materials may be used to acquire materials capable of meeting the project technical specifications. Any material used to construct the clay liner portion of the base liner system shall meet all of the requirements of the project technical specifications.

The GCL will be installed beneath and in uniform contact with the geomembrane liner. The GCL will overlay a compacted clay liner, in accordance with the specifications. Any material used to construct the GCL portion of the base liner system shall meet all of the requirements of the project technical specifications and Section .1624 of the Solid Waste Rules.

Construction methods used for placement of the compacted clay liner or GCL will be in accordance with the project technical specifications.

4.3 Geomembrane Liner

The geomembrane material will have a demonstrated water vapor transmission rate less than or equal to 0.03 gm/M^2-day. The geomembrane will also have physical and chemical resistance to environmental exposure, waste placement, and leachate generation. The primary liner will be high density polyethylene with a minimum thickness of 60 mils.

The installation of the geomembrane will conform to manufacturer's recommendations and the project technical specifications. The liner edge will be installed and secured into an anchor trench at the Phase limits. Refer to Appendix B for anchor trench calculations.

4.4 Leachate Collection Pipes

Leachate collection piping will have a minimum nominal diameter of six (6) inches for lateral collectors and eight (8) inches for main collectors, and be made of high density polyethylene material. The pipe will provide adequate structural strength to support static and dynamic loads produced by materials and equipment used during construction and operation of the landfill. The pipe will also provide adequate structural strength to support static loads produced by the waste fill and components of the final cap. Refer to Appendix A for pipe stability calculations.

The leachate collection pipes will be installed according to the Sheet C4 of the permit drawings for Phase 3 and Sheet C8 for Phase 4. All piping will be constructed with cleanouts where physically possible for periodic cleaning and maintenance. The bedding material for the collection lines will be #5 washed aggregate with no more than five (5) percent by weight passing the #200 sieve. This aggregate will also be chemically compatible with leachate generated in the phase and shall meet all the requirements of the project technical specifications.

4.5 Drainage Layers

The aggregate used as the drainage layer in the phase will not be adversely affected by leachate produced in the phase and will promote lateral drainage of leachate. The drainage layer material shall meet all the requirements of the project technical specifications.

The drainage layer will be placed by methods given in the project technical specifications and the Site Specific Construction Quality Assurance Plan. The drainage layer material will be stable on the 3:1 side slopes of the phase. Please refer to the Design Hydrogeologic Report prepared by Bunnell-Lammons, Inc.

4.6 Filter Layers

Filter layers in the leachate collection system will prevent migration of fine soil particles from entering the aggregate drainage layer, while allowing water and gases to enter the drainage medium without clogging. Geosynthetic filters shall demonstrate adequate permeability and soil particle retention, while having chemical and physical resistance from waste placement, leachate, and any overlying material. Geosynthetic materials shall meet all of the requirements of the project technical specifications.

All filter layers will be installed according to the project technical specifications, construction drawings, and the Site Specific Construction Quality Assurance Plan. Geosynthetic filters will not be wrapped directly around leachate collection piping.

4.7 Erosion Control

The erosion control structures are designed and will be maintained to manage the run-off generated by the 24-hour, 25-year storm event and will conform to the requirements of the Sedimentation Pollution Control Law (15A NCAC 4). An erosion and sedimentation control permit from NCDENR-Land Quality Section is pending. A copy of the approved erosion control plan will be forwarded to the Solid Waste Section prior to the issuance of a Permit to Construct for Phase 3. Erosion control measures for Phase 3 are shown on Sheet C 5 of the Permit to Construct plans. Final erosion control measures are shown on Sheet C11.

5.0 DESIGN HYDROGEOLOGIC REPORT

The Design Hydrogeologic Report for Phases 3 & 4 was prepared by BLE, Inc. A copy of this report was included with the design package submitted to the Solid Waste Section under separate cover.

6.0 ENGINEERING DRAWINGS

6.1 Existing Conditions

Sheet C1 of the design drawings shows existing site topography, borings, piezometers, existing and proposed ground water monitoring wells, existing and proposed gas probes, existing roads, existing buildings, existing MSW Phases 1 and 2, existing landfill facilities, and the proposed location of the Phases 3 & 4 Expansion.

6.2 Grading Plans

The grading plans identify the proposed limits of excavation, clay liner elevations, and drainage layer elevations. Sheet 3A shows the subgrade elevation when two (2)-feet of compacted clay is utilized. The subgrade elevations associated with a GCL liner are six (6)-inches above those shown on Sheet C3A. Sheet C3B of the construction drawings shows the top of clay liner or top of GCL elevations. Sheet C4 shows the top elevation of the drainage layer.

6.3 Base liner System

The grades for the top of the Phase 3 clay liner or GCL are shown on Sheet C3B. Sheet C7 shows the top of the Phase 4 clay liner elevations. As shown on the drawings, the minimum floor slope within the Phases 3 & 4 Expansion is 2.75 percent. Sheet C14 of the permit drawings shows the post-settlement contours for the top of clay. The minimum post-settlement slope of the base liner system is greater than two (2) percent. The interior 3:1 side slopes and exterior fill slopes are also shown on Sheet C3. The

anchor configuration and details of the base liner system are shown on the detail Sheets, D1-D11.

6.4 Leachate Collection System

The leachate collection system for Phase 3 is shown on Sheet C4 of the permit drawings. Sheet C8 shows the Phase 4 leachate collection system. The drainage layer washed stone for the leachate collection system is placed directly on the geotextile cushion and primary geomembrane. The cleanouts and sump locations are also identified on the drawings. The top of the stone drainage layer is shown on Sheets C4 and C8 of the drawings. Details for the leachate collection system, including sump details, cleanout details, and piping details are shown on the detail Sheets, D1-D11. The proposed leachate system force main and gravity sewer beyond the limits of the landfill cells are shown on Sheet C18.

6.5 Stormwater Segregation System

Phases 3 & 4 will be covered by a synthetic stormwater control liner that lies on top of the drainage layer. (Refer to Sheet C5). This stormwater control liner will allow stormwater runoff to collect in the lower end of the phase. Stormwater runoff will then be pumped over the perimeter embankment though a six –inch (6") and discharged into a gravity drainage pipe. The drainage pipe will discharge at a point near the unnamed stream just north of Phase 3. An energy dissipater will be installed at the discharge point. Prior to entering an inactive area of landfill, the stormwater control liner will be partially removed. The overlying synthetic cover will be pulled back in stages, therefore keeping even active areas exposed to a minimum amount of rainwater. As the active working face increases in elevation, berms will be used to direct stormwater runoff to periphery ditches. See Sheets D1-D6 for a detail of the temporary stormwater control berm.

6.6 Cap System

Sheets C6 and C10 of the permit drawings show proposed temporary and permanent cap grades of the proposed Phases 3 & 4 Expansion. Intermediate cover will be placed on the temporary cap slopes. As adjacent phases are developed, the temporary slopes will increase to the ultimate build-out of the phase. The final cap will include a one (1) foot thick compacted intermediate cover, an eighteen (18)-inch thick clay layer, a forty (40) mil textured HDPE geomembrane, a double-sided eight (8)-ounce geocomposite, and an eighteen (18)-inch thick vegetative\erosion layer. Details of the cap system are shown on Sheets D1-D11 of the permit drawings.

Although not required by Solid Waste Rules or air permitting rules, Haywood County is in the process of developing a methane gas collection and combustion system at the White Oak Landfill. A methane collection system for Phases 3 & 4 is included in this submittal. The proposed methane gas collection system for Phases 3 & 4 has been shown

on Sheet C12 of the permit drawings. The proposed gas collection system will connect to the proposed gas collection system for Phases 1 and 2. The proposed expansion of the system will consist of vertical gas extraction wells, horizontal gas collection wells, intermediate gas collection piping connecting the extraction wells to 12" and 16" transmission headers located at the eastern margin of Phase 1. The transmission lines will lead to a future blower and flare located just to the east of the existing Phase 1 waste area. The methane extraction wells will be constructed prior to construction of the final cap. A typical gas collection well has a radius of influence of approximately 100 to 125 feet. This results in approximately fourteen (14) wells proposed for the Phases 3 & 4 area. The typical well penetrates the waste mass and allows a conduit for vertical migration of methane gas. The wells will be installed to a depth that is 10' above the top of stone leachate collection system layer. An HDPE boot will be placed at the area where the extraction well penetrates the cap geomembrane to retard surface water and oxygen infiltration into the waste layers. A bentonite/soil mixture will also be placed and compacted around the vertical collection wells where the wells penetrate the clay liner.

6.7 Erosion Control

An erosion control plan submittal for Phases 3 & 4 is in the process of being finalized. In addition to the existing sediment basin located near the leachate lagoon north of the Phase 1 waste area, three additional permanent sediment basins are proposed at the north and west area of Phases 3 & 4. These basins will be utilized to control sedimentation during construction and operation of the phases. Storm water runoff will be directed to these basins prior to release to nearby streams. An additional sediment basin will be constructed to the south of the proposed soil stockpile area located to the south of Phases 3 & 4. In all cases, ditches, piping, and sediment basins were sized to accommodate the greatest flow that will be encountered throughout the lifetime of the landfill phase. Often, the greatest flow will be seen as the landfill reaches its capacity when the slopes are steepest, many years into the future. A copy of the erosion control permits associated with the development of Phases 3 & 4 will be forwarded to the Solid Waste Section upon receipt. The White Oak Landfill is being operated under a general stormwater permit that issued in November of 2007.

The erosion and sedimentation control law is performance based and although existing erosion control permits and measures are in-place, it is still the responsibility of the contractor and landfill operator to ensure that the erosion control systems are functioning properly. Existing and proposed erosion/sedimentation control structures include sediment basins, storm drains, temporary slope drains, check dams, and diversion ditches. Sediment basins will be checked after periods of significant runoff. Sediment will be removed from the basin to its original dimension when sediment accumulates to one half of the design depth. The sedimentation basins, embankments, ditches, inlets and outlets will also be inspected for erosion damage. All necessary repairs will be made immediately. Any trash or debris within the riser pipes will be removed. Storm drain outlets and diversion ditches will be inspected for damage after each runoff event. Rip

rap will be placed in ditches and at pipe outlets to prevent erosion and wash outs. Provisions for a vegetative ground cover sufficient to control erosion must be accomplished within fifteen days upon completion of any phase of grading. Embankment slopes shall be periodically inspected for erosion. The embankment slopes shall be mowed at a frequency sufficient to maintain a good stand of vegetation. The slopes shall be mowed once in any one (1) year period. The embankment slopes shall be refertilized in the second year unless vegetation growth is fully adequate. Any damaged areas will be reseeded, fertilized, and mulched immediately. Seeding, fertilizing and mulching shall be in accordance with the North Carolina Erosion and Sedimentation Control Guidelines.

The erosion control plan for the construction of the Phase 3 is included on Sheet C5 of the permit drawings. The final erosion control plan is shown on Sheet C11 of the permit drawings.

6.8 Vertical Separation Requirements

Cross sections of Phases 3 & 4 are shown on Sheets C22 through C24 of the permit drawings. These drawings illustrate the base liner thickness, the depth of waste, the cap system thickness, and the existing ground elevation, the potentiometric surface, and bedrock elevations. Cross sections of the subsurface conditions, created from boring data at the site, are shown in the Phases 3 & 4 Design Hydrogeologic Report prepared by BLE, Inc. The report also contains an average seasonal high water contour map, a bedrock contour map, and a potentiometric surface map. The minimum separation between the **bottom** of the proposed clay liner and the water table in Phases 3 & 4 is 6 feet, located near the center of the Phases 3 & 4 area and at the sump area at the northern margin of Phase 3. This vertical separation increases up to 16 feet near the high point at the western edge of the new phase. Therefore, although the long-term settlement across the footprint of the landfill could be as much as 18 inches in places, the original separation between the base grades and the average high water table will allow for this magnitude of potential settlement. The estimated subgrade settlement is shown in the BLE Design Hydrogeologic Report. The projected settlement is shown on Sheet C21 of the permit drawings.

Differential settlement was looked at to ensure that if one area of the landfill subsides greater than adjacent areas, the resultant slope will still be sufficient for leachate migration to the sump areas. The worst case scenario would be if the southern margin of Phase 3 subsided the greatest amount estimated by the BLE, Inc. Design Hydrogeologic Report – 15", while the northern margin showed no subsidence. In this event, the resultant grade of the landfill floor would still be greater than 2%, which would allow for leachate to migrate to the sumps.

APPENDIX A

Pipe Stability Calculations

APPENDIX B

HDPE Liner Anchor Trench Calculations

APPENDIX A

Pipe Stability Calculations

Appendix A

Pipe Stability Calculations

Max. landfill elevation: 2676
Clay grade elevation: 2548
Maximum overburden depth: 128'

Overburden Description (landfill fully developed)

Unit Weights:

Drainage layer stone: 130 lbs/ft^2
Compacted waste: 55 lbs/ft^2
Compacted soil material: 110 lbs/ft^2

Overburden Pressure

Drainage layer: 2 ft @ 130 lbs/ft^2 = 250 lbs/ft^2
Compacted waste: 128 ft @ 55 lbs/ft^2 = 7,040 lbs/ft^2
Compacted soil: 4 ft @ 110 lbs/ft^2 = 440 lbs/ft^2
7,740 lbs/ft^2

or $\frac{7{,}740 \text{ lbs/ft}^2}{144 \text{ in}^2/1 \text{ ft}^2} = 53.8$ psi

Check for Wall Crushing

$S_a = \frac{(SDR - 1)\, P_t}{2} = 430.4$ psi

$P_t = 53.8$ psi
SDR = 17

Assume compressive yield strength of HDPE pipe is approximately 1,500 psi, therefore, safety factor against wall crushing: $\frac{1{,}500 \text{ psi}}{430.4 \text{ psi}} = 3.4$

Check for Wall Buckling

$P_{cd} = 0.8 \sqrt{(E' \times P_c)}$
$P_t = 53.8$ psi
$P_c = \frac{2.32\,(E')}{(SDR)^3} = 14.17$

- P_{cd} must be greater than P_t to resist against wall buckling
- Assume E' = 30,000 psi (crushed stone compacted)
- (Ref. pg. 37 of DriscoPipe design manual)
  Time dependent modulus of eleasticity @ 150 psi tensile stress = 30,000 psi

$P_{od} = 0.8\sqrt{(3{,}000 \times 14.17)}$
$P_{od} = 165$ psi

•150 psi assumption for tensile stress was based on discussion with DricoPipe engineer Bill Shultz

165 psi > 53.8 psi, therefore, there is resistance to wall buckling
Safety Factor: 165/53.8 = 3.1

Ring Deflection

Allowable ring deflection: $\Delta Y/D = (0.25)E(SDR)$
$\Delta Y = (6.625)(0.25)(0.01)(17)$
$\Delta Y = 0.28$"

$\Delta Y/D = 0.28"/6.625" = 4.23\%$

ΔY = vertical deflection (in.)
D = Pipe O.D. (in.)
E = tangential strain in surface of pipe ring due to reflection (=0.01) pg. 39 DriscoPipe manual)
SDR = Standard dimension ratio, D/t
t = pipe wall thickness
For 6" SDR 17, D = 6.625", t= 0.39"

Vertical soil strain: $E = P_t/E'$
$E = 53.8/3{,}000$
$E = 0.0179$

E' = Soil modulus, psi (3,000 psi)
E = Vertical soil strain
P_t = total vertical soil pressure = 53.8 psi

Allowable ring deflection > vertical soil strain
$\Delta Y/D = 0.0423/0.0179$

Safety Factor: 0.0423/0.0179 = 2.36 Pipe meets requirements

APPENDIX B

HDPE Liner Anchor Trench Calculations

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Engineering • Planning • Finance
McGill Associates, P.A. P.O. Box 2259, Asheville, NC 28802
55 Broad Street, Asheville, NC 28801 828-252-0575 Fax 828-252-2518

PROJECT: Haywood County - White Oak LF
PROJECT NO.: Phases 3 & 4
DESCRIPTION: Anchor Trench
CALCULATED BY: WHS CHECKED BY:
DATE: 9/2/08 SHEET NO. 1 OF 6

Material Properties:

Washed Stone: γ_s = 130 pcf
ϕ_s = 40°

Embankment Fill: γ_f = 125 pcf
ϕ_f = 32°

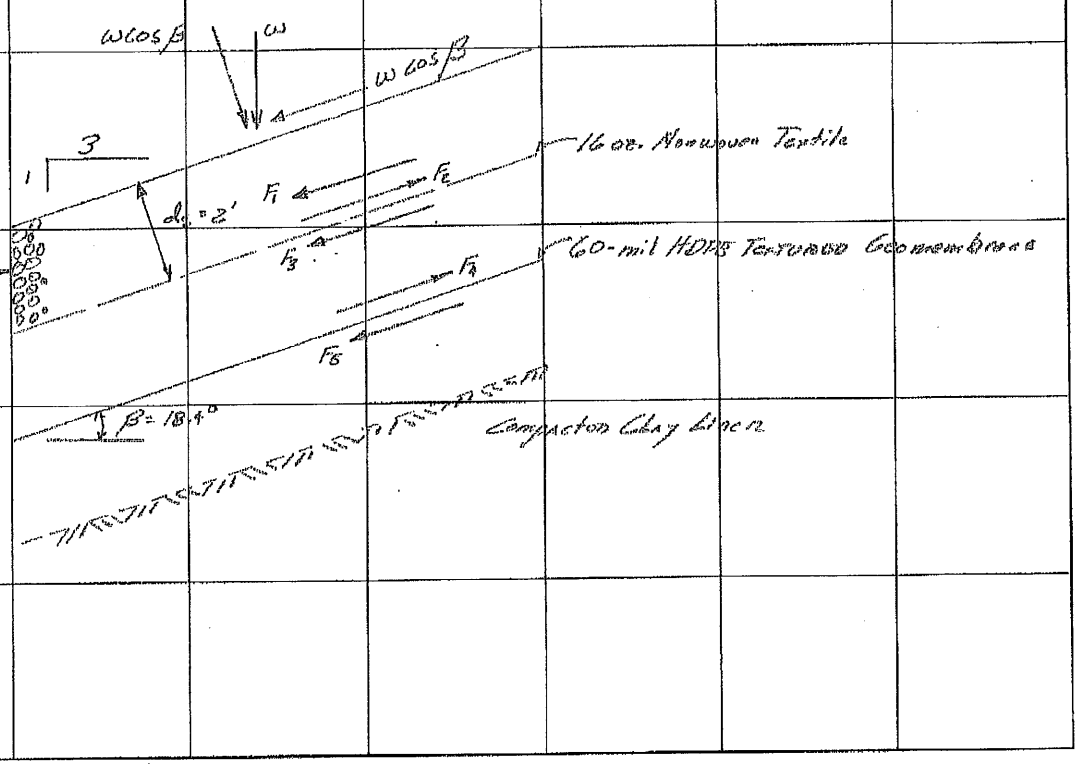
Compacted Clay: γ_c = 120 pcf
ϕ_c = 25°

Minimum interface friction angle between Compacted Clay Liner (L) and the 60 mil HDPE Textured Geomembrane (a): δ_{La} = 17°

Minimum interface friction angle between Nonwoven Geotextile Fabric (r) and the 60-mil HDPE Textured Geomembrane (a): δ_{ra} = 20°

Minimum interface friction angle between Nonwoven Geotextile Fabric (r) and the washed stone drainage layer (s): δ_{rs} = 24°

Resolution of Shear Stress in Sections Constructed with No Waste Applied:



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55 Broad Street, Asheville, NC 28801 828-252-0575 Fax 828-252-2518

PROJECT: Haywood County - White Oak LF
PROJECT NO.: Phase 3:4
DESCRIPTION: Anchor Trench
CALCULATED BY: WHS CHECKED BY:
DATE: 7/2/08 SHEET NO. 2 OF 6

$w = (d_s / \cos\beta)(\gamma_s)$
$= (2' / \cos 18.4°)(130 pcf)$

$\gamma_s = 130 pcf$, $d_s = 2'$, $\beta = 18.4°$

$\therefore w = 274 psf$

$N = w \cos\beta$
$= (274 psf)(\cos 18.4°)$

$w = 274 psf$, $\beta = 18.4°$

$\therefore N = 260 psf$

$F_1 = (N)(\tan \delta_{FS})$
$= (260 psf)(\tan 24°)$

$N = 260 psf$, $\delta_{FS} = 24°$

$\therefore F_1 = 116 psf$

$F_2 = (N)(\tan \delta_{FG})$
$= (260 psf)(\tan 20°)$

$N = 260 psf$, $\delta_{FG} = 20°$

$\therefore F_1 = 95 psf$

$F_1 - F_2 =$ Tensile stress carried by 16oz nonwoven geotextile
$= 116 psf - 95 psf$
$= 21 psf$

Maximum inside slope length @ Toe to existing Liner = 70'
Total Tensile Stress in Fabric, T, is

$T_F = (70')(21 psf)$
$= 1470 lbs/LF$ of fabric

From publishon data, 16 oz nonwoven geotextile table has a tensile yield strength @ 195 to 220 #/inch (2340 lbs/ft to 2640 lbs/ft.)

$F.S._{(min)} = 2340 lbs/ft / 1470 lbs/ft = 1.59$ O.K.

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55 Broad Street, Asheville, NC 28801 828-252-0575 Fax 828-252-2518

PROJECT: Haywood County - White Oak LF
PROJECT NO.: Phase 3 & 4
DESCRIPTION: Anchor Trench
CALCULATED BY: WHS CHECKED BY:
DATE: 9/2/08 SHEET NO. 3 OF 6

By inspection: $F_3 = F_2$ (in opposing direction)

$\therefore F_3 = 95$ psf

$F_4 = (N)(\tan \delta_{LC})$ $N = 260$ psf; $\delta_{LC} = 17°$

$(260 psf)(\tan 17°)$

$\therefore F_4 = 79$ psf

Tensile Strength carried by HDPE Textured Geomembrane $= F_3 - F_4$
$= 95$ psf $- 79$ psf
$= 16$ psf

Max inside slope length @ Tie-in to Existing Liner $\approx 70'$

$T_G = (70')(16 psf)$
$= 1120$ lbs/LF of Geomembrane

From published data, 60-mil HDPE Textured Geomembrane liners have an approximate yield strength in wide width tension of approximately 130 lbs/inch (1560 lbs/LF)

F.S. 1560 lbs/LF / 1120 lbs/ft = 1.39 OK.

By inspection: $F_5 = F_4$ in opposing direction

$\therefore F_5 = 79$ psf

Internal shear in Compacted Clay:

$T = N(\tan \Phi_c)$ $N = 260$ psf; $\Phi_c = 25°$
$= (260 psf)(\tan 25°)$
$= 121$ psf

F.S. (min) = 121 psf / 79 psf = 1.5 OK

By inspection, stresses w/ waste deposition should result in decreased stresses in Liner Components due to an increase in normal forces and friction developed at the edge of waste at the transition from base grades up the interior slope.

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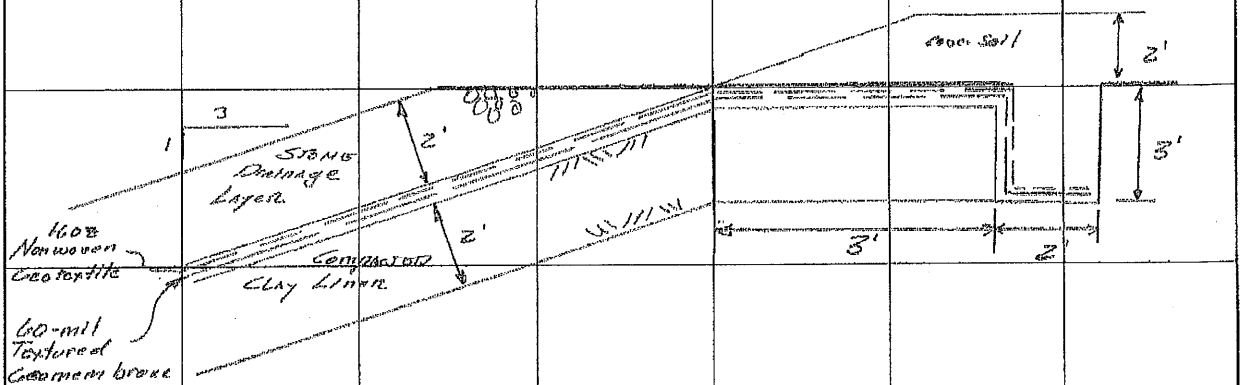
55 Broad Street, Asheville, NC 28801 828-252-0575 Fax 828-252-2518

PROJECT: Haywood County - White Oak LF
PROJECT NO.: Phase 3 & 4
DESCRIPTION: Anchor Trench
CALCULATED BY: WHS CHECKED BY:
DATE: 9/2/08 SHEET NO. 4 OF 6



Cover soil Density: γ_s = 125 pcf
Anchor Trench Soil Density: γ_s = 125 pcf
Anchor Trench width: L_{AT} = 2'
Anchor Trench depth: d_{AT} = 3'
Depth of Cover Soil: d_{CS} = 2'
Runout Trench Length: L_{RO} = 3'
Anchor Trench Backfill Material friction Angle: ϕ = 25°
Minimum Interface Adhesion: a = 0

Anchor Trench Runout Resistance (Liner to clay)

$P_{12L} = (S_{N1} \tan \delta_{1c} + a) L_{RO}$
where $S_{N1} = (\gamma_s)(d_{CS})$
$= (125 pcf)(2')$
S_{N1} = 250 psf

$= ((250 psf)(\tan 17°) + 0)(3')$
P_{12L} = 229 lbs/ft

Anchor Trench Bottom Resistance: (Liner)

$P_{22L} = (S_{N2} \tan \delta_{1c} + a) L_{AT}$
where $S_{N2} = (\gamma_s d_{CS}) + (\gamma_s d_{AT})$
$= (125 pcf)(2') + (125 pcf)(3')$
$= 250 psf + 375 psf$
S_{N2} = 625 psf

$= ((625 psf)(\tan 17°) + 0)(2)$
P_{22L} = 382 lbs/ft

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55 Broad Street, Asheville, NC 28801 828-252-0575 Fax 828-252-2518

PROJECT: Haywood County - White Oak LF
PROJECT NO.: Phase 3+4
DESCRIPTION: Anchor Trench
CALCULATED BY: WHS CHECKED BY:
DATE: 9/2/08 SHEET NO. 5 OF 6

Anchor Trench Sidewall Resistance (Liner)

$K_o = (1 - \sin\phi)$
$= 1 - \sin 25°$
$= 0.58$

Avg. normal stress through anchor Trench

$S_{AVGV} = (S_{n1} + S_{n2})/2$
$= (250\ psf + 625\ psf)/2$
$S_{AVGV} = 438\ psf$

$S_{AVGH} = (K_o)(S_{AVGV})$
$= (0.58)(438\ psf)$
$S_{AVGH} = 254\ psf$

$S_{HAVG} = S_{n3} = 254\ psf$

$P_{R3L} = (S_{n3} \tan\delta_{LG} + a)(d_{AR})$
$= ((254\ psf)(\tan 17°) + 0)(3')$
$P_{R3L} = 233\ lbs/LF$

Geotextile to Liner:
Minimum Geotextile to Liner Interface Friction Angle: $\delta_{TL} = 20°$
Minimum Geotextile Interface Adhesion: $a = 0$

Anchor Trench Runout

$P_{RIT} = (S_{n1} \tan\delta_{TS} + a)(L_{RO})$
where $S_{n1} = (\gamma_F)(d_{AS})$
$= (125\ pcf)(2')$
$= 250\ psf$

$P_{RIT} = ((250\ psf)(\tan 20°) + 0)(3')$
$P_{RIT} = 273\ lbs/LF$

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55 Broad Street, Asheville, NC 28801 828-252-0575 Fax 828-252-2518

PROJECT: Haywood County - White Oak LF
PROJECT NO.: Phase 3/4
DESCRIPTION: Anchor Trench
CALCULATED BY: CMS CHECKED BY:
DATE: 9/2/08 SHEET NO. 6 OF 6

Anchor Trench Bottom Resistance (Geotextile)

$P_{RBT} = (S_{N2} \tan \delta_{R6} + a_a)(L_{AT})$

where $S_{N2} = (\delta_{sat})(d_{eq}) + (\delta_R)(d_{AT})$

$= (125\ pcf)(2') + (125\ pcf)(3')$

$= 250\ psf + 375\ psf$

$= 625\ psf$

$= ((625\ psf)(\tan 20°) + 0)(2')$

$P_{RBT} = 455\ lb/ft$

Anchor Trench Sidewall (Geotextile)

$K_o = (1 - \sin \phi)$

$= 1 - \sin 25°$

$K_o = 0.58$

Avg normal Stress Through Anchor Trench

$S_{AVGN} = (S_{N1} + S_{N2})/2$

$= (250\ psf + 625\ psf)/2$

$= 438\ psf$

$S_{AVGH} = K_o * S_{AVGN}$

$= (0.58)(438\ psf)$

$= 254\ psf$

$S_{AVGH} = S_{N3}$

$P_{RST} = (S_{N3} \tan \delta_{R6} + a_a)(d_{AT})$

$= (254\ psf)(\tan 20°) + a_a)(3')$

$P_{RST} = 277\ lbs/ft$

TOTAL Anchor Trench Pullout:

$T_{AT} = P_{RBL} + P_{RSL} + P_{RBT} + P_{RST} + P_{RBT} + P_{RST}$

$= 229\ lbs/ft + 382\ lbs/ft + 233\ lbs/ft + 273\ lbs/ft + 455\ lbs/ft + 277\ lbs/ft$

$= 1849\ lbs/ft$

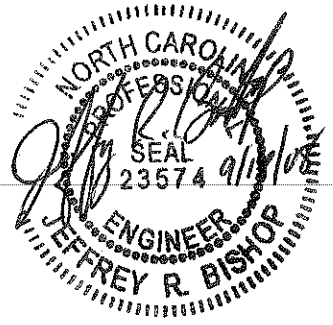
F.S. = 1849 lbs/ft / 1470 lbs/ft = 1.26 O.K.

SECTION 5
CQA PLAN

SITE SPECIFIC CONSTRUCTION QUALITY ASSURANCE PLAN

WHITE OAK MSW LANDFILL
PHASES 3 & 4
HAYWOOD COUNTY, NORTH CAROLINA

JEFFREY R. BISHOP, P.E.



McGill ASSOCIATES

Engineering • Planning • Finance
Asheville, North Carolina

September 2008
Revised March 2009
Revised September 2009

07518

SITE SPECIFIC CONSTRUCTION QUALITY ASSURANCE PLAN

White Oak MSW Landfill
Haywood County, North Carolina
Phases 3 & 4

This Construction Quality Assurance Plan has been prepared as required under Rule .1617 and in accordance with Rule .1621.

1.0 INTRODUCTION

1.1 Project Background

The White Oak MSW Landfill Site is the current MSW landfill for Haywood County. The current project involves the construction of a 15.5-acre expansion referred to as Phases 3 & 4. Phase 3, consisting of 8.8 acres, will be constructed initially and will provide approximately 5 years of landfill airspace. Phase 4 will be constructed and brought on line as Phase 3 nears operational capacity. Phase 1 of the landfill began receiving wastes in October 1993. The current active waste area, Phase 2, began operation in November 2001. This project will include connecting to portions of the existing Phase 1 and Phase 2 liner edge. The Phases 3 & 4 Expansion will consist of structural fill to achieve the desired gradients followed by a compacted, low-permeability clay liner layer, a 60-mil high density polyethylene (HDPE) geomembrane liner, and an aggregate drainage layer. The White Oak Landfill site is located in Haywood County at 3898 Fines Creek Road (S.R. 1338).

1.2 Project Scope

The purpose of this Site Specific Construction Quality Assurance Plan (SSCQAP) is to provide guidance to McGill Associates and sub-contractor personnel on required documentation activities during the construction of the engineered Phase expansion. This guidance is intended to ensure that construction meets the requirements of Haywood County and the Project Construction Quality Assurance (CQA) Plan and project drawings and specifications.

The overall goals of the SSCQAP are to ensure that proper construction techniques and procedures are used to verify that the materials and installation techniques used meet Project CQA Plan and project drawings and specifications. Additionally, the program will identify and define problems that may occur during construction and ensure that these problems are corrected before the construction is complete. At completion of work, the program will culminate in a certification report, which documents that, the

clay liner and the geosynthetic liners have been constructed in substantial compliance with this SSCQAP and project drawings and specifications. The primary emphasis of the SSCQAP is careful documentation during the preparation and placement of the clay and the geosynthetic liner.

1.2.1 Scope of Services

The Scope of Services provided by CQA Consulting Firm for the construction of engineered base is as follows:

1. Pre-Construction materials evaluation (structural fill, clay liner, geosynthetics).
2. Structural Fill observation, testing, documentation, and verification of construction procedures.
3. Clay liner or geosynthetic clay liner (GCL) observation, testing, documentation, and verification of construction procedures.
4. Geosynthetic observation, testing, documentation, and verification of construction procedures.
5. Provide CQA Report and CQA Certification that Phases 3 & 4 was constructed in accordance with this SSCQAP.

1.2.2 Construction Schedule

Construction of Phase 3 shall be completed within 270 consecutive calendar days.

Description
Preconstruction Meeting
Underdrain Installation
Extension of Existing Leachate Gravity Sewer From Phases 1 & 2, Beneath Phase 3
Structural Fill Subgrade Installation
Primary Clay Liner or Geosysnthetic Clay Liner Installation
Primary Geomembrane Liner Installation
Primary Geotextile Cushion Installation
Installation of Leachate Collection System
Installation of Washed Stone Drainage Layer
Submit CQA Report and CQA Certification

2.0 Parties Involved

2.1 Haywood County

Contact: Mr. Stephen King, (828) 627-8042
Title: Haywood County Solid Waste Director

Contact: Mr. Mark Shumpert, P.E. (828) 356-2114
Title: Haywood County Engineer

Contact: Mr. David Cotton (828) 452-6625
Title: Haywood County Manager

2.2 McGill Associates, P.A.

Contact: Jeffrey R. Bishop, P.E. (828) 252-0575
Title: Project Engineer

2.3 General Contractor

Contact: Unknown

Title:

2.3.1 Surveyor

Contact: Unknown

Title:

2.3.2 Geosynthetic Manufacturer

Contact: Unknown

Title:

2.3.3 Geosynthetic Installer

Contact: Unknown

2.4 Construction Quality Assurance Consulting Firm

Contact: Unknown

Title:

2.4.1 CQA Certifying Engineer

Name: Unknown

Title:

CQA Resident Engineer

Name: Unknown

Title:

Geosynthetic Testing Laboratory

Contact: Unknown

Title:

2.4.4 Soils Laboratory (permeability testing)

Contact: Unknown

Title:

3.0 Preconstruction Meeting

A Preconstruction meeting will be held prior to the beginning of construction. The following people shall be present: Owner representative, Solid Waste Director, County Engineer, Project Engineer, Design Engineer, Certifying CQA Engineer/CQA Project Manager, Resident CQA Engineer, General Contractor, Geosynthetics Installer, and all other subcontractors.

The following items will be discussed at a minimum:

Any questions about the SSCQAP will be addressed and any modifications that result will be documented. Any modifications to the approved SSCQAP must be approved by the North Carolina Department of Environment, Health, and Natural Resources, Division of Waste Management, Solid Waste Section (DEHNR Solid Waste Section).

- Special permits and state and/or federal regulations.
- Responsibilities, expectations, and roles of each party.
- Lines of authority and proper lines of communication.
- Procedures for documenting and reporting information.
- Distribution and storage of documents and reports.
- Protocol for testing and geosynthetic sample management.
- Protocol for handling construction deficiencies.
- Protocol for repairs and re-testing.
- Conduct site walk through:

  Discuss work plans
  Inspect material handling and storage locations
  Review office facilities (copy machine, mailing, etc.)

- Review detailed time schedule for all operations.
- Review work area security, check-in procedure, and safety protocol.
- Establish procedures for material processing.
- Review site health and safety requirements.

The Preconstruction Meeting will be documented by McGill Associates and a copy of the meeting minutes will be distributed to all parties who attend.

4.0 Definitions

4.1 Construction Quality Assurance

A planned and systematic application of all means and actions designed to provide adequate confidence that items or services meet design and specifications requirements and will perform satisfactorily in service. In the context of the geosynthetic liner system, construction quality assurance refers to means and actions employed by the CQA Resident Engineer, CQA Senior Lead Technician, and the CQA Monitors to

ensure conformity of the liner system installation with guidelines set forth in the SSCQAP, construction plans, and construction specifications.

4.2 Construction Quality Control

Those actions which provide a means to measure and regulate the characteristics of an item or services to design, and specifications requirements. In the context of the geosynthetic liner system installation, quality control refers to those actions taken by the Geosynthetic Contractor/Manufacturer to ensure that the product and the workmanship meets the requirements set forth in the SSCQAP, construction plans, and construction specifications.

4.3 Design Engineer

The individual or firm responsible for the preparation of this SSCQAP, construction drawings, and construction specifications.

4.4 Project Engineer

The individual or firm responsible for the implementation of this SSCQAP, construction drawings, and construction specifications.

4.5 General Contractor

The firm responsible for the complete construction of the soil and geosynthetic components of the landfill as specified in this SSCQAP and as shown on the construction drawings and construction specifications.

4.6 Construction Quality Assurance Consultant

The firm responsible for observing, testing and documenting activities related to construction quality assurance during the installation of the leak detection layer, clay liner, geomembrane liner, and the leachate collection system. The CQA Certifying Engineer is responsible for issuing a summary certification and documentation report bearing his/her Professional Engineering Seal. The CQA Resident Engineer is responsible for the management of on-site CQA personnel and providing the Project Engineer and Owner with a daily report of the construction activities.

5.0 DOCUMENTATION PROCEDURES

5.1 Standard Reporting Procedures

The CQA Technicians shall issue a daily report of construction activities. These reports shall include, as a minimum, the following information:

An identifying sheet number for cross-referencing and documentation control.

Date, project name, location and other identification.

1. Weather conditions.
2. Problems encountered and resolutions.
3. Descriptions and locations of ongoing construction.
4. Equipment and personnel in each work area, including subcontractors.
5. Descriptions and specific locations of areas or units of work being tested and/or observed and documented (identified by coordinates or seam/panel numbers).
6. Locations where samples were taken.
7. A summary of test results, failures, and re-tests.

5.2 Monitors of geosynthetic installation shall perform and/or provide the following information and services:

a. Material delivery (time, date, and physical condition of material)
b. Unloading and on-site storage and transport
c. Sampling for conformance testing
d. Deployment operations (roll #, panel #, approved QA\QC cert, thickness, overlap, defects, etc.)
e. Seam preparation (proper overlap and cleanliness)
f. Seaming operations (seaming method, seam#, welding technician, welding apparatus #, welder settings, ambient temperature, chronological order of seams welded, seam length, etc.)
g. Conditions of panel before and after placement
h. Locate and document all defects in the geosynthetic material.
i. Repairs (location, method, technician, date, etc.)
j. Trial seams (monitor preparation and testing)
k. Nondestructive testing (visual observation and documentation)
l. Sampling for destructive seam testing (locating test location)
m. Final walkovers (confirm defect repairs)

5.3 Applicable Forms

As a minimum, the CQA monitors will utilize the following forms for the project:

1. Daily Field Report
2. Weekly Progress Report
3. Nuclear Density Testing
4. Drive Cylinder Test Report
5. Soil Testing Tracking Log
6. Certificate of Acceptance of Soil Subgrade
7. Geosynthetic Materials Inventory Checklist
8. Weather Log
9. Trial Weld Form
10. Panel Deployment
11. Panel Seaming
12. Nondestructive Seam Testing
13. Destructive Sample Test Log
14. Geosynthetic Defect Log
15. Geosynthetic Repair Log
16. Construction Site Safety Form
17. Construction Photo Log
18. Certificate of Completion

5.4 Problem/Deficiency Identification and Corrective Action Report

The CQA Monitor is required to inform the General Contractor and/or the Geosynthetic Contractor, or their representatives, in a timely manner, of any difference between the interpretation of the SSCQAP, the construction plans and construction specifications by the contractor versus the CQA Monitor's interpretation. In addition, any actual or suspect work deficiencies shall be brought to the Project Engineer's and Owner's attention.

A special meeting shall be held when and if a problem or deficiency is present. At a minimum, the meeting shall be attended by the General Contractor, the Owner, the Project Engineer, the CQA Resident Engineer, and the CQA Monitor. If the problem involves a possible design modification, the Design Engineer shall be notified. The purpose of the meeting is to define and resolve the problem or work deficiency as follows:

1. Define and discuss the problem or deficiency

2. Review alternative solutions
3. Implement an action plan to resolve the problem or deficiency

The CQA Resident Engineer or his representative will document all proceedings.

Any changes and/or modifications to the SSCQAP must be approved by the Owner, Design Engineer, Project Engineer, CQA Certifying Engineer, and the DEHNR Solid Waste Section.

5.5 Plan Modifications

Design and/or specification changes shall be made only with written approval of the Owner, the Design Engineer and the Project Engineer. Substantial design changes shall also require approval from the DEHNR Solid Waste Section.

5.6 Scope Change

The CQA Resident Engineer shall notify the Project Engineer whenever additional engineering services are requested by Owner that exceed the original scope of services.

5.7 Photographic Documentation

Photographs taken to document observations, problems, and/or deficiencies, or work in progress will include identification of the date, location, direction of view, and time period. Photographs will be filed in chronological order in a permanent protective file by the CQA team. One set of prints shall be turned over to both the Owner and Project Engineer at the conclusion of the project.

The permanent file will also contain a comprehensive index of each photo, which the CQA Monitor is responsible for preparing and maintaining. This index will include the following information:

1. Date of photograph
2. Provide a location and scale where photographed, including information regarding the orientation of the photograph itself for proper viewing
3. Subject description
4. Photo file number

The following is a list of minimum photographs to be taken during cell construction:

1. Subgrade/subbase proof rolling
2. Geosynthetic conformance sampling

3. Geomembrane deployment
4. Fusion welding devices
5. Extrusion welding devices
6. Air testing
7. Vacuum box testing
8. Seaming
9. Destructive sample location and removal
10. Trial welds
11. Tensiometer testing
12. Geotextile deployment
13. On-site lab soil testing
14. Drainage Layer Construction
15. Progress photographs
16. Design modifications
17. Construction deficiencies
18. Completed construction

5.8 Final Construction Documentation Report

During placement of the drainage layer and stormwater control liner, the CQA Resident Engineer shall prepare a final certification-documentation report covering the installation and testing of the clay and geosynthetic lining system. This report shall certify that the clay or GCL system and geosynthetic liner system has been constructed in substantial accordance with this SSCQAP, the construction drawings, and the construction specifications. A Draft Copy of this report shall be issued to the Project Engineer following completion of the lining system. The final report shall be issued to the Project Engineer following completion of the drainage layer. For this project, two (2) copies of the draft version, five (5) copies of the final version of the report, and a digital copy of the final version of the report, complete with all attachments shall be issued.

5.9 Format of CQA Report

As a minimum, the certification report will contain the following items for discussion in the narrative portion of the report. The proposed table of contents is:

5.9.1 Table of Contents

Section

1.0 Summary of Information

1.1 Narrative
1.2 Reference Information

2.0 Soil Preconstruction Data (embankment and clay liner)

2.1 Proctors
2.2 Soil Density/Moisture
2.3 Soil Classification

3.0 Subgrade Field Data

3.01 Moisture Content
3.02 Field Density Testing

3.1 Clay Liner or GCL Field Data

3.21 Moisture Content
3.22 Field Density Testing
3.23 Permeability Testing

4.0 Soil Laboratory Data

4.1 Construction Proctors
4.2 Soil Classification
4.3 Permeability

5.0 Geosynthetic Quality Control

5.1 Manufacturer's Q.C.
5.2 Installer Resumes
5.3 Material Conformance Testing

6.0 Geosynthetic Liner Field Data

6.1 Weather Log
6.2 Trial Welds
6.3 Panel Placement
6.4 Panel Seaming
6.5 Non-Destruct Test
6.6 Destruct Test
6.7 Repair Log
6.8 Installed Quantities

6.9 Defect Location Map

7.0 Protective/Drainage Layer Data

7.1 Preconstruction testing

7.2 Field and laboratory testing

7.2.1 Sieve analysis
7.2.2 Permeability testing

8.0 Project Meeting Minutes

9.0 Construction Photographs

10.0 Pertinent Information

5.9.2 List of Drawings

As a minimum, the certification will include in an appendix the following proposed list of drawings:

- Geomembrane Panel Layout
- Defect Location Map
- Map giving elevation of subgrade, clay or GCL liner, and drainage layer at a maximum frequency of every fifty (50) feet and a maximum frequency of every fifty (50) feet along grade breaks.

5.10 Site Surveying Requirements

The CQA Resident Engineer shall coordinate all survey activities with the surveyor, provided by the Contractor. Survey services will be required for initial site layout, final grade verification, and primary geomembrane as-built survey. All grade surveying shall be conducted on a maximum 50-foot grid and a maximum 50-foot frequency along grade breaks. The certification surveys will be as directed by the CQA Resident Engineer and shall include the following items:

- Panel placement and seaming locations
- Location of destructive testing samples
- Location of all significant repairs
- Topographic survey of base grades
- Topographic survey of top of clay or GCL liner
- Topographic survey of top of drainage layer

6.0 LANDFILL CONSTRUCTION-EARTHWORK

6.1 Subgrade/ Structural Fill Preparation

6.1.1 Subgrade

Subgrade preparation shall be performed by the General Contractor and in accordance with the construction drawings and construction specifications.

The General Contractor shall be responsible for preparing the subgrade prior to placement of the base liner system and is responsible for constructing the subgrade in accordance with the technical specifications.

Before beginning placement of the Compacted Clay Liner:

1. The Resident CQA Engineer shall document that a licensed land surveyor has verified that all grades and elevations are consistent with the DEHNR Solid Waste Section approved engineering plans.

2. The Resident CQA Engineer shall document that he/she has visually inspected the subgrade surface to evaluate its suitability and that the subgrade meets the criteria specified in the project specifications.

3. The prepared subgrade shall be proof-rolled using a smooth-drum roller (minimum 20 tons) making a minimum of two (2) passes in each direction or other procedures and equipment approved by the Project Engineer.

4. The Resident CQA Engineer shall document that the subgrade has been tested for conformance to the construction specifications at the following minimum frequencies:

Construction Testing SUBGRADE TESTING FREQUENCIES		
TEST	ASTM METHOD	QUANTITY
Field Density	D6938, D1556, D2937	1/5,000 YD^3
Field Moisture	D2216, D6938, D4643	1/5,000 YD^3

6.1.2 Structural Fill

Structural fill shall be the soil placed to achieve the design subgrade contours. The subgrade will be tested for field density and field moisture content at a minimum frequency of one (1) test per 5,000 cubic yards placed. Testing will also consist of visual observation and documentation of proof-rolling with a smooth-drum roller (minimum 20 tons) with at least two (2) passes in each direction or by other procedures and equipment approved by the Project Engineer. If a nuclear gauge is used as the primary means of construction testing, the instrument shall be calibrated properly and test data shall be verified using alternate test methods such as drive cylinders. An alternate test method shall be used at least once for every hundred tests performed with the nuclear gauge. The alternate test method should be performed in the same area as an instrument reading in order to allow accurate comparison of the data resulting from the two tests.

Preconstruction Qualification Structural Fill		
Test	**ASTM Method**	**Quantity**
Natural Moisture Content	D2216	1/5,000 YD^3
Laboratory Compaction	D698	1/5,000 YD^3

Construction Testing STRUCTURAL FILL TESTING FREQUENCIES		
TEST	ASTM METHOD	QUANTITY
Field Density	D6938, D1556, D2937	1/5,000 YD^3
Field Moisture	D2216, D6938, D4643	1/5,000 YD^3

6.2 Select Backfill Placement and Testing

Select backfill will be utilized on a limited basis in berms near the liner edge and at anchor trenches. This material will have the same preconstruction and testing requirements as the subgrade, with the exception that the preconstruction and construction testing will have to be performed to show conformance with the Maximum Particle Size requirements. The testing requirements are as follows:

Preconstruction Qualification		
Test	**ASTM Method**	**Quantity**
Natural Moisture Content	D2216	1/5,000 YD^3
Laboratory Compaction	D698	1/5,000 YD^3
Grain Size Analysis	D422	1/5,000 YD^3
*** Preconstruction test samples shall be taken from the borrow source and or clay stockpiled prior to construction.**		
Construction Testing		
Test	**ASTM Method**	**Quantity**
Field Density	D6938, D1556, D2937	1/5,000 YD^3
Field Moisture	D2216, D6938, D4643	1/5,000 YD^3
Grain Size Analysis	D422	1/5,000 YD^3

6.3 Compacted Clay Liner Material

The Compacted Clay Liner shall consist of low-permeability soils placed on the prepared subgrade.

Table 1 - QA Testing Frequencies and Criteria for Compacted Clay Liner Layer

Preconstruction Qualification		
Test	**ASTM Method**	**Quantity**
Natural Moisture Content	D2216	1/1,000 YD^3 or Change in Material
Grain Size Analysis	D422 or D1140	1/5,000 YD^3 or Change in Material
Classification	D2487	1/5,000 YD^3 or Change in Material
Atterberg Limits	D4318	1/5,000 YD^3 or Change in Material
Laboratory Compaction	D698 - Standard	1/5,000 YD^3 or Change in Material
Permeability **	D5084	1/10,000 YD^3 or Change in Material Three per Moisture-Density Curve

*** Preconstruction test samples shall be taken from the borrow source and or clay stockpiled prior to construction.**

** The Moisture-Density Curve shall show the region in which the required maximum permeability is met. A minimum of three (3) permeability tests (ASTM D5084) shall be performed per curve to establish the zone of acceptable moistures and densities at which the required maximum permeability may be achieved. If the Contractor elects to run multiple curves to enlarge the zone of acceptance, all curves must be submitted.

Construction Testing		
Test	**ASTM Method**	**Quantity**
Field Density	D6938, D1556, D2937	1/10,000 FT^2/Lift
Field Moisture	D2216, D6938, D4643	1/10,000 FT^2/Lift
Classification	D2487	1 per acre per lift
Permeability	Extracted per D1587 Tested Per D5084	1/40,000 FT^2/Lift
Atterberg Limits	D4318	1/5,000 YD^3
Grain Size	D422 or D1140	1/5,000 YD^3
Maximum particle Size		3- inch diameter (lower 18 inches) 1/4-inch diameter (top 6 inches)
Soil Layer Thickness	Observation, Field Measurement	Continuous Observation, Minimum of Five (5) per Lift

If a nuclear gauge is used as the primary method for construction testing of the clay liner, the test data shall be verified by alternate test methods at least once for every 10 tests performed.

Any modifications made to these testing frequencies will require prior approval from the DEHNR Solid Waste Section.

Clay liner material generally consists of cohesive soils with low hydraulic conductivity used as barriers in lining systems. Soils used in clay liners shall consist of clean, select material free of debris, excessive coarse particles or other deleterious matter. Soils with a visibly identifiable organic content, or soils classified according to the Unified Soil Classification System as organic silt or organic clay (OL, OH) shall not be used.

Any tests resulting in the penetration of the compacted clay liner shall be repaired by backfilling the test area with a hand-tamped 50/50 bentonite/clay mixture.

6.4 Clay Liners

Prior to the construction of a clay liner, soil evaluation tests shall be performed to confirm the adequacy of clay liner materials procured from each on-site or off-site source area. All tests shall be performed in a geotechnical laboratory. The General Contractor shall submit the results of source evaluation tests to the Project Engineer. Previous testing and evaluations of the soil sources may also be used to evaluate the soil material. The material shall be accepted or rejected by the Project Engineer according to these results. The acceptance and rejection criteria for the clay liner material will be verified by the construction of a test pad in accordance with the construction specifications

6.4.1 Quality Assurance Testing

Permeability tests shall be performed at a confining pressure of 25 psi +/- 1 psi and with a gradient in accordance with ASTM method D5084. Samples taken from each location shall be compared to the approved moisture-density-permeability relation. Test frequencies for construction testing are given in Table 1 of Section 6.3. The Resident CQA Engineer shall certify that the clay liner was constructed using the same methods and acceptance criteria consistent with test pad construction and tested according to the DEHNR Solid Waste Section approved plans.

6.4.2 Test Pad Construction

The test pad shall be constructed in accordance with the technical specifications. The results of the test pad testing shall be in accordance with Table 1 in Section 6.3 and the previously approved moisture-density-permeability relationship established from

preconstruction testing. Field moisture and density tests and laboratory permeability tests will be performed by the Resident CQA Engineer for each lift placed on the test pads to verify the construction method, equipment, and material to achieve the maximum required permeability for the clay liner. If the contractor chooses to construct the test pads within the cell, all lifts of the test pads must pass to enable them to remain as part of the clay liner. The Contractor shall allow sufficient time for construction and testing of the test pad prior to placement of the Compacted Clay Liner.

6.4.3 Clay Liner Placement

The clay liner shall be placed in accordance with Section 02300 of the technical specifications.

6.4.4 Clay liner Acceptance

The Resident CQA Engineer must approve the condition of the clay liner prior to the geosynthetic installer deploying the geomembrane.

The soil components of the lining system will be approved by the Resident CQA Engineer when:

1. The installation of the soil components is finished.

2. Verification of the adequacy of the constructed components, including repairs, if any, is completed in accordance with this SSCQAP and the technical specifications.

All documentation of installation is completed.

The depth and grade of the clay liner has been verified by a licensed surveyor and has been approved by the project engineer.

3. The appropriate frequency of permeability tests have been performed and the results have been approved by the Certifying CQA Engineer.

4. The Soil QA Monitors shall certify that installation of the soil components has proceeded in accordance with this SSCQAP and the Technical Specifications.

6.5 Granular Drainage and Protective Layer

The Granular Drainage and Protective Layer will be the twenty-four (24) inch layer of material placed directly over the liner system to provide protection for the liner system as well as a drainage conduit for leachate drainage. The testing requirements are as follows:

Testing Frequencies and Criteria for Granular Drainage and Protective Layer

Preconstruction Qualification		
Test	**ASTM Method**	**Quantity**
Moisture Content	D2216	1 per source***
Grain Size	D422 or D1140	1 per source***
Classification	D2487	1 per source
Calcium Carbonate	D4373	1 per source
Permeability	D2434	1 per source
***In addition to quarry certificate		
Construction Testing		
Test	**ASTM Method**	**Quantity**
Grain Size	D422	1/1,500 YD^3
Permeability	D2434	1/6,000 YD^3

6.6.2 Placement

Placement of the granular drainage layer shall be performed by a low ground pressure dozer and/or off-road dump truck not in direct contact with the geomembrane. A minimum depth of 2 feet of drainage layer material must be maintained at all times during placement activities when vehicles other than the low ground pressure dozer are needed. High traffic areas, such as access roads constructed to transport material into the landfill, should have a minimum depth of three (3) feet.

The drainage layer shall be placed in the coolest part of the day when possible in order to reduce the potential for wrinkles forming in the geomembrane. See Sections 1.4.2 and 1.1.5 of Appendix B for information on evaluating and repairing wrinkles in the geomembrane.

The Resident CQA Engineer will observe placement activities. The General Contractor is to provide laborers ahead of drainage material placement to assist in minimizing wrinkle formation of the geomembrane. Temperature variations may impact the Contractor's ability to place this material.

6.6.3 Depth Verification

CQA Monitor(s) will randomly verify granular drainage layer depth utilizing test pits or survey means. A Surveyor licensed in the State of North Carolina will survey the top of the drainage layer to certify proper depth was achieved. The General Contractor may use depth markers (i.e., painted tubes, flags, traffic cones, etc.) during placement to provide depth control and minimize possible damage to geomembrane. Depth markers shall be removed as the drainage layer is completed. Depth markers shall not be constructed of a material that could potentially puncture the geomembrane and shall be approved by the Project Engineer.

7.0 LANDFILL CONSTRUCTION-GEOMEMBRANE

7.1 Geomembrane Liner

The geosynthetic components of the lining system will be approved by the Resident CQA Engineer when:

The installation of the geosynthetic components has been completed in accordance with this SSCQAP and the Technical Specifications.

Verification of the adequacy of all seams including associated testing and repairs, if any, is completed in accordance with this SSCQAP and the Technical Specifications.

1. All documentation of installation is completed.

2. The Geosynthetic CQA Monitor(s) are able to recommend acceptance.

7.2 Geomembrane Quality Control

The Geosynthetic Contractor/Manufacturer will provide geosynthetic quality control in accordance with Appendix A.

7.3 Geomembrane Quality Assurance

7.3.1 Conformance Sampling

Conformance testing will be done on-site as material arrives and is inventoried. Conformance sampling procedures will be in accordance with Appendix A.

7.4 Geomembrane Seaming

Field seaming will be done in accordance with Appendix B.

7.4.1. Double Tracked Fusion Welding

All seaming performed shall utilize the double-tracked fusion process when possible. Detailing and repairs do not require double tracked fusion welding.

7.4.2 Extrusion Welding

Extrusion welding shall only be used when double-tracked fusion welding is not possible. The extrusion process will be utilized for repair or detail work, attaching temporary rain flaps, capping a failed seam, or completion of other appurtenances that cannot be performed with fusion welding.

7.5 Geomembrane/Seam Repairs

All repairs to the geomembrane or seams shall be done utilizing the extrusion welding process. All repair work shall be conducted in accordance with Appendix B.

7.6 Geotextile Quality Control

The Geosynthetic Contractor/Manufacturer shall provide quality control information in accordance with Appendix C.

7.7 Geotextile Quality Assurance

Conformance sampling will be performed on-site as material arrives and is inventoried. All conformance sampling will be in accordance with Appendix C.

8.0 LEACHATE COLLECTION PIPING

8.1 Definition and Applicability

Leachate Collection Piping pertains to the High Density Polyethylene Pipe (HDPE) pipe utilized in the collection and transmission of leachate and/or other contaminated liquids generated as a byproduct of the disposal of MSW.

8.2 Quality Control Documentation

Prior to the shipment of any HDPE pipe, the Manufacturer shall provide the Resident CQA Engineer with the following information:

1. A specification for the HDPE pipe that includes all properties contained in the Project Technical Specifications measured using the appropriate test methods.

2. At a minimum, results shall be given for the following:

Property	Test Method	Frequency
Relative Density	ASTM D1505	Per Shipment
Melt Index	ASTM D1238	Per Shipment
Carbon Black Content	ASTM D3350	Per Shipment
Tensile Strength at Yield	ASTM D638, Type IV	Per Shipment
Elastic Modulus	ASTM D638	Per Shipment

The Manufacturer shall identify all HDPE pipe products with the following:

Manufacturers Name
Product Identification
Size
SDR Rating

The Resident CQA Engineer shall review these documents and shall report any discrepancies with the above requirements to the Project Engineer. The Resident CQA Engineer shall verify that:

Property values submitted by the Manufacturer meet the required Project Technical Specifications.

Measurements of properties by the Manufacturer are properly documented and that the test methods used are acceptable.

HDPE pipe products are appropriately labeled.

Appendix A

1.0 Geomembranes

1.1 Description and Applicability

Geomembranes are low permeability geosynthetic barriers used in lining systems. This Section is applicable to smooth and textured high density polyethylene (HDPE) geomembranes. This Section may need to be modified when using other geomembranes.

1.2 Manufacturing Plant Inspection

The Owner or other appropriate representative may conduct an inspection of the Manufacturer's plant. In addition, the Project Engineer, or his designated representative, may visit the manufacturing plant for a project-specific inspection if deemed necessary. If possible, the project-specific inspection shall be prior to or during the manufacturing of the geomembrane rolls for that particular project. The purpose of the plant inspection is to review the manufacturing process and quality control procedures.

The manufacturing plant inspection shall include:

Verification that properties guaranteed by the manufacturer are met and meet all the project specifications.

Verification that the measurement of properties by the Manufacturer is properly documented and test methods used are acceptable.

Spot inspection of the rolls and verification that they are free of imperfections or any sign of contamination by foreign matter.

Review of handling, storage, and transportation procedures, and verification that these procedures will not damage the geomembrane.

Verification that roll packages have a label indicating the name of the manufacturer, type of geomembrane, thickness, roll number, and roll dimensions.

Verification that extrusion rods and/or beads are produced from the same base resin type as the geomembrane.

A report describing the inspection shall be retained by the Owner and by the Project Engineer for project-specific inspections.

1.3 Quality Control Documentation

Prior to the shipment of any geomembrane, the Manufacturer shall provide the Resident CQA Engineer with the following information:

1. The origin (supplier's name and production plant) and identification (brand name and number) of the resin used to manufacture the geomembrane.

2. Copies of dated quality control certificates issued by the resin supplier.

3. Results of tests conducted by the Manufacturer to verify that the resin used to manufacture the geomembrane meets the project specifications.

4. A statement indicating that the amount of reclaimed polymer added to the resin during manufacturing was done with appropriate cleanliness.

5. A list of the materials that comprise the geomembrane, expressed in the following categories as percent by weight: polyethylene, carbon black, other additives.

6. A specification for the geomembrane that includes all properties contained in the project specifications measured using the appropriate test methods.

7. Written certification that minimum values given in the specification are guaranteed by the Manufacturer.

8. Quality control certificates, signed by a responsible party employed by the Manufacturer. Each quality control certificate shall include roll identification numbers, testing procedures, and results of quality control tests. At a minimum, results shall be given for the following:

Property	Test Method	Frequency
Thickness	ASTM D-5199 (Smooth) ASTM D-5994 (Textured)	Each Roll
Relative Density	ASTM D-1505	Every 5th roll
Tensile Properties	ASTM D6693 Type IV	Every 5th roll
Tear Resistance	ASTM D1004 Die C	Every 5th roll
Puncture Resistance	ASTM D-4833	Every 5th roll
Carbon Black Content	ASTM D-1603	Every 5th Roll
Carbon Black Dispersion	ASTM D-5596	Every 5th Roll

The Manufacturer shall identify all rolls of geomembranes with the following:

Manufacturer's name
Product identification
Thickness
Roll number
Roll dimensions

The Resident CQA Engineer shall review these documents and shall report any discrepancies with the above requirements to the Project Engineer. The Resident CQA Engineer shall verify that:

Property values certified by the Manufacturer meet all of its guaranteed specifications.

Measurements of properties by the Manufacturer are properly documented and that the test methods used are acceptable.

Quality control certificates have been provided at the specified frequency for all rolls, and that each certificate identifies the rolls related to it.

Rolls are appropriately labeled.

Certified minimum properties meet the project specifications.

1.4 Conformance Testing

1.4.1 Sampling Procedures

Upon delivery of the rolls of the geomembrane, the Resident CQA Engineer shall ensure that conformance test samples are obtained for the geomembrane. The geomembrane rolls to be sampled shall be selected by the Resident CQA Engineer. Samples shall be taken across the entire width of the roll judged by the Resident CQA Engineer not to be damaged. Unless otherwise specified, samples shall be 3 ft (1 m) long by the roll width. The Resident CQA Engineer shall mark the machine direction on the samples with an arrow.

A lot shall be defined as a group of consecutively numbered rolls from the same manufacturing line. Alternatively, a lot may be designated by the Certifying CQA

Engineer based on a review of all roll information including quality control documentation and manufacturing records.

If the Project Engineer desires, the Resident CQA Engineer can perform the conformance test sampling at the manufacturing plant. This may be advantageous in expediting the installation process for very large projects.

Unless otherwise specified in the project specifications, samples shall be taken at a rate of one per lot and not less than one per 100,000 ft^2 (10,000 m^2) of geomembrane. These samples shall be forwarded to the Resident CQA Engineer for testing.

1.4.2 Conformance Tests

The following conformance tests shall be conducted:

Relative Density (ASTM D-1505)
Carbon black content (ASTM D-1603)
Carbon black dispersion (ASTM D-5596)
Thickness – Smooth (ASTM D-5199)
Thickness - Textured (ASTM D-5994)
Tensile properties (ASTM D-6693, Type IV)

Other conformance tests may be required by the project specifications.

1.4.3 Test Results

All conformance test results shall be reviewed and accepted or rejected by the Certifying CQA Engineer prior to the deployment of the geomembrane. The Certifying CQA Engineer shall examine all results from laboratory conformance testing and shall report any non-conformance to the Project Engineer. The Certifying CQA Engineer shall be responsible for checking that all test results meet or exceed the property values listed in the project specifications.

If a test result is in nonconformance, all material from the lot represented by the failing test shall be considered out-of-specification and rejected. Alternatively, at the option of the Project Engineer, additional conformance test samples may be taken to "bracket" the portion of the lot not meeting the project specification. This procedure is valid only when all rolls in the lot are consecutively produced and numbered from one manufacturing line. To isolate the out-of-specification material, additional samples must be taken from rolls that have roll numbers immediately adjacent to the roll that was sampled and failed. If both additional tests pass, the roll that represents the initial failed test and the roll manufactured immediately after that roll (next large roll number)

shall be rejected. If one or both of the additional tests fail, then the entire lot shall be rejected or the procedure repeated with two additional tests that bracket a greater number of rolls within the lot.

1.5 Geomembrane Specifications

1.5.1 Materials

The geomembrane materials used for construction shall be in strict accordance with the technical specifications.

1.5.2 Construction

The geomembrane liner shall be installed as soon as practical after completion and approval of the compacted clay liner or portion thereof. The top of the compacted clay liner will be surveyed to ensure adequate thickness of clay material and proper grades toward the collection sump area have been achieved. The geomembrane is to cover the bottom of the secure cell and the side slopes in accordance with the Contract Drawings.

Areas to receive liner installation should be relatively smooth and even, free of ruts, voids, etc., to the extent required by the Engineer. This shall be accomplished by final dressing of the compacted liner with smooth drum rollers. No vehicles are permitted on final dressed surfaces unless authorized by the Engineer.

An anchor trench (as illustrated on the Contract Drawings) will be required to secure the geomembrane. No loose soil will be allowed to underlie the geomembrane in the anchor trenches. The time schedule for excavation and backfilling of the anchor trenches is to be approved by the Engineer so that desiccation of trench soils does not occur prior to backfilling.

Before the geomembrane installation begins, the Resident CQA Engineer shall verify that:

1) A State of North Carolina licensed Professional Land Surveyor has verified all lines and grades of the compacted clay liner.

2) A qualified and licensed Professional Engineer has verified that the clay liner surface meets the criteria specified in the project specifications.

3) The clay liner surface to be lined has been rolled, compacted, or hand-worked so as to be free of irregularities, protrusions, loose soil, and abrupt changes in grade.

4) The surface of the clay liner does not contain stones, which may be damaging to the geomembrane.

5) There is no area excessively softened by high water content.

6) There is no area where the clay liner surface contains desiccation cracks, which may damage the geomembrane.

7) The clay liner has sufficient thickness and that all permeability tests have not exceeded the specified maximum permeability.

8) The geomembrane to be deployed has an absolute minimum thickness of 60 mils and passing conformance samples at the frequencies specified in Section 1.4.1 of this Appendix B and be documented .

The Installer shall certify in writing that the surface on which the geomembrane will be installed is acceptable. A certificate of acceptance shall be given by the Installer to the Resident CQA Engineer prior to commencement of geomembrane deployment in the area under consideration. The Certifying CQA Engineer shall be given a copy of this certificate by the Resident CQA Engineer.

After the underlying soil has been accepted by the Installer, it is the Installer's responsibility to indicate to the General Contractor any change in the underlying soil condition that may require repair work. The General Contractor will consult with the Resident CQA Engineer regarding the need for repairs. If the Resident CQA Engineer concurs with the Installer, the General Contractor shall ensure that the underlying soil is repaired.

At any time before or during the geomembrane installation, the Resident CQA Engineer shall indicate to the General Contractor any locations which may not be adequately prepared for the geomembrane.

The Resident CQA Engineer shall verify that the **anchor trench** is constructed in accordance with the following:

1) The anchor trench has been constructed according to the project plans and specifications.

2) If the anchor trench is excavated in a clay material susceptible to desiccation, the amount of trench open at any time is minimized. The Resident CQA Engineer shall inform the Contractor and Project Engineer of any signs of significant desiccation associated with the anchor trench construction.

3) Rounded corners are provided in the trench so as to avoid sharp bends in the geomembrane.

4) Excessive amounts of loose soil are not allowed to underlie the geomembrane in the anchor trench.

5) The anchor trench is adequately drained to prevent ponding or softening of the adjacent soils while the trench is open.

6) The anchor trench is backfilled and compacted as outlined in the project specifications.

Care shall be taken when backfilling the trenches to prevent any damage to the geosynthetic components. The Resident CQA Engineer shall observe the backfilling operation and advise the Contractor and Project Engineer of any problems. Any problems shall be documented by the Resident CQA Engineer in his daily report.

Appendix B

1.0 Field Seaming

1.1.1 Seam Layout

Before installation begins, the Installer shall provide the Resident CQA Engineer and the Project Engineer with a panel layout drawing. This drawing shall present all the proposed seams of the lining system at the facility. The Project Engineer and the Resident CQA Engineer shall review the panel layout drawing and verify that it is consistent with the technical specifications and the Division approved plans. No panels may be seamed until written approval of the panel layout drawing has been provided by the Project Engineer. In addition, panels not specifically shown on the panel layout drawing may not be used without the Project Engineer's prior approval.

In general, seams should be oriented parallel to the line of maximum slope, thus, oriented along, not across, the slope. In corners and odd-shaped geometric locations, the number of seams should be minimized. No horizontal seam should be less than 10 ft (3.0m) from the toe or crest of the slope, or areas of potential stress concentrations, unless otherwise authorized by the Project Manager.

A seam numbering system compatible with the panel numbering system shall be used by the Resident CQA Engineer and the CQA monitors.

1.1.2 Accepted Seaming Methods

Approved processes for field seaming are fusion welding and extrusion welding. Proposed alternate processes shall be documented and submitted by the Installer to the Project Engineer for approval. Only apparatuses that have been specifically approved by make and model shall be used. The Contractor shall submit all documentation regarding seaming methods to be used to the Resident CQA Engineer for review.

1.1.2.1 Fusion Process

The CQA monitor shall log ambient temperature, seaming apparatus, and geomembrane surface temperatures at appropriate intervals and report any noncompliances to the Resident CQA Engineer.

The Resident CQA Engineer shall verify that:

The Installer maintains on-site the number of spare operable seaming apparatuses agreed upon at the pre-construction meeting.

Equipment used for seaming is not likely to damage the geomembrane.

The electric generator is placed on a smooth base such that no damage occurs to the geomembrane.

A smooth insulating plate or fabric is placed beneath the hot welding apparatus after usage such that no damage occurs to the geomembrane.

1. A movable protective layer is used as required by the Installer directly below each overlap of geomembrane that is to be seamed to prevent buildup of moisture between the sheets and to prevent debris from collecting around the pressure rollers.

2. In general, the geomembrane panels are aligned to have an overlap of 4 to 6 in (100 mm to 150 mm) for fusion welding. In any event, the final overlap shall be sufficient to allow peel tests to be performed on the seam.

3. No solvent or adhesive is used.

4. The geomembrane is protected from damage in heavy traffic areas.

1.1.2.2 *Extrusion Process*

The CQA monitor shall log ambient temperature, seaming apparatus, and geomembrane surface temperatures at appropriate intervals and report any noncompliances to the Resident CQA Engineer.

The Resident CQA Engineer shall verify that:

The Installer maintains on-site the number of spare operable seaming apparatuses agreed upon at the pre-construction meeting.

Equipment used for seaming is not likely to damage the geomembrane.

Prior to beginning a seam, the extruder is purged until all heat-degraded extrudate has been removed from the extruder barrel.

Clean and dry welding rods or extrudate pellets are used.

The electric generator is placed on a smooth base such that no damage occurs to the geomembrane.

Grinding is completed no more than one hour prior to seaming.

A smooth insulating plate or fabric is placed beneath the hot welding apparatus after usage such that no damage occurs.

The geomembrane is protected from damage in heavy traffic areas.

Exposed grinding marks adjacent to an extrusion weld shall be minimized. In no instance shall exposed grinding marks extend more than 1/8 in (6 mm) from the finished seamed area.

In general, the geomembrane panels are aligned to have a nominal overlap of 3 in (75 mm) for extrusion welding. In any event, the final overlap shall be sufficient to allow peel tests to be performed on the seam.

No solvent or adhesive is used.

The procedure used to temporarily bond adjacent panels together does not damage the geomembrane; in particular, the temperature of hot air at the nozzle of any temporary welding apparatus is controlled such that the geomembrane is not damaged

1.1.3 Seam Preparation

The CQA monitors shall verify that prior to seaming, the seam area is clean and free of moisture, dust, dirt, debris or foreign material of any kind. If seam overlap grinding is required, the CQA monitors must ensure that the process is completed according to the Manufacturer's instruction within one hour of the seaming operation, and in a way that does not damage the geomembrane. The CQA monitors shall also verify that seams are aligned with the fewest number of wrinkles and "fishmouths".

1.1.4 Test Seams

Trial seams shall be made on fragment pieces of geomembrane liner to verify that conditions are adequate for production seaming. Trial seams shall be performed in accordance with Section 02620 of the technical specifications.

1.1.5 General Seaming Procedures

During general seaming, the CQA monitors shall ensure the following:

Fishmouths or wrinkles at the seam overlaps shall be cut along the ridge of the wrinkle in order to achieve a flat overlap. The cut fishmouths or wrinkles shall be seamed and any portion where the overlap is inadequate shall then be patched with an oval or round patch of the same geomembrane extending a minimum of 6 in (150 mm) beyond the cut in all directions.

If seaming operations are carried out at night, adequate illumination shall be provided.

Seaming shall extend to the outside edge of panels placed in the anchor trench.

All cross seam tees should be extrusion welded to a minimum distance of 4 in (100 mm) on each side of the tee.

No field seaming shall take place without the Master Seamer being present.

A firm substrate may be required to be provided by using a flat board, a conveyor belt, or similar hard surface directly under the seam overlap to achieve proper support.

The Resident CQA Engineer shall verify that the above seaming procedures or any other procedures agreed upon and indicated in the Preconstruction Meeting or construction progress meetings are followed, and shall inform the Project Engineer of any nonconformance.

1.1.6 Seaming Weather Conditions

1.1.6.1 *Cold Weather Conditions*

To ensure a quality installation, if seaming is conducted when the ambient temperature is below 40°F (5°C), the following conditions shall be met:

Geomembrane surface temperatures shall be determined by the Resident CQA Engineer at intervals of at least once per 100 feet (30 m) of seam length to determine if preheating is required. For extrusion welding, preheating is required if the surface temperature of the geomembrane is below 41°F (5°C).

1. For fusion welding, preheating may be waived by the Project Engineer based on a recommendation from the Resident CQA Engineer, if the Installer demonstrates to their satisfaction that welds of equivalent quality may be obtained without preheating at the expected temperature of installation.

2. If preheating is required, the CQA monitors shall observe all areas of geomembrane that have been preheated by a hot air device prior to seaming, to ensure that they have not been overheated.

3. Care shall be taken to confirm that the surface temperatures are not lowered below the minimum surface temperatures specified for welding due to winds or

other adverse conditions. It may be necessary to provide wind protection for the seam area.

4. All preheating devices shall be approved prior to use by the Resident CQA Engineer.

Additional destructive tests shall be taken at an interval between 250 feet and 500 feet 75 to 150 m) of seam length, at the discretion of the Resident CQA Engineer.

Sheet grinding may be performed before preheating, if applicable.

Test seams shall be conducted under the same ambient temperature and preheating conditions as the production seams. Under cold weather conditions, additional trial seams shall be conducted if the ambient temperature drops by more than 10°F from the initial trial seam test conditions. Such new seams shall be constructed upon completion of seams in progress during temperature drop.

1.1.6.2 *Warm Weather Conditions*

At ambient temperatures above 104°F, no seaming of the geomembrane shall be permitted unless the Installer can demonstrate to the satisfaction of the Resident CQA Engineer that geomembrane seam quality is not compromised. Test seams shall be conducted under the same ambient temperature conditions as the production seams. At the option of the Resident CQA Engineer, additional destructive tests may be required for any suspect areas.

1.2 Nondestructive Seam Testing

1.2.1 Concept

The Installer shall nondestructively test all field seams over their full length using an air pressure test (for double fusion seams only, a vacuum test or other approved method. Air pressure testing and vacuum testing are described elsewhere respectively. The purpose of nondestructive tests is to check the continuity of seams. It does not provide quantity information on seam strength. Nondestructive testing shall be carried out as the seaming work progresses, not at the completion of all field seaming.

For all seams, the CQA monitors shall:

Observe nondestructive testing procedures.

Record location, data, test unit number, name of tester, and outcome of all testing.

Inform the Installer and Resident CQA Engineer of any required repairs.

Any seams that cannot be nondestructively tested shall be cap-stripped. The cap-stripping operations shall be observed by the Resident CQA Engineer and Installer for uniformity and completeness.

1.2.2 Air Pressure Testing

Air pressure testing is applicable to double fusion welding which produces a double seam with an enclosed space.

The Equipment for air pressure testing shall consist of the following:

An air pump (manual or motor driven), equipped with pressure gauge and capable of generating and sustaining a pressure between 25 and 30 psi (160 and 200 kPa) and mounted on a cushion to protect the geomembrane.

A rubber hose with fittings and connections.

A sharp hollow needle, or other pressure feed device, approved by the Resident CQA Engineer.

The following procedures shall be followed:

Seal both ends of the seam to be tested.

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

Insert a protective cushion between the air pump and the geomembrane.

Pressurize the air channel to a pressure of approximately 30 psi (200 Kpa). Close valve, allow 2 minutes for pressure to stabilize, and sustain pressure for at least 5 minutes. Pressure loss over the 5-minute period should not exceed 3psi.

If loss of pressure exceeds the maximum permissible pressure differential as outlined in the project specifications or does not stabilize, locate fault area and repair in accordance with Section 1.4.3.

Cut opposite end of tested seam area once testing is complete to verify continuity of the air channel. If air does not escape, locate blockage and retest unpressurized area.

Remove needle or other approved pressure feed device and grind and weld or patch the hole in the geomembrane.

1.2.3 Vacuum Testing

Vacuum testing is applicable to extrusion welding.

The equipment shall consist of the following:

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

A pump assembly equipped with a pressure controller and pipe connections.

A rubber pressure/vacuum hose with fittings and connections.

A soapy solution. (CQA monitors shall ensure solution makes bubbles when air is passed through.)

A bucket and wide paint brush, or other means of applying the soapy solution.

The following procedures shall be followed:

Wet a strip of geomembrane approximately 12 in X 48 in (0.3 m X 1.2 m) with the soapy solution.

Place the box over the wetted area.

Close the bleed valve and open the vacuum valve.

Ensure that a leak-tight seal is created.

Energize the vacuum pump and reduce the applied pressure to approximately 5 psi (10 in of Hg/35kPa) gauge.

For a minimum of 10 seconds, apply vacuum with the box placed and maintaining a seal, examine the geomembrane through the viewing window for the presence of soap bubbles.

If no bubble appears after 10 seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum 3 in (75 mm) overlap, and repeat the process.

All areas where soap bubbles appear shall be marked and repaired in accordance with Section 1.4.3.

1.2.4 Test Failure Procedures

The Installer shall complete any required repairs in accordance with Section 1.4.3. For repairs, the CQA monitor shall:

Observe the repair and testing of the repair.

Mark on the geomembrane that the repair has been made.

Document the repair procedures and test results.

1.3 Destructive Seam Testing

1.3.1 Concept

The purpose of destructive tests is to evaluate seam strength. Destructive seam tests shall be performed at selected locations. Seam strength testing shall be done as the seaming work progresses, not at the completion of all field seaming.

1.3.2 Location and Frequency

The Resident CQA Engineer shall select where seam samples will be cut out for laboratory testing. The frequency and locations shall be established as follows:

A minimum frequency of one test location per 500 feet (150 m) of seam length performed by each welding machine. This frequency is to be determined as an average taken throughout the entire facility.

Test locations shall be determined during seaming at the discretion of the Resident CQA Engineer or the Project Engineer. Special consideration shall be given to locations where the potential for imperfect welding, such as overheating, contamination, and offset welds exists.

1.3.3 Sampling Procedures

Samples shall be cut by the Installer at locations chosen by the Resident CQA Engineer as the seaming progresses so that laboratory test results are available before the geomembrane is covered by another material. The Resident CQA Engineer shall:

Observe sample cutting.

1. Assign a number to each sample, and mark it accordingly.

2. Record sample location on layout drawing.

3. Record reason for taking the sample at this location (e.g., statistical routine, suspicious feature of the geomembrane).

All holes in the geomembrane resulting from destructive seam sampling shall be repaired in accordance with repair procedures described in Section 1.4.3 immediately following receipt of successful test results. The continuity of the new seams in the repaired area shall be tested according to Section 1.2.3. All holes in the geomembrane shall be temporarily patched or repaired in accordance with Section 1.4.3 before the end of each work day in order to protect the clay liner from inclement weather.

1.3.4 Sampling Procedure

Destructive sampling shall be performed in accordance with Section 02620 of the technical specifications.

1.3.5 Field Testing

Destructive field testing shall be performed in accordance with Section 02620 of the technical specifications.

1.3.6 Destructive Test Failure

Destructive test failures shall be handled in accordance with Section 02620 of the technical specifications.

1.4 Defects and Repairs

1.4.1 Identification

All seams and non-seam areas of the geomembrane shall be examined by the CQA monitors for identification of defects, holes, blisters, undispersed raw materials, large

wrinkles and any sign of contamination by foreign matter. The geomembrane surface shall be cleaned by the Installer prior to examination if the CQA monitor determines that the amount of dust or mud inhibits examination.

1.4.2 Evaluation

Each suspect location both in seam and non-seam areas shall be nondestructively tested using the methods described in Section 1.2. Each location which fails the nondestructive testing shall be marked by the CQA monitor and repaired by the Installer. Work shall not proceed with any materials that will cover locations that have been repaired until successful nondestructive and/or laboratory tests are obtained.

When seaming of the geomembrane is completed, and prior to placing overlying materials, the Resident CQA Engineer shall indicate to the General Contractor any large wrinkles that should be cut and reseamed by the Installer. The number of wrinkles to be repaired should be kept to an absolute minimum. Therefore, wrinkles should be located during the coldest part of the installation period, while keeping in mind the forecasted weather to which the undercover geomembrane may be exposed. Wrinkles are considered to be large when the geomembrane can be folded over onto itself which is generally a wrinkle that extends 12 in (0.3 m) from the subgrade. Seams produced while repairing wrinkles shall be nondestructively tested.

When placing overlying material on the geomembrane, every effort must be made to minimize wrinkle development. If possible, cover should be placed during the coolest weather. In addition, small wrinkles should be isolated and covered as quickly as possible to prevent their growth. The placement of cover materials shall be observed by McGill Associates or a CQA monitor to ensure that wrinkle formation is minimized and that, in all cases, the geomembrane is not folded over on itself.

1.4.3 Repair Procedures

Any portion of the geomembrane exhibiting a flaw, or failing a destructive or nondestructive test, shall be repaired. Several procedures exist for the repair of these areas. The final decision as to the appropriate repair procedure shall be determined by the Project Engineer and the Resident CQA Engineer.

1. The repair procedures available include:

    a. Patching, used to repair holes, tears, undispersed raw materials, and contamination by foreign matter.

    b. Spot welding used to repair pinholes, or other minor, localized flaws.

c. Capping, used to repair large lengths of failed seams.

d. Extrusion welding the flap, used to repair areas of inadequate fusion seams which have an exposed edge. Repairs of this type shall be approved by Resident CQA Engineer and shall not exceed 100 ft (30 m) in total length.

e. Removing bad seam and replacing with a strip of new material welded into place.

2. For any repair method, the following provisions shall be satisfied:

a. Surfaces of the geomembrane which are to be repaired using extrusion methods shall be ground no more than one hour prior to the repair.

b. All surfaces shall be clean and dry at the time of the repair.

c. All seaming equipment used in repairing procedures shall meet the requirements of this SSCQAP.

d. Patches or caps shall extend at least 6 in (150 mm) beyond the edge of the defect, and all corners of patches shall be rounded with a radius of approximately 3 in (75 mm).

1.4.4 Repair Verification

The CQA monitors shall observe all nondestructive testing of repairs and shall record the number of each repair, date and test outcome. Each repair shall be nondestructively tested using the method described in Section 1.2 as appropriate. Repairs that pass the nondestructive test shall be taken as an indication of an adequate repair. Repairs more than 500 ft (50 m) long require destructive test sampling. Failed tests require that the repair shall be redone and re-tested until a passing test results.

1.5 Geomembrane Protection

The quality assurance procedures indicated in this Section are intended only to assure that the installation of adjacent materials does not damage the geomembrane. The quality assurance of the adjacent materials themselves are covered in separate Sections of this manual.

1.5.1 Soils

1. Placement of gravel on the geomembrane shall not proceed at an ambient temperature below 32 degrees F (0 degrees C) nor above 104 degrees F (40 degrees C) unless otherwise specified.

2. Placement of gravel on the geomembrane should be done during the coolest part of the day to minimize the development of wrinkles in the geomembrane.

3. Equipment used for placing gravel shall not be driven directly on the geomembrane.

4. A minimum thickness of 24 inches of gravel shall be maintained between the geotextile cushion and the top of the drainage layer Off-road trucks shall have a minimum thickness of 3 feet between them and the geomembrane/geotextile cushion.

5. In any areas traversed by heavy construction, any vehicles other than low ground pressure vehicles approved by the Project Engineer, the gravel layer shall have a minimum thickness of 3 ft (09 m). This requirement may be waived if provisions are made to protect the geomembrane through an engineered design approved by the Project Engineer. Drivers shall proceed with caution when traveling on the overlying gravel and prevent spinning of tires or sharp turns.

6. Leachate collection pipes shall not be crossed with construction equipment without the full two (2) feet of stone in place. In areas where off-road trucks must repeatedly cross the leachate piping, a temporary stone road shall be build to bridge over the pipe and maintain a minimum thickness of three (3) feet.

7. Care shall be taken to avoid creating wrinkles in the geomembrane during placement of the gravel layer.

1.5.2 Sumps and Appurtenances

The sumps shall be constructed in accordance with the technical specifications and the Resident CQA Engineer shall certify the following:

1. Installation of the geomembrane, sumps, equipment, and appurtenant areas has been performed properly, and connections of geomembrane to sumps and appurtenances have been made according to project specifications.

2. Extreme care is taken while welding around appurtenances since nondestructive testing will be difficult in these areas.

3. The geomembrane has not been visibly damaged while making connections to sumps and appurtenances.

4. The Resident CQA Engineer or his representative shall be present at all times when the Installer is welding geomembrane to appurtenant structures.

The Resident CQA Engineer shall inform the Project Engineer in writing if the above conditions are not fulfilled.

Appendix C

1.0 Geotextiles

1.1 Definition and Applicability

Geotextiles are used in protection and filtering applications in lining systems. This Section does not describe procedures for other applications such as erosion control or reinforcement. This Section is applicable to nonwoven geotextiles made of polyester of polypropylene and not applicable to nonwoven geotextiles made of other materials or woven geotextiles.

1.2 Manufacturing Plant Inspection

The Owner or an appropriate representative may conduct a periodic inspection of the Manufacturer's plant. In addition, the Project Engineer or his designated representative may visit the manufacturing plant for a project-specific inspection if deemed necessary. If possible, the project-specific inspection shall be prior to or during the manufacturing of the geotextile rolls for that particular project. The purpose of the plant inspections is to review the manufacturing process and quality control procedures.

The manufacturing plant inspection shall include:

1. Verification that properties of the geotextile guaranteed by the Manufacturer are met and meet the project specifications.

2. Verification that the measurement of properties by the manufacturer is properly documented and test methods used are acceptable.

3. Inspection of the rolls and verification that they are free of imperfections or any sign of contamination by foreign matter.

4. Review of packaging, handling, storage, and transportation procedures and verification that these procedures will not damage the geotextile.

5. Verification that roll packages have a label indicating the name of the manufacturer, type of geotextile, roll number and roll dimensions.

6. Verification that the geotextiles are inspected continuously for the presence of needles using a metal detector.

A report describing the inspection will be retained by the Owner for periodic inspections and by the Project Engineer for project-specific inspections.

1.3 Quality Control Documentation

Prior to the shipment of any geotextile, the Manufacturer shall provide the Resident CQA Engineer with the following information:

1. Results of tests conducted by the Manufacturer to verify that the material used to manufacture the geotextile meets the project specifications.

2. A specification for the geotextile that includes all properties contained in the Project Technical Specifications were measured using the appropriate test methods.

3. Written certification that minimum values given in the Project Technical Specifications are guaranteed by the Manufacturer.

4. Quality control certificates, signed by a responsible party employed by the Manufacturer. Each quality control certificate shall include roll identification numbers, testing procedures, and the results of quality control tests. At a minimum, results shall be given for the following:

Property	Test Method	Frequency
Mass per Unit Area	ASTM D-5261	Each Roll
Grab Tensile Strength	ASTM D-4632	Every 5th Roll
Grab Tensile Elongation	ASTM D-4632	Every 5th Roll
Puncture (pin) Strength	ASTM D-4833	Every 5th Roll
Apparent Opening Size (AOS)	ASTM D-4751	Every 5th Roll

The Manufacturer shall identify all rolls of geotextiles with the following:

Manufacturer's name
Product identification
Thickness
Roll number
Roll dimensions

The Resident CQA Engineer shall review these documents and shall report any discrepancies with the above requirements to the Project Engineer. The Resident CQA Engineer shall verify that:

Property values certified by the Manufacturer meet all of its guaranteed specifications.

Measurements of properties by the Manufacturer are properly documented and that the test methods used are acceptable.

Quality control certificates have been provided at the specified frequency for all rolls, and that each certificate identifies the rolls related to it.

Rolls are appropriately labeled.

Certified minimum properties meet the project specifications.

1.4 Conformance Testing

1.4.1 Sampling Procedures

Upon delivery of the rolls of geotextiles, the Resident CQA Engineer shall ensure that conformance test samples are obtained for the geotextile. The rolls to be sampled shall be selected by the Resident CQA Engineer. Samples shall be taken from any portion of a roll that has not been damaged. Unless otherwise specified, samples shall be 3 ft (1 m) long by the roll width. The Resident CQA Engineer shall mark the machine direction on the samples with an arrow. All lots of material and the particular test sample that represents each lot should be defined before the samples are taken.

A lot shall be defined as a group of consecutively numbered rolls from the same manufacturing line. Alternatively, a lot may be designated by the Certifying CQA Engineer based on a review of all roll information including quality control documentation and manufacturing records.

Unless otherwise specified in the project specifications, samples shall be taken at a rate of one per lot, not to be less than one per 100,000 ft^2 of geotextile. These samples shall then be forwarded to the Geosynthetic laboratory for testing to ensure conformance with the project specifications.

1.4.2 Conformance Tests

The following conformance tests shall be conducted;

Mass per Unit Area (ASTM D5261)
Grab Tensile Strength (ASTM D4632)
Grab Tensile Elongation (ASTM D4632)
Puncture Strength (ASTM D4833)

Apparent Opening Size (ASTN D4751)

1.4.3 Test Results

All conformance test results shall be reviewed and accepted or rejected by the Certifying CQA Engineer prior to the deployment of the geotextile. The Certifying CQA Engineer shall examine all results from laboratory conformance testing and shall report any non-conformance to the Project Engineer. The Certifying CQA Engineer shall be responsible for checking that all test results meet or exceed the property values listed in the project specifications.

If a test result is in nonconformance, all material from the lot represented by the failing test shall be considered out-of-specification and rejected. Alternatively, at the option of the Project Engineer, additional conformance test samples may be taken to "bracket" the portion of the lot not meeting the project specification. This procedure is valid only when all rolls in the lot are consecutively produced and numbered from one manufacturing line. To isolate the out-of-specification material, additional samples must be taken from rolls that have roll numbers immediately adjacent to the roll that was sampled and failed. If both additional tests pass, the roll that represents the initial failed test and the roll manufactured immediately after that roll (next large roll number) shall be rejected. If one or both of the additional tests fail, then the entire lot shall be rejected or the procedure repeated with two additional tests that bracket a greater number of rolls within the lot.

2.0 Geocomposites

2.1 Definition and Applicability

Geocomposites are geosynthetic nets with geotextile heat bonded to the surface. The geocomposite can be single-sided or double-sided depending on the application. They are used as a drainage medium in lining systems, where the properties of the geotextile can either serve as a filter media from clogging the geonet or increase stability of the lining system. This Section is applicable to geocomposites where the geonet portion is made of high density polyethylene (HDPE), including "foamed" HDPE products but is not applicable to geocomposites where the geonet is made of other polymers.

2.2 Manufacturing Plant Inspection

The Owner or appropriate representative may conduct a periodic inspection of the Manufacturer's plant. In addition, the Project Engineer, or his designated representative may visit the manufacturing plant for a project-specific inspection if deemed necessary. If possible, the project-specific inspection shall be prior to or

during the manufacturing of the geocomposite rolls for that particular project. The purpose of the inspection is to review the manufacturing process and quality control procedures.

The manufacturing plant inspection shall include:

Verification that properties guaranteed by the Manufacturer are met and meet all project specifications.

1. Verification that properties guaranteed by the Manufacturer are met and meet all Project Technical Specifications.

2. Verification that the measurement of properties by the Manufacturer is properly documented and test methods used are acceptable.

3. Spot inspection of the rolls and verification that they are free of imperfections or any sign of contamination by foreign matter.

4. Review of packaging, handling, storage, and transportation procedures and verification that these procedures will not damage the geocomposite.

5. Verification that the geotextiles are inspected continuously for the presence of needles using a metal detector.

6. Verifications that roll packages have a label indicating the name of the manufacturer, type of geocomposite, roll number and roll dimensions.

A report describing the inspection will be retained by the Owner for periodic inspections and by the Project Engineer for project-specific inspections.

2.3 Production

The geocomposite shall be manufactured by heat bonding the geotextile to the HDPE drainage net on one or both sides. No burn through geotextiles shall be permitted. No glue or adhesive shall be permitted.

The geonet portion of the geocomposite shall be manufactured by extruding two sets of strands to form a three (3) dimensional structure to provide planar water flow.

2.4 Quality Control Documentation

Prior to the shipment of any geocomposite, the Manufacturer shall provide the Resident CQA Engineer with the following information:

1. The origin (supplier's name and production plant) and identification (brand name and number) of the resin used for geonet.

2. Copies of dated quality control certificates issued by the geonet resin supplier.

3. Results of tests conducted by the Manufacturer to verify that the resin used to manufacture the geonet meets the Project Technical Specifications.

4. A statement indicating that the amount of any reclaimed polymer added to the resin during manufacturing was done with appropriate cleanliness.

5. A list of the materials that comprise the geonet, expressed in the following categories as a percent by weight: polyethylene, carbon black, other additives.

6. Results of tests conducted by the Manufacturer to verify that the material used to manufacture the geotextile meets the Project Technical Specifications.

7. A specification for the geocomposite that includes all properties contained in the Project Technical Specifications measured using the appropriate test methods.

8. Written certification that minimum values given in the Project Technical Specification are guaranteed by the Manufacturer.

9. Quality control certificates, signed by a responsible party employed by the Manufacturer. Each quality control certificate shall include roll identification numbers, testing procedures, and results of quality control tests. At a minimum, results shall be given for the following:

GEONET COMPONENT		
Property	**Test Method**	**Frequency**
Density	ASTM D1505 or ASTM D792, Method B	Every 5th Roll
Thickness	ASTM D5199	Each Roll
Carbon Black Content	ASTM D1603	Every 5th Roll
Peak Tensile Strength	ASTM D5035	Every 5th Roll
Transmissivity (MARV)	ASTM D4716	Every 5th Roll
GEOTEXTILE COMPONENT		
Property	**Test Method**	**Frequency**
Mass per Unit Area	ASTM D5261	Each Roll
Grab Tensile Strength	ASTM D4632	Every 5th Roll
Grab Tensile Elongation	ASTM D4632	Every 5th Roll

Puncture Strength	ASTM D4833	Every 5th Roll
Permittivity (min. avg.)	ASTM D4491	Every 5th Roll
Apparent Opening Size (AOS)	ASTM D4751	Every 5th Roll
UV Stability, % Retained (500 hr.)	ASTM D4355	Every 5th Roll
GEOCOMPOSITE		
Property	**Test Method**	**Frequency**
Ply Adhesion	ASTM D7005	Every 5th Roll
Transmissivity (MARV)	ASTM D4716	Every 5th Roll

The manufacturer shall identify all rolls of geocomposite with the following:

Manufacturers Name
Product Identification
Roll Number
Roll Dimensions

The Resident CQA Engineer shall review these documents and shall report any discrepancies with the above requirements to the Project Engineer. The Resident CQA Engineer shall verify that:

Property values certified by the Manufacturer meet all of its guaranteed specifications.

Measurements of properties by the Manufacturer are properly documented and that the test methods used are acceptable.

Quality control certificates have been provided at the specified frequency for all rolls, and that each certificate identifies the rolls related to it.

Rolls are appropriately labeled.

Certified minimum properties meet the project specifications.

2.5 Conformance Testing

2.5.1 Sampling Procedures

Upon delivery of the rolls of geocomposite, the Resident CQA Engineer shall ensure that conformance test samples are obtained for the geocomposite. The rolls to be

sampled shall be selected by the Resident CQA Engineer. Samples shall be taken from any portion of a roll that has not been damaged. Unless otherwise specified, samples shall be 3 ft. (2 m) long by the roll width. The Resident CQA Engineer shall mark the machine direction on the samples with an arrow.

A lot shall be defined as a group of consecutively numbered rolls from the same manufacturing line. Alternatively, a lot may be designed by the Certifying CQA Engineer based on a review of all roll information including quality control documentation and manufacturing records.

Unless otherwise specified in the project specifications, samples shall be taken at a rate of one per lot, not to be less than one per 100,000 ft^2 of geocomposite. These samples shall then be forwarded to the Geosynthetic laboratory for testing to ensure conformance to the project specifications.

2.5.2 Conformance Tests

The following conformance tests shall be conducted;

Ply Adhesion (ASTM D7005)
Transmissivity (ASTM D4716)

2.5.3 Test Results

All conformance test results shall be reviewed and accepted or rejected by the Certifying CQA Engineer prior to the deployment of the geocomposite. The Certifying CQA Engineer shall examine all results from laboratory conformance testing and shall report any non-conformance to the Project Engineer. The Certifying CQA Engineer shall be responsible for checking that all test results meet or exceed the property values listed in the project specifications.

If a test result is in nonconformance, all material from the lot represented by the failing test shall be considered out-of-specification and rejected. Alternatively, at the option of the Project Engineer, additional conformance test samples may be taken to "bracket" the portion of the lot not meeting the project specification. This procedure is valid only when all rolls in the lot are consecutively produced and numbered from one manufacturing line. To isolate the out-of-specification material, additional samples must be taken from rolls that have roll numbers immediately adjacent to the roll that was sampled and failed. If both additional tests pass, the roll that represents the initial failed test and the roll manufactured immediately after that roll (next large roll number) shall be rejected. If one or both of the additional tests fail, then the entire lot shall be rejected or the procedure repeated with two additional tests that bracket a greater number of rolls within the lot.

Appendix D

1.0 Geosynthetic Clay Liners (GCL)

1.1 Description and Applicability

Geosynthetic Clay Liners (GCL) are a manufactured hydraulic barrier consisting of granular sodium bentonite clay bonded to a layer or layers of geosynthetics. This Section is applicable to all GCL type liner systems. This Section may need to be modified when using other variations of GCL liners.

1.2 Manufacturing Plant Inspection

The Owner or other appropriate representative may conduct an inspection of the Manufacturer's plant. In addition, the Project Engineer, or his designated representative, may visit the manufacturing plant for a project-specific inspection if deemed necessary. If possible, the project-specific inspection shall be prior to or during the manufacturing of the geosynthetic clay liner rolls for that particular project. The purpose of the plant inspection is to review the manufacturing process and quality control procedures.

The manufacturing plant inspection shall include:

Verification that properties guaranteed by the manufacturer are met and meet all the project specifications.

Verification that the measurements of properties by the Manufacturer are properly documented and test methods used are acceptable.

Spot inspection of the rolls and verification that they are free of imperfections or any sign of contamination by foreign matter.

Review of handling, storage, and transportation procedures, and verification that these procedures will not damage the GCL.

Verification that roll packages have a label indicating the Product Identification Information (Manufacturer's name and address brand product code), lot number, roll number, and roll length, width and weight.

A report describing the inspection shall be retained by the Owner and by the Project Engineer for project-specific inspections.

1.3 Quality Control Documentation

Prior to the shipment of any geomembrane, the Manufacturer shall provide the Resident CQA Engineer with the following information:

1. Certificates of analysis for the bentonite clay used in the GCL production demonstrating compliance with the swell index and fluid loss values shown in the Minimum Required Physical Properties of Geosynthetic Clay Liner table in the Technical Specifications.

2. Manufacturer's test data for the finished GCL product demonstrating compliance with the values shown in the specified Minimum Required Physical Properties of Geosynthetic Clay Liner table in the Technical Specifications.

3. GCL lot and roll numbers supplied for the project (with corresponding shipping information).

4. A specification for the GCL that includes all properties contained in the project specifications measured using the appropriate test methods.

5. Written certification that minimum values given in the specification are guaranteed by the Manufacturer.

6. Quality control certificates, signed by a responsible party employed by the Manufacturer. Each quality control certificate shall include roll identification numbers, testing procedures, and results of quality control tests. At a minimum, results shall be given for the following:

Property	Test Method	Frequency
Bentonite Swell Index[1]	ASTM D 5890	1 per 50 tonnes
Bentonite Fluid Loss[1]	ASTM D 5891	1 per 50 tonnes
Bentonite Mass/Area[2]	ASTM D 5993	Every 40,000 ft^2
GCL Tensile Strength[3]	ASTM D 6768	Every 200,000 ft^2
GCL Peel Strength[3]	ASTM D 6496	Every 40,000 ft^2
GCL Index Flux[4]	ASTM D 5887	Weekly
GCL Hydraulic Conductivity[4]	ASTM D 5887	Weekly
GCL Hydrated Internal Shear Strength[5]	ASTM D 5321 ASTM D 6243	Periodic

Notes: [1] Bentonite property tests performed at a bentonite processing facility before shipment to manufacturer's production facilities.

[2] Bentonite mass/area reported at 0 percent moisture content.

[3] All tensile strength testing is performed in the machine direction using ASTM D 6768. All peel strength testing is performed using ASTM D 6496.

[4] Index flux and permeability testing with deaired distilled/deionized water at 80 psi cell pressure, 77 psi headwater pressure and 75 psi tailwater pressure. Manufacturer to supply last 20 weekly values prior to the end of the production date of the supplied GCL.

[5] Peak values measured at 200 psf normal stress for a specimen hydrated for 48 hours.

The Manufacturer shall identify all rolls of geomembranes with the following:

Manufacturer's name and address
Brand Product Code
Lot Number
Roll number
Roll Length and width
Roll Weight

The Resident CQA Engineer shall review these documents and shall report any discrepancies with the above requirements to the Project Engineer. The Resident CQA Engineer shall verify that:

Property values certified by the Manufacturer meet all of its guaranteed specifications.

Measurements of properties by the Manufacturer are properly documented and that the test methods used are acceptable.

Quality control certificates have been provided at the specified frequency for all rolls, and that each certificate identifies the rolls related to it.

Rolls are appropriately labeled.

Certified minimum properties meet the project specifications.

1.4 Conformance Testing

1.4.1 Sampling Procedures

Upon delivery of the rolls of the GCL, the Resident CQA Engineer shall ensure that conformance test samples are obtained for the GCL. The GCL rolls to be sampled

shall be selected by the Resident CQA Engineer. Samples shall be taken across the entire width of the roll judged by the Resident CQA Engineer not to be damaged. Unless otherwise specified, samples shall be 3 ft (1 m) long by the roll width. The Resident CQA Engineer shall mark the machine direction on the samples with an arrow.

A lot shall be defined as a group of consecutively numbered rolls from the same manufacturing line. Alternatively, a lot may be designated by the Certifying CQA Engineer based on a review of all roll information including quality control documentation and manufacturing records.

If the Project Engineer desires, the Resident CQA Engineer can perform the conformance test sampling at the manufacturing plant. This may be advantageous in expediting the installation process for very large projects.

Unless otherwise specified in the project specifications, samples shall be taken at a rate of one per lot and not less than one per 100,000 ft^2 (10,000 m^2) of GCL. These samples shall be forwarded to the Resident CQA Engineer for testing.

1.4.2 Conformance Tests

The following conformance tests shall be conducted:

Bentonite Mass per unit area (ASTM D 5993)
Bentonite Swell Index (ASTM D 5890)
Bentonite Fluid Loss (ASTM D 5891)
Grab Tensile Strength (ASTM D 6495)

Other conformance tests may be required by the project specifications.

1.4.3 Test Results

All conformance test results shall be reviewed and accepted or rejected by the Certifying CQA Engineer prior to the deployment of the GCL. The Certifying CQA Engineer shall examine all results from laboratory conformance testing and shall report any non-conformance to the Project Engineer. The Certifying CQA Engineer shall be responsible for checking that all test results meet or exceed the property values listed in the project specifications.

If a test result is in nonconformance, all material from the lot represented by the failing test shall be considered out-of-specification and rejected. Alternatively, at the option of the Project Engineer, additional conformance test samples may be taken to "bracket" the portion of the lot not meeting the project specification. This procedure is valid only when all rolls in the lot are consecutively produced and numbered from one

manufacturing line. To isolate the out-of-specification material, additional samples must be taken from rolls that have roll numbers immediately adjacent to the roll that was sampled and failed. If both additional tests pass, the roll that represents the initial failed test and the roll manufactured immediately after that roll (next large roll number) shall be rejected. If one or both of the additional tests fail, then the entire lot shall be rejected or the procedure repeated with two additional tests that bracket a greater number of rolls within the lot.

1.5 GCL Specifications

1.5.1 Materials

The GCL materials used for construction shall be in strict accordance with the technical specifications.

1.5.2 Damage From Shipping and Handling

The Resident CQA Engineer shall observe the unloading and storage of the GCL rolls once they arrive at the project site. Rolls with its protective plastic sleeve torn or damaged during transit should be inspected for damage in the area of the torn sleeve. If the geotextile under the torn sleeve is also torn, the outermost wrap of GCL on the roll should be unwound and discarded when the roll is installed. The Resident CQA Engineer shall so mark the roll and ensure the Installer removes and discards the damaged portion of the GCL roll. At the time the roll is unwound, the Resident CQA Engineer will ensure that further damage to the roll did not occur. If so then additional wraps will be removed and discarded prior to the roll being installed.

Rolls that are dropped and/or bent during the unloading, storage or dropped and/or bent while being transported from the storage area to the project site will be so noted by the Resident CQA Engineer and will be moved away from the project site. These rolls will not be used on the project site.

1.5.3 Construction

The GCL shall be installed as soon as practical after completion and approval of the compacted clay liner or portion thereof. The top of the compacted clay liner will be surveyed to ensure adequate thickness of clay material and proper grades toward the collection sump area have been achieved. The GCL is to cover the bottom of the secure cell and the side slopes in accordance with the Contract Drawings.

Areas to receive GCL installation should be relatively smooth and even, free of ruts, voids, etc., to the extent required by the Engineer. This shall be accomplished by final dressing of the compacted clay liner with smooth drum rollers. No vehicles are permitted on final dressed surfaces unless authorized by the Engineer.

An anchor trench (as illustrated on the Contract Drawings) will be required to secure the GCL. No loose soil will be allowed to underlie the GCL in the anchor trenches. The time schedule for excavation and backfilling of the anchor trenches is to be approved by the Engineer so that desiccation of trench soils does not occur prior to backfilling.

Before the GCL installation begins, the Resident CQA Engineer shall verify that:

1) A State of North Carolina licensed Professional Land Surveyor has verified all lines and grades of the compacted clay liner.

2) A qualified and licensed Professional Engineer has verified that the clay liner surface meets the criteria specified in the project specifications.

3) There are no ambient site conditions which could affect the quality of the installation of the GCL. Specifically, the presence at the project site of excessively high winds, rain, standing water, snow or other conditions that may be construed as unsuitable weather conditions for GCL installation.

4) The clay liner surface to be lined has been rolled, compacted, or hand-worked so as to be free of irregularities, protrusions, loose soil, and abrupt changes in grade.

5) The surface of the clay liner does not contain stones, which may be damaging to the GCL.

6) There is no area excessively softened by high water content.

7) There is no area where the clay liner surface contains desiccation cracks, which may damage the GCL.

8) The clay liner has sufficient thickness and that all permeability tests have not exceeded the specified maximum permeability.

9) Passing conformance samples at the frequencies specified in Section 1.4.1 of this Appendix D have been received and documented.

The Installer shall certify in writing that the surface on which the GCL will be installed is acceptable. A certificate of acceptance shall be given by the Installer to the Resident CQA Engineer prior to commencement of GCL deployment in the area under consideration. The Certifying CQA Engineer shall be given a copy of this certificate by the Resident CQA Engineer.

After the underlying soil has been accepted by the Installer, it is the Installer's responsibility to indicate to the General Contractor any change in the underlying soil condition that may require repair work. The General Contractor will consult with the Resident CQA Engineer regarding the need for repairs. If the Resident CQA Engineer concurs with the Installer, the General Contractor shall ensure that the underlying soil is repaired.

At any time before or during the GCL installation, the Resident CQA Engineer shall indicate to the General Contractor any locations which may not be adequately prepared for the geomembrane.

The Resident CQA Engineer shall verify that the **anchor trench** is constructed in accordance with the following:

1) The anchor trench has been constructed according to the project plans and specifications.

2) If the anchor trench is excavated in a clay material susceptible to desiccation, the amount of trench open at any time is minimized. The Resident CQA Engineer shall inform the Contractor and Project Engineer of any signs of significant desiccation associated with the anchor trench construction.

3) Rounded corners are provided in the trench so as to avoid sharp bends in the GCL.

4) Excessive amounts of loose soil are not allowed to underlie the GCL in the anchor trench.

5) The anchor trench is adequately drained to prevent ponding or softening of the adjacent soils while the trench is open.

6) The GCL is placed such that it extends across the anchor trench floor but not up the rear wall of the trench. Excess material should be cut off, not folded over on top of the existing material.

7) The anchor trench is backfilled and compacted as outlined in the project specifications.

Care shall be taken when backfilling the trenches to prevent any damage to the geosynthetic components. The Resident CQA Engineer shall observe the backfilling operation and advise the Contractor and Project Engineer of any problems. Any problems shall be documented by the Resident CQA Engineer in his daily report.

1.5.4 Panel Placement

The Resident CQA Engineer shall observed and verify that the unrolling and placement of the GCL is performed in such a way that the GCL is not damaged or unduly stretched, folded, or creased during installation.

When GCL is placed on slopes and the GCL roll is suspended at the top of the slope and pulled down the slope, the Resident CQA Engineer shall observe and verify that excessive tension does not develop on the material and that the underside of the panel is not damaged by friction with the subgrade.

1.5.5 Seaming

The Resident CQA Engineer shall:

1. Observe and verify the minimum acceptable overlap for all seams (parallel to the slope and perpendicular to the slope).

2. Verify the quantity and continuity of accessory bentonite used for horizontal seams and other tie-in points.

3. Verify there is no dirt or other debris in the overlap zone or on the bottom geotextile on the overlying GCL panel.

1.5.6 Damage Repair

The Resident CQA Engineer shall inspect any GCL damaged during installation and verify that:

1. The damaged GCL is not on a slope steeper than 10H:1V. If the slope is steeper than 10H:1V then the entire GCL roll will be removed and replaced with an undamaged roll.

2. The damaged GCL is on a slope flatter than or equal to 10H:1V. If the slope is flatter than 10H:1V then the damage may be repaired in accordance with the Technical Specifications.

3. The repair is located and repaired in accordance with the Technical Specifications.

SECTION 6
OPER. PLAN

OPERATIONS PLAN

WHITE OAK MSW LANDFILL
PHASES 3 & 4
HAYWOOD COUNTY, NORTH CAROLINA

JEFFREY R. BISHOP, P.E.

McGill ASSOCIATES

Engineering • Planning • Finance
Asheville, North Carolina

September 2008
Revised February 2009
Revised April 2009
Revised September 2009

07518

HAYWOOD COUNTY
WHITE OAK LANDFILL
OPERATION PLAN

Note: Original Operations Plan prepared By Municipal Engineering for development of Phase 2. Operational Plan has been modified to include Phase 3 and 4

Operations Plan
White Oak MSW Landfill

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INTRODUCTION

The Haywood County White Oak Landfill will only accept Municipal Solid Wastes (MSW) generated in Haywood County. The White Oak MSW Landfill consists of Phases 1 and 2, which comprise 21.5 acres of lined MSW landfill area. Phase 1 began receiving wastes in October of 1993. The most recently constructed cell was Phase 2, consisting of 10.26 acres, which was granted a Permit To Operate on November 7, 2001. Existing Phases 1 and 2 will reach their waste fill capacity in early 2010. The County will implement a lateral expansion of existing MSW Phases 1 and 2 to include proposed Phases 3 and 4. MSW Phase 3 will be constructed initially and will provide the County approximately 5 years of disposal airspace. MSW Phase 4 will be brought online as Phase 3 reaches its capacity. Phases 3 and 4 will be constructed with either 24 inches of cohesive soil (permeability less than 1.0×10^{-7} cm/sec) or a geosynthetic clay liner system (GCL) consisting of 18 inches of cohesive soil (permeability less than 1.0×10^{-5} cm/sec) overlain with a GCL material with a demonstrated hydraulic conductivity of not more than 5×10^{-9} cm/sec under the anticipated confining pressure; a 60-mil High Density Polyethylene (HDPE) liner; a 16-ounce geotextile cushion; and 24 inches of washed stone leachate collection layer. A leachate collection piping system will be installed on top of the 60-mil HDPE liner and 16-ounce geotextile and within the 24-inch washed stone layer. Leachate will flow to a sump area located near the northern margin of Phase 3. The sump will include two side slope riser pumping stations that will pump leachate over the northern periphery berm to a gravity sewer system prior to discharge to the leachate storage lagoon. In conjunction with the development of MSW Phase 3, the leachate lagoon will be expanded and an additional HDPE liner will be installed. Leachate is transported by truck from the storage lagoon to a discharge point in the Waynesville wastewater treatment system. The three existing sump areas within MSW Phases 1 and 2 will continue to operate during and after the construction of Phases 3 and 4. Leachate flows by gravity from these areas to the storage lagoon. Also in conjunction with the development of MSW Phase 3, a side slope riser pump station and dual contained force main will be installed at the MSW Phase 1 (Cells 1-3) sump area. The gravity sump from MSW Phase 1 will continue to operate. Leachate will be pumped directly to the transport tanker truck during the time period that the storage lagoon is being expanded.

At the White Oak Landfill, the County is in the process of closing the 4.0-acre Construction & Demolition Landfill (C&DLF). The County also operates a 4.8-acre Land Clearing and Inert Debris Landfill (LCID). Haywood County is in the process of adding a 2.0-acre Mulching and Grinding Treatment and Processing Facility and a 1.5-acre Small Type 2 Composting Facility.

MSW Phases 3 and 4 will be marked off by 4-inch square concrete markers painted day-glo orange, at maximum 200-foot intervals. Solid waste will not be placed within nine (9) feet of this boundary to assure that waste is being placed directly above the liner system so that no leachate can flow outside of this area. The lined area will incorporate a berm that will segregate area for solid waste and where stormwater is to be diverted as runoff.

All stormwater that comes in contact with solid waste will be handled as leachate. The leachate is collected and held in the leachate lagoon. The leachate from Phases 3 and 4 will be pumped by two pumping stations to the leachate storage lagoon and a side slope riser pump station will be installed at the MSW Phase 1, Cells 1-3 sump. Leachate flows by gravity from existing MSW Phases 1 and 2 to the storage lagoon. Leachate is treated at the Waynesville Waste Water Treatment Plant. The leachate will have to be tested according to the pretreatment conditions outlined in the pre-treatment agreement.

Tanker trucks will transport the leachate a discharge point in the Waynesville wastewater treatment system. The County will continue to explore the feasibility of installing a force main in order to pump leachate directly to the treatment plant.

The leachate will be pumped out of the leachate lagoon into either tanker trucks or recirculated into the working face of the landfill. The pumping of leachate will be on an as needed basis. During wet weather, the pump and hauling may have to be done 24 hours a day for several days or until the leachate lagoon levels have been reduced. On the other hand, during dry weather, leachate may not have to be hauled for several days at a time.

Leachate may be recirculated per the procedures described in Appendix 4, Haywood County's Recirculation Plan.

The leachate lagoon will be inspected on a monthly basis and a report generated and placed in the landfill records. The report will include the date the liner was inspected, the inspector, general observations since the last inspection, visible abrasions, possible stress cracks, or obvious punctures.

Stress cracks can occur in wrinkles that are generated from heat expansion or contraction due to freezing. Also, the HDPE liner may deteriorate due to ultra violet light and this can appear as an abrasion where material can be scraped away with a hard object. If any damage or possible weak spots due to ultra violet exposure has been detected, a qualified HDPE installation company shall be notified immediately so that a repair patch can be installed. The leachate level shall not be allowed to exceed the depth of the damaged liner until it has been repaired and tested by the liner installation company. Once this has been accomplished all testing documentation shall be placed in the operating records. A second textured 60-mil HDPE liner will be installed over the existing HDPE liner at the storage lagoon during the MSW Phase 3 construction.

Daily cover will be the combination of soil, synthetic covers, and mulched material (a demonstration period for mulched material is underway). Soil cover will be placed at least once a week. See Section 2b for the requirements of the Alternate Daily Cover tarp and mulched material.

The County has implemented a program at the landfill for detecting and preventing the disposal of hazardous and liquid wastes. The program consists of random inspection of incoming loads at a minimum of 1% of the weekly traffic. Landfill personnel have been trained to recognize hazardous and liquid wastes. Records will be kept on the training and the inspections. See Appendix 1 for a description of waste screening procedures.

The Haywood County Solid Waste Department will monitor 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 Appendix 3 for the Explosive Gas Control Plan. 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 **21 calendar days** upon completion of any phase of landfill development.

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

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

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

Ground and surface water will be sampled and analyzed according to Subtitle D Appendix I detection monitoring requirements. The monitoring frequency for all Appendix I detection monitoring constituents will be at least semi-annual 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 semi-annual sampling event. At least one sample from each well (background and downgradient) will be collected and analyzed during subsequent semiannual sampling events. In conjunction with the development of MSW Phase 3, the "Environmental Monitoring Plan, Proposed Phase 3 & 4 MSW Cell Areas" was prepared by BLE, Inc.

If Haywood 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.

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. Haywood 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. The White Oak Landfill will receive both baled and loose wastes from their Solid Waste Processing Facility, located on Recycle Road in Clyde.

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 wastes are taken to a designated area of the landfill for disposal. The landfill operator will immediately cover the asbestos wastes with a minimum of six inches of soil. Asbestos wastes are only accepted on Thursdays and a 24 hour notice will be given to the Landfill before any asbestos arrives, and records will be kept as to whom and type of asbestos was buried.

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. Haywood 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. Development of a contingency plan to properly manage any identified hazardous and liquid wastes. The plan must address identification, removal, storage and final deposition of the waste.

g. Waste placement will be within the area limits of the base liner system and in a manner consistent with the effective permit. The County may dispose of baled wastes or loose wastes. Baled wastes are handled, placed, and covered in similar fashion as loose wastes. Wastes are transported to the landfill primarily by County-operated transfer trucks, where they are placed on the floor of the cell as close to the working face as possible. Landfill operators either stack bales or push loose wastes and construct a working face in 8' to 10' lifts. Wastes are covered with approved daily cover materials.

2. Cover material requirements.

a. Except as in Part (b), Haywood 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. Haywood County currently uses a synthetic material to cover the vertical working face at the end of the working day when bales have been disposed at the White Oak Landfill. This operation is described in Appendix 2A. Haywood County proposes the addition of an Alternate Daily Cover (ADC) procedure to their operating plan: a synthetic tarp to be used as daily cover on the working face or until it is necessary to cover with earthen material. Also, the County will begin a six months demonstration period for the use of a mulch/soil mixture as an ADC. The mulch ADC will consist of one and one/half (1-1/2) inches of mulched material combined with four and one/half (4-1/2) inches of soil. At a minimum, soil cover will be used once a week.

i) A demonstration period for the ADC tarp was conducted from June 28, 2007 to December 28, 2007. See Appendix 2B for the operating plan for the ADC tarp. Also included in Appendix 2B is a copy of the ADC request for demonstration letter from Mr. Stephen King, Haywood County Solid Waste Director, a copy of the ADC demonstration authorization

letter from Mr. James Patterson of NCDENR to Mr. King, and a photo of the ADC tarp applied to the White Oak Landfill during the demonstration period.

ii) The County is conducting a demonstration period for the use of mulch/soil as an ADC. An extension until July 9, 2009 for the demonstration period has been granted by the NCDENR-Solid Waste Section, Compliance Branch. The County proposes using one and one/half inches of mulched material along with four and one/half inches of soil as an ADC. The mulched material will primarily be used to help stabilize wet access areas of the landfill.

Landfill Staff will utilize one of two methods for producing the mulch/soil ADC. One procedure will be to place in a line two loads of dirt, one load of mulch, and another load of dirt (all equal volume) in the area of the landfill to receive cover. The four piles will be walked into the surface by landfill equipment to create the desired cover depth. The landfill operator will work the loads to ensure an even distribution of mulch throughout the cover area. The second method is to pile three loads of dirt and one load of mulch (all equal volume) out of the way of landfill operations in an area of the landfill that can be utilized for a temporary stockpile. The four loads will be thoroughly mixed using landfill equipment to achieve an even distribution of the mulched material. The stockpiled ADC will be utilized as needed.

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 County is currently under a demonstration period (until July 9, 2009) to utilize compost from the Composting Operation as a soil amendment when applying grass seed to any landfill area. See Appendix 6 for the requirements of the use of compost on landfill slopes.

3. Disease vector control

a. Haywood 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 by approved daily cover. At a minimum soil will be used once a week. Any waste that requires immediate cover will be covered immediately with soil. In conjunction with the development of the White Oak Landfill, the County was required to construct a chain-link "bear" fence. The fence will be relocated as part of the MSW Phase 3 & 4 expansion.

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

4. Explosive gases control

a. Haywood 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. Haywood County will implement a routine methane monitoring program to ensure that the standards of 4 (a) are met. See Appendix 3 for the Explosive Gas Control Plan for Haywood County White Oak Landfill.

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. Haywood 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.

e. Although the County does not have nor is required to operate a methane collection and combustion system, provisions for a methane extraction and collection system are included in the MSW Phases 3 and 4 Permit To Construct. Any future gas collection system will connect to a planned methane collection and combustion associated with MSW Phases 1 and 2.

6. Access and safety requirements

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

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

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

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

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

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

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

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

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

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 **21 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.

b. Surface water shall not be impounded over or in waste.

c. Solid waste shall not be disposed of in water.

d. Leachate shall be contained on site and properly treated prior to discharge.

e. The construction of MSW Phase 3 will impact approximately 0.45 acres of wetlands and 185 linear feet of stream, which will require the 404/401 permits from the United States Army Corps of Engineers and the North Carolina Department of Environment and Natural Resources. A submittal for these impacts has been made to the appropriate agencies. A copy of the 404/401 permits are included in Section 12 of the Permit to Construct MSW Phase 3.

f. Beyond the stream and wetlands mitigation required for (e) above, 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 non-point 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.

(ii) Gas Condensate means the liquid generated as a result of gas recovery processes at the MSWLF unit.

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

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

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

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

(iv) Gas monitoring results and any remediation plans;

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

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

(vii) Any cost estimates and financial assurance documentation.

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

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

11. Spreading and Compacting Requirements

a. The landfill will restrict solid waste into the smallest area feasible, typically 60' x 75' area. Waste will be covered with six (6) inches of daily cover. This lift will absorb the rain water and allow some of it to evaporate prior to reaching the leachate collection system. When a heavy rain does occur, the impact on the leachate collection system will not be immediate. Prior to placement of solid waste over any leachate pipe, the geotextile fabric that is covering the stone will be folded back so that solid waste will be in direct contact with the stone. This method will not allow biological growth to develop on the geotextile which could eventually clog the system.

b. Solid waste will be compacted as densely as practical into cells. The compactor should run over an area of solid waste a minimum of 6 times. The initial lift of solid waste will be placed loosely at a depth of 4 feet. As this lift is being placed, a spotter should be placed in the landfill

to assure that the compactor does not drive any long, sharp objects through the protective cover into the liner system. If an object were to penetrate the liner system, the protective cover must be removed and the penetration repaired. The subsequent lifts can be placed up to final grades or until the diversion berm needs to be moved to cell 2 which will allow for more horizontal space. Heavy landfill equipment including articulating dump trucks, and compactor will only be allowed on areas that have a minimum of 4' of solid waste. Only low pressure equipment such as a D6 LGP Caterpillar will be allowed on the protective cover.

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

12. Leachate Management Plan

a. Leachate flows by gravity from three locations within existing MSW Phases 1 and 2. In conjunction of the MSW Phase 3 project, a side slope riser pumping station and dual-contained force main will be constructed in MSW Phase 1, Cells 1-3 in the vicinity of the sump. For leachate generated within the MSW Phases 3 and 4 areas, two side slope riser pumping stations located within Phase 3 will pump leachate to the gravity collection system prior to discharge into the leachate storage lagoon. The leachate pumps contain a high-water level alarm, which will alert Landfill Staff when high leachate levels are encountered. The leachate pipes can be cleaned with a jet cleaner with access through the cleanouts and leachate test wells. The County will video inspect on a yearly basis up to 2,000 l.f. of leachate lines, until two years of clean lines are observed for an individual line. Jet cleaning will be performed on leachate lines that video inspections show the need for cleaning. The County will review on an annual basis the feasibility of jet-cleaning and/or video inspecting additional leachate collection lines. The side slope riser pumps shall be pulled and inspected annually. Any worn or damaged parts will be replaced. The pump stations will be inspected for proper operation and run-time hours will be documented. Landfill personnel shall maintain records of all inspections, cleaning, and repairs made on the leachate collection system.

b. Haywood County will maintain records for the amount of leachate collected and transported to the wastewater treatment facility.

c. Haywood 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 Town of Waynesville Waste Water Treatment Plant.

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

weather, the pump and hauling may have to be done 24 hours a day for several days until the leachate lagoon levels have been reduced.

In the early phases of waste fill operations in MSW Phase 3, the discharge from the stormwater removal pump can be diverted to the leachate gravity system, if necessary during extreme conditions.

f. Leachate will be recirculated upon approval of the NCDENR-Division of Waste Management. See Appendix 4 for Haywood County's Recirculation Plan.

Appendix 1

WASTE SCREENING PROCEDURES

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 mayor 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 anyone 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 26 1.3, **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.I.P CONSITIUENTS & 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.
Chloroform	6.0	Methyl ethyl ketone	200
Chromium	5.0	Nitrobenzene	2.0
m-Cresol	200	Pentachlorophenol	100
o-Cresol	200	Pyridine	5.0
p-Cresol	200	Selenium	1.0
Cresol	200	Silver	5.0
1,4-Dichlorobenzene	10.0	Tetrachloroethylene	0.7
1,2-Dichloroethane	0.7	Toxaphene	0.5
1,1-Dichloroethylene	0.5	Trichloroethylene	0.5
2,4-Dichlorophenoxyacetic acid	0.7	2,4,5-Trichlorophenol	400
2,4-Dinitrotoluene	0.13	2,4,6-Trichlorophenol	2.0
Endrin	0.02	2,4,5-TP (Silvex)	1.0
Heptachlor (and its hydroxide)	0.008	Vinyl Chloride	0.2

By law PCB's are no longer used as dielectrics in transformers and capacitors manufactured after 1979. There are many millions of pounds of PCBs still in use or in storage. One example is the ballasts used in fluorescent light fixtures. It has been estimated that there are between 0.5 million and 1.5 billion ballasts currently in use in this country. Due to the long life of these units, about half of these may be of pre-1979 manufacture and contain PCBs. Since each ballast contains about one ounce of nearly pure PCB fluid, there are about **20 to 30 million pounds** of PCBs in existing lighting fixtures. These items are not subject to RCRA Subtitle D Waste Screening!

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

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

2. PCB Regulatory Requirements

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

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

D. FUNDAMENTALS OF WASTE SCREENING

1. Know Your Generators and Haulers

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

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

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

2. Inspections

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

Ideally, all loads should be screened; however, it is generally not practical to inspect in detail all incoming loads. Random inspections, therefore, can be used to provide a reasonable means to adequately control the receipt of inappropriate wastes. Random inspections are simply inspections made on less than every load. At a minimum the inspection frequency will not be less than one percent of the waste stream.

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

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

Loads will be inspected on the tipping floor at the baler facility prior to actual disposal of the waste at the working face of the landfill unit to provide the County the opportunity to refuse or accept the wastes.

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.

Haywood 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, Haywood 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

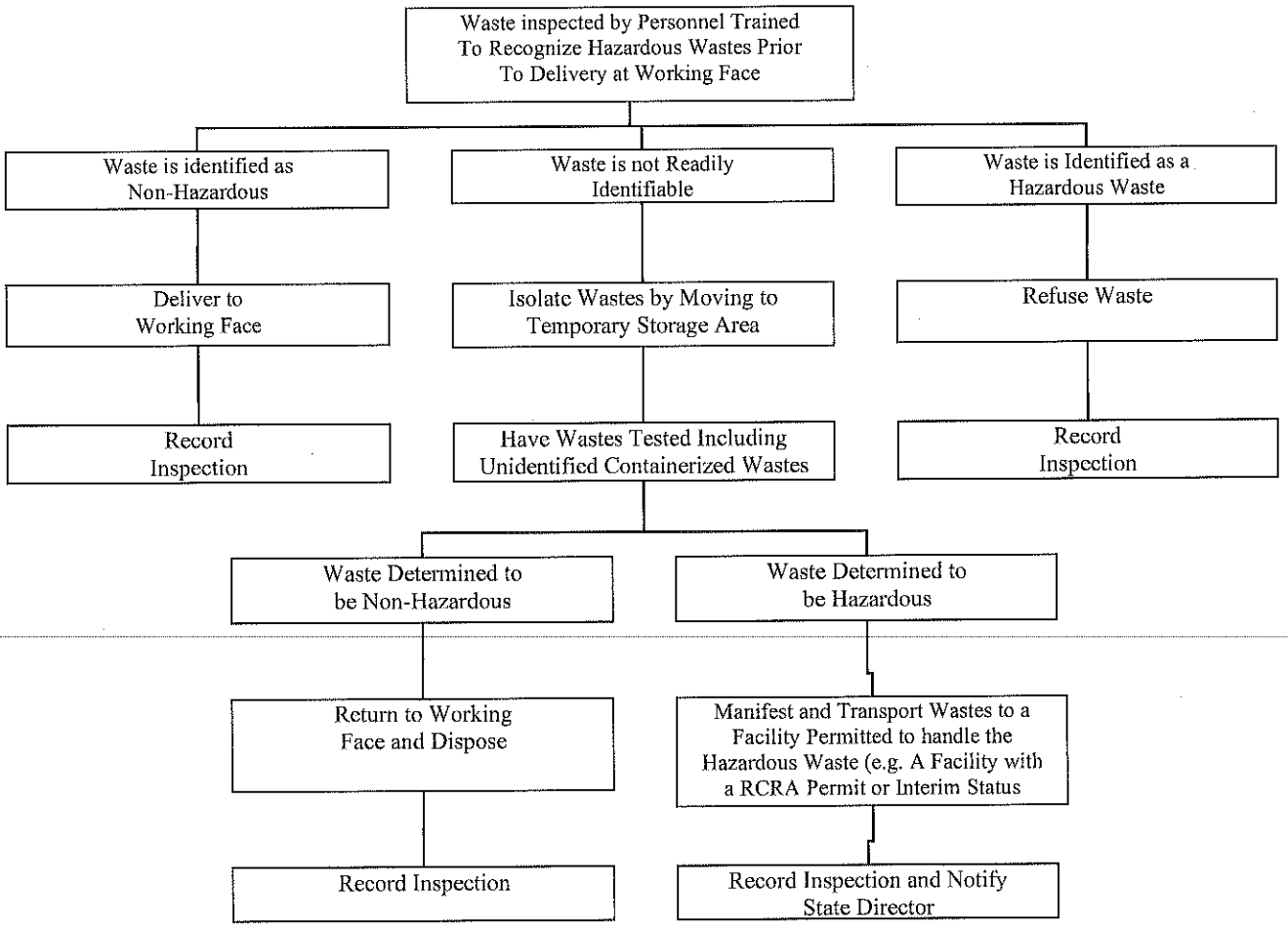
Records must be kept pursuant to an incident where regulated hazardous waste or prohibited waste is found at the landfill. It is also recommended that records be kept of all screening activities and incidents, whether or not, regulated or prohibited wastes are found. This will help prove that the landfill 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 identity
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	_____	_____
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

Appendix 2A

HAYWOOD COUNTY SYNTHETIC COVER OPERATION PLAN
March 2000

1. Determine the size of the area to be covered. Be sure to allow for five to ten feet extra on each measurement to ensure that the refuse is completely covered.

2. The synthetic cover is shipped to the landfill site with panels folded accordion-type, then rolled up. Unroll the cover along the working face (depending upon operations), and attach the leading edge of the unrolled panel to existing landfill equipment with ropes (i.e. to the top of the blade).\

3. Pull the sewn panels of cover across the compacted trash. The synthetic cover maybe pulled from any direction, which may vary from day to day. Keep the leading edge between the two machines (or people) as high as possible to eliminate drag.

4. Anchor the edges of synthetic cover every 20 feet with tires (with rims) or sandbags to hold the synthetic cover in place. If it is windy, more anchoring may be required. Make sure a large enough panel has been ordered to completely cover the refuse (base this on the heaviest day of the week). If complete coverage is not possible, cover the exposed refuse with soil, but take care not to place too much dirt on the synthetic cover if it is to be re-used.

5. On the next day of operations, remove the tires and/or sandbags. Simply pull the synthetic cover across itself (to reduce drag) and off the refuse to an area that is inactive. Anchor the edges again to prevent wind form lifting the blanket. At the end of the day, pull the synthetic cover back across the refuse by repeating steps 3 and 4 until a new panel is needed.

Synthetic Cover is designed to be used as landfill daily cover on the vertical working face of stacked bales. The material shall be ±6-mil sheet plastic, available at any hardware store. For best results, it is recommended that the area to be covered be kept as close to a square shape as possible not to exceed 75' x 75' in size. Not only does this procedure allow for easier coverage, it allows for better management of the working face and saves time at the end of the working day.

Haywood County will use a panel of synthetic cover that is pulled over the working face on a daily basis by two pieces of landfill equipment. At the end of the working day, the panel will be secured in place. This is attained by one of two methods – the panel may be heavy enough to hold itself in place due to accumulation of soil and is left in that manner, or tires (with rims on) are placed on the panel to secure it in place.

The working face is operated in this manner, brought to an intermediate grade and then covered with the required six (6) inches of soil. The process will continue until a lift is completed. The process is then started over on the next lift until the landfill is filled to final grade and a section is closed. At a minimum, six (6) inches of soil cover will be used once a week.

Tips to Remember

1. Always pull the fabric across itself during installation and removal to make each panel last as long as possible.

2. Avoid driving on the panel(s); this may cause punctures and tears.

3. Tie the panel(s) to the top of the dozer blade and raise the blade to minimize dragging on refuse.

4. Use tires (filled, or with rims) or sandbags to hold the panel(s) down overnight. Soil can be used if you plan to leave panel(s) in place and cover with refuse.

5. Minimize stress between dozer/compactors while pulling on the panels(s).

Appendix 2B

HAYWOOD COUNTY SYNTHETIC COVER OPERATION PLAN
and
DEMONSTRATION REPORT
February 2009

Demonstration Period Report

Haywood County used 3 Landfill Tarp Systems tarps during the demonstration period. The tarps were pulled over the working face at the end of the day as described in the Operations section below. The tarps were used on approximately 25% of the days during the demonstration period. Variables affecting the use of the tarps include the location within the landfill and wet weather conditions. The tarps were not used when the working face was near the permanent or temporary slopes because soil cover was used in these areas. Additionally, the tarps were not used during wet weather due to the fact that extra water weight could cause tearing of the tarps. The use of the tarps allowed for a seamless integration from one day to the next and the County will continue to use these tarps as a method of daily cover.

Operations

1. By the end of each day of operations, the horizontal or lateral expansion of the working face will be covered with at least six (6) inches of earthen material. The working face will be maintained at a minimum of a 4:1 slope and compacted to reach maximum waste density possible to minimize the size of the working face; preserve landfill space; and deter wind-blown litter. An ADC synthetic cover may be used in place of soil at the discretion of the landfill operator. At the end of the operating day, a 50' x 50', 6.5 oz/sq.ft. tarp will be pulled over the slope of the working face. The tarp will cover all exposed portions of the working face, and the corners and sides of the tarp will be weighted with dirt and/or small stones to prevent the wind from exposing any waste. At the beginning of the next operating day, the tarp will be walked off of the working face and stored in an adjacent area to the working face.

2. The proposed ADC will consist of three (3) Landfill Tarp systems. Each tarp will be approximately 50' x 50' in size, and 6.5-8.5 oz/sq.ft. The tarp is constructed of a woven polypropylene that is puncture, tear and U.V. resistant. The synthetic cover is shipped to the landfill site with panels folded accordion-type, and rolled up. Unroll the cover along the working face (depending upon operations), and attach the leading edge of the unrolled panel to existing landfill equipment with ropes (i.e., to the top of the blade).

3. Pull the sewn panels of cover across the compacted trash. The synthetic cover maybe pulled from any direction, which may vary from day to day. Keep the leading edge between the two machines (or people) as high as possible to eliminate drag.

4. Anchor the edges of synthetic cover every 20 feet with tires (with rims intact or filled with concrete) or sandbags to hold the synthetic cover in place. If it is windy, more anchoring may be required.

5. On the next day of operations, remove the tires and/or sandbags. Simply pull the synthetic cover across itself (to reduce drag) and off the refuse to an area that is inactive. Anchor the edges again to prevent wind from lifting the blanket. At the end of the day, pull the synthetic cover back across the refuse by repeating steps 3 and 4 until a new panel is needed.

The Synthetic Cover is designed to be used as landfill daily cover on a working face. For best results, it is recommended that the area to be covered be kept as close to a square shape as possible. Not only does this procedure allow for easier coverage, it allows for better management of the working face and saves time at the end of the working day.

Haywood County will continue to use the plastic panel cover that is currently approved to cover the working face of stacked bales. At the end of the working day, the plastic panel will be secured in place similar to the proposed 6.5-oz. Synthetic Cover.

The working face is operated in this manner, brought to an intermediate grade and then covered with the

required soil. The process will continue until a lift is completed. The process is then started over on the next lift until the landfill is filled to final grade and a section is closed. At a minimum six (6) inches of soil cover will be used once a week.

TIPS TO REMEMBER

1. Always pull the fabric across itself during installation and removal to make each panel last as long as possible.

2. Avoid driving on the panel(s); this may cause punctures and tears.

3. Tie the panel(s) to the top of the dozer blade and raise the blade to minimize dragging on refuse.

4. Use tires (tires must be filled with concrete or include rims) or sandbags to hold the panel(s) down overnight. Soil can be used if you plan to leave panel(s) in place and cover with refuse.

5. Minimize stress between dozer/compactors while pulling on the panel(s).

Appendix 3

EXPLOSIVE GAS CONTROL PLAN FOR - HAYWOOD COUNTY

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

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

The permanent probes will surround the active waste areas. Haywood County's landfill is designed with a base liner system and cap system, there should be no migration of methane in the permeable *in situ* soils.

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

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

Appendix 4

HAYWOOD COUNTY'S RECIRCULATION PLAN

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

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

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

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

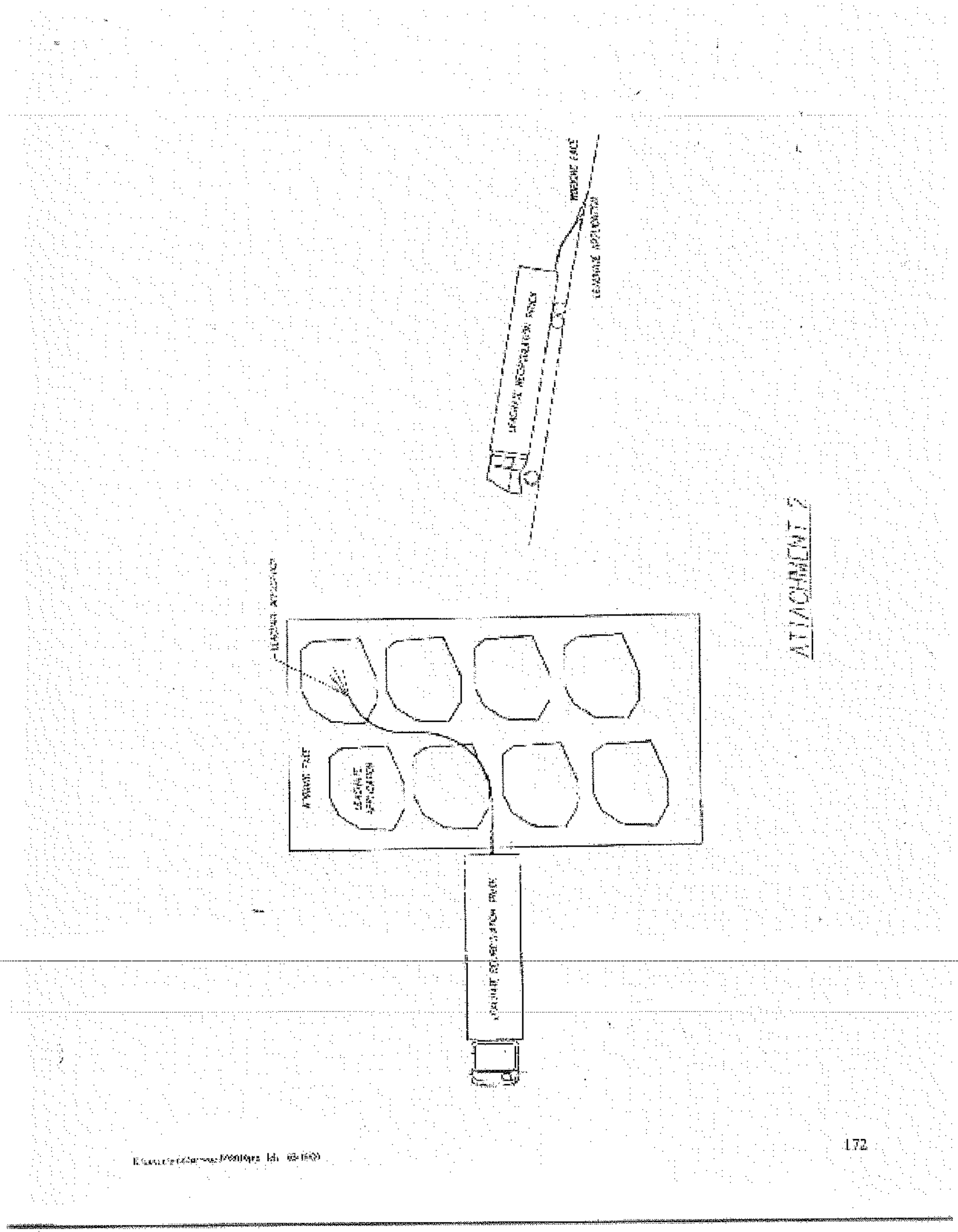
Monthly monitoring will be performed to measure the leachate head at the leachate head detection well and analyze the leachate for BOD, COD, temperature and pH.
The following conditions will be met by Haywood County:

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

ATTACHMENT 1

BASELINE DATA

TO BE ADDED IN THE FUTURE


ATTACHMENT 2
172

ATTACHMENT 3

HAYWOOD COUNTY LEACHATE HEAD READINGS

DATE	DEPTH AT HEAD TEST WELL

ATTACHMENT 4

HAYWOOD COUNTY LEACHATE RECIRCULATION DATA

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

ATTACHMENT 5

HAYWOOD COUNTY VISUAL MONITORING LOG

DATE	INDIVIDUAL MONITORING	OBSERVATIONS

ATTACHMENT 6

HAYWOOD COUNTY RAINFALL AND LAGOON DEPTH LOG

DATE	RAINFALL (INCHES)	LAGOON DEPTH (FEET)

Appendix 5

OPERATIONS PLAN
MULCHING AND GRINDING TREATMENT AND PROCESSING
WHITE OAK LANDFILL
HAYWOOD COUNTY, NORTH CAROLINA
February 2008

I. INTRODUCTION

A. Purpose of Plan

This operations plan has been developed for the proposed Mulching and Grinding Treatment and Processing Facility located at the White Oak Landfill in Haywood County, North Carolina. This plan has been prepared in accordance with the requirements of the North Carolina Department of Environment, Health, and Natural Resources (DENR), Division of Solid Waste Management, Solid Waste Rules (15A NCAC 13B).

The purpose of this plan is to provide the owner and operator with a reference manual that includes necessary information, procedures, and applicable rules for properly operating the Treatment & Processing Facility. All personnel involved with the management or supervision of operations at the facility will be required to review the Operations Plan and to maintain the facility in conformance with applicable requirements. A copy of the Operations Plan will be kept in the vicinity of the Mulching and Grinding Treatment and Processing Facility at all times.

B. Facility Location

The Mulching and Grinding Treatment and Processing Facility is located at the White Oak Landfill at 3898 Fines Creek Road, Waynesville, North Carolina 28785 and is operated by Haywood County. The Treatment and Processing Facility is located south of the Phase 2 MSW Landfill and east of the Phase 1 Construction/Demolition Landfill. Figure 1 illustrates the Overall Site Plan for the White Oak Landfill and Figure 2 shows the Mulching and Grinding Treatment and Processing Facility.

C. Service Area

This Mulching and Grinding Treatment and Processing Facility will provide service for all of Haywood County.

II. SITING REQUIREMENTS

Siting requirements are shown on Figure 2 as well as described as follows:

1) The proposed Treatment and Processing Facilities are not located in the 100-year flood plain.
2) A 50-foot buffer between all property lines and the treatment and processing areas is maintained.
3) A 25-foot buffer shall be maintained between material stockpiles and berms and swales to allow for access of fire-fighting equipment.
4) A 200-foot buffer is maintained between treatment and processing facilities and residences.
5) A 100-foot buffer is maintained between treatment and processing facilities and water supply wells.
6) Haywood County has no zoning requirements for the treatment and processing site property.
7) Diversion berms and drainage ditches are designed to ensure that there will be no standing water in the treatment and processing area and there will be no off-site drainage problems and also to divert runoff from processing areas to sediment basins.
8) An all-weather gravel access road to the site will be kept passable at all times.
9) An erosion control permit submittal for the site is pending and will be provided to the NCDENR-DWM prior to commencement of treatment and processing operations.
10) Site screening of the treatment and processing site is not required.
11) Access to the treatment and processing facility is controlled by properly trained employees.
12) The area has diversion berms leading to a sediment basin. Both the ditches and the sediment basin can be utilized to control runoff from a potential fire.
13) An aerial photo illustrating the area within one-fourth mile of the site was submitted to NCDENR in the "White Oak Landfill MSWLF Site Study", dated November 4, 1998.

III. OPERATIONS PROCEDURES

A. Overview

The Mulching and Grinding Treatment and Processing Facility will consist of approximately 2.0 acres. The location of the facility is shown on Figures 1 & 2. For the twelve-month period from July 1, 2006 through June 30, 2007, the White Oak Landfill averaged 100 tons per month of wood mulch material. Mulched material will be used as an Alternate Daily Cover material during a demonstration period which concludes on July 9, 2009. The mulch ADC will be used on the MSW Landfill and in wet areas of gravel access roads. The mulch ADC will be mixed with soil at a 3:1 soil/mulch ratio. A description of the procedures used for creating the soil/mulch ADC are included in Section 2(b)(ii) of the White Oak MSW Landfill Operations Plan. A portion of the mulched material may be used as a bulking agent in the adjacent composting facility.

Normal working hours for the Mulching and Grinding Treatment and Processing Facility are 8:00 a.m. to 4:30 p.m., Monday through Friday and 8:00 a.m. to 12:00 p.m. on Saturday. The facility is closed on Sunday and the following holidays: New Year's Day, Independence Day, Thanksgiving Day, and Christmas Day.

B. Personnel

The facility is owned and operated by Haywood County. A minimum of two part-time staff employees is required for the daily operation of the Mulching and Grinding Treatment and Processing Facility. These employees are properly trained in safety procedures and the inspection of incoming wastes. Training material published by the Solid Waste Association of North America (SWANA) is utilized for initial training of on-site personnel and for continuing education. The employees also direct and coordinate the movement of collection vehicles into and out of the Mulching and Grinding Treatment and Processing Facility.

C. Technical Operational Requirements

On or before August 1st of each year, the owner or operator shall report to the North Carolina Solid Waste Section, for the previous year beginning July 1st and ending June 30th, the amount by weight of the solid waste that was received at the facility and disposed of in a landfill, incinerated, or converted to fuel. To the maximum extent practicable, such reports shall indicate by weight the county of origin of all solid waste. The owner or operator shall transmit a copy of the report to the county in which the facility is located and to each county from which waste originated.

The following operational criteria shall be met at the Mulching and Grinding Treatment and Processing Facility:

1) Only clean unpainted untreated wood and brush will be used in the mulching process, including pallets.
2) Those items specified as "yard trash" as defined in Section .0101(55) of the Solid Waste Rules may not be included in the Mulching operation. Yard trash includes those materials resulting from landscaping and yard maintenance, such as brush, grass, tree limbs, and similar vegetative material.
3) Mulched materials will be removed from the site several times a week.
4) Sludges may not be included in mulched materials.
5) Neither hazardous waste nor asbestos containing waste shall be accepted at the mulching facility.
6) Household hazardous waste shall not be accepted at the mulching facility.
7) The Mulching and Grinding Treatment and Processing Facility shall not allow uncontrolled public access.
8) Alternate daily coverage materials will include only those materials specified as suitable for mulching, as described in C 1-6 herein.
9) Only clean, unpainted masonry, concrete, and asphalt may be ground for use as road base and ditch lining material.
10) Open burning of solid waste is prohibited.

11) Arrangements with the local fire protection agency to immediately provide fire-fighting services when needed is required (see Section F below).
12) Personnel training shall be provided to insure that all employees are trained in site specific safety, remedial, and corrective action procedures.
13) Signs providing information on waste that can be received, dumping procedures, the hours during which the site is open for public use, the permit number and other pertinent information shall be posted at the site entrance.
14) The County uses a multi-level waste screening procedure, as outlined in Appendix 1 of the White Oak MSW Landfill Operations Plan. Waste haulers are directed by the scale attendant to the appropriate disposal location. Also on site is the appropriate signage directing haulers to the correct disposal drop-off points, with information pertaining the types of allowable materials for each unit of the White Oak MSWLF. Additionally, landfill personnel are on-site to further inspect waste loads. In the event that inappropriate materials are disposed at the Mulching and Grinding Treatment and Processing Facility, these materials shall be segregated from the appropriate mulching materials and then disposed in the correct landfill unit.

D. Traffic Control

Access to the Mulching and Grinding Treatment and Processing Facility is controlled by properly trained employees who are located at the entrance of the facility. As vehicles arrive at the Mulching and Grinding Treatment and Processing Facility, site personnel will direct the driver to position the vehicle at the correct unloading location. When the contents of the vehicle are emptied, the driver is instructed to move the vehicle away from the Treatment and Processing area.

E. Housekeeping, Litter, and Vector Control

Incoming wastes will be transported to the Mulching and Grinding Treatment and Processing Facility in covered or enclosed vehicles. Outgoing transfer trailers will also be covered or enclosed. Throughout the day and at the end of each working day, facility personnel will police the area for litter. Mosquitoes and rodents shall be controlled so as to protect the public health and welfare.

F. Fire Control

In the event that a fire occurs, the local authorities will be notified immediately. The telephone numbers of local fire, police, ambulance and hospital facilities are posted in and around the facility at all times. Additionally, the White Oak Landfill facility keeps a water tank truck on site at all times. In the event of a fire at the facility the DENR will be notified within 24 hours and written notification will be submitted within 15 days.

G. Storm Water Management and Erosion Control

An erosion control permit submittal for the Mulching and Grinding Treatment and Processing Facility is pending and will be provided to the NCDENR-DWM upon receipt. Standard erosion control practices, such as a sediment basin, silt fencing, vegetating slopes, and diversion ditches will be utilized at the site. Runoff from the processing area will be diverted through ditches to a sediment basin prior to discharge off the property.

H. Zoning

Haywood County has no zoning requirements for the Treatment and Processing Site property. A detailed discussion of the zoning requirements for Haywood County is included in the "White Oak Landfill, MSWLF Site Study", dated November 4, 1998.

Appendix 6

OPERATIONS PLAN
SMALL TYPE 2 COMPOSTING FACILITY
WHITE OAK LANDFILL
HAYWOOD COUNTY, NORTH CAROLINA
February 2009

I. INTRODUCTION

A. Purpose of Plan

This operations plan has been developed for the proposed Small Type 2 Composting Facility located at the White Oak Landfill in Haywood County, North Carolina. This plan has been prepared in accordance with the requirements of the North Carolina Department of Environment, Health, and Natural Resources (DENR), Division of Solid Waste Management, Solid Waste Rules (15A NCAC 13B).

The purpose of this plan is to provide the owner and operator with a reference manual that includes necessary information, procedures, and applicable rules for properly operating the Composting Facility. All personnel involved with the management or supervision of operations at the facility will be required to review the Operations Plan and to maintain the facility in conformance with applicable requirements. A copy of the Operations Plan will be kept in the vicinity of the Composting Site at all times.

B. Facility Location

The Small Type 2 Composting Facility is located at the White Oak Landfill at 3898 Fines Creek Road, Waynesville, North Carolina 28785 and is operated by Haywood County.

C. Service Area

The Composting Facility will provide service for all of Haywood County.

II. SITING REQUIREMENTS

The proposed composting facility site is located south of the Phase 2 MSW cell and east of the Phase 1 Construction & Demolition cell. The location of the composting facility is illustrated on Figures 1 and 2 of the plans. Siting requirements are shown on the plans as well as described as follows:

1) The proposed Composting Facility is not located in the 100-year flood plain.
2) A 200-foot buffer is maintained between the composting facility and all residences.
3) A 100-foot buffer is maintained between the compositing facility and water supply wells.
4) A 50-foot buffer is maintained between all property lines and the composting facility.
5) A 25-foot minimum distance between compost areas and swales or berms will be maintained in order to allow for adequate access of fire-fighting equipment.
6) Haywood County has no zoning requirements for the composting site property.
7) Diversion berms and drainage ditches are designed to ensure that there will be no standing water in the composting area and there will be no off-site drainage problems and also to divert runoff from composting areas to sediment basins.
8) A 50-foot minimum buffer between perennial streams and the compost area will be maintained.
9) An all-weather gravel access road to the site will be kept passable at all times.
10) An erosion control permit submittal for the site is pending and a copy of the permit will be sent to NCDENR-DWM prior to commencing grading of the site.
11) The depth from the composting pad to the seasonal high water table shall be maintained at least 24 inches.
12) Portions of the site used for waste receipt and storage, active composting, and curing shall have a soil texture finer than loamy sand, soils which are in abundance at the White Oak Landfill.
13) Access to the composting facility is controlled by properly trained employees.
14) The site will have diversion berms and ditches leading to two sediment control structures. Both the ditches and the sediment control structures can be utilized to control runoff from a potential fire.
15) An aerial photo illustrating the area within one-fourth mile of the site was submitted to NCDENR-DWM in the "White Oak Landfill MSWLF Site Study", dated November 4, 1998.

III. OPERATIONS PROCEDURES

A. Overview

The Small Type 2 Composting Site will consist of an area of approximately 1.5 acres where composting will take place. The County intends to use culls from pre-consumer agricultural activities as a primary material source for the composting operation. Approximately 230 tons of agricultural culls per quarter will be available to the County for composting. Additionally, there are additional clean wood materials available at the landfill for composting as a result of the grinding operation, but these materials are typically mulched and used prior to them becoming available for composting. For the twelve-month period from July 2006 through June 2007, the White Oak Landfill averaged 100 tons per month of vegetative material, suitable for composting. Composted material will be utilized on site as a soil amendment for newly grassed areas. The rate of compost use will be determined as the compost is developed and the chemical constituency of the material is known. An analysis of compost taken from the Johnson

Tomato Packing House in Canton was conducted. The Johnson Packing House compost will be similar in nature to compost produced at the White Oak Landfill. Additionally, analysis was conducted on the soils at the White Oak Landfill that will be used on intermediate slopes where compost will be used to establish vegetative cover. The results of the analyses and proposed compost application rates are included in Appendices of this composting operations plan. The County is conducting a demonstration period, which concludes July 9, 2009, for the use of composting material as an alternative cover material.

Haywood County will initially use existing landfill equipment to manage and turn windrows of composting material. The County plans to purchase a windrow turner to aerate compost, as the operation develops.

Normal working hours for the Composting Site are 8:00 a.m. to 4:30 p.m., Monday through Friday and 8:00 a.m. to 12:00 p.m. on Saturday. The facility is closed on Sunday and the following holidays: New Year's Day, Independence Day, Thanksgiving Day, and Christmas Day.

B. Personnel

The facility is owned and operated by Haywood County. A minimum of two part-time staff employees is required for the daily operation of the Composting Site. These employees are properly trained in safety procedures and the inspection of incoming wastes. Training material published by the Solid Waste Association of North America (SWANA) is utilized for initial training of on-site personnel and for continuing education. The employees also direct and coordinate the movement of collection vehicles into and out of the Composting Site.

C. Technical Operational Requirements

On or before August 1st of each year, the owner or operator shall report to the North Carolina Solid Waste Section, for the previous year beginning July 1st and ending June 30th, the amount by weight of the solid waste that was received at the facility and disposed of in a landfill, incinerated, or converted to fuel. To the maximum extent practicable, such reports shall indicate by weight the county of origin of all solid waste. The owner or operator shall transmit a copy of the report to the county in which the facility is located and to each county from which waste originated.

The following operational criteria shall be met at the Composting Site:

1) Small Type 2 Composting Facilities shall process or store less than 1,000 cubic yards of material for composting per quarter, and occupy less than two acres of land.
2) Type 2 composting facilities may receive pre-consumer meat-free food processing waste, vegetative agricultural waste, source separated paper or other source separated specialty wastes, which are low in pathogens and physical contaminants

3) Waste acceptable for a Type 1 facility may be composted at a Type 2 facility. Type 1 wastes include yard and garden waste, silvicultural waste, untreated and unpainted wood waste or any combination thereof.
4) Sludges may not be included in a Type 2 Composting Facility.
5) Neither hazardous waste nor asbestos containing waste shall be accepted at the composting facility.
6) Household hazardous waste shall not be accepted at the composting facility.
7) The composting site shall not allow uncontrolled public access.
8) Compost shall be maintained at or above 104 degrees Fahrenheit for 14 days or longer and the average temperature for that time shall be higher than 113 degrees Fahrenheit. The temperature of all compost produced shall be monitored sufficiently to ensure that the pathogen reduction criteria is met. The data shall be recorded on the form included in the Appendices.
9) Nitrogen bearing wastes shall be incorporated as necessary to minimize odor and the migration of nutrients.
10) The finished compost shall meet the classification and distribution requirements outlined in Rule 15A NCAC 13B.1407 of the Solid Waste Regulations.
11) Open burning of solid waste is prohibited.
12) Arrangements with the local fire protection agency to immediately provide fire-fighting services when needed is required (see Section F below).
13) Personnel training shall be provided to insure that all employees are trained in site specific safety, remedial, and corrective action procedures.
14) Signs providing information on waste that can be received, dumping procedures, the hours during which the site is open for public use, the permit number and other pertinent information shall be posted at the site entrance.

D. Traffic Control

Access to the Composting Site is controlled by properly trained employees who are located at the entrance of the landfill. As vehicles arrive at the Composting Site, site personnel will direct the driver to position the vehicle at the correct unloading location. When the contents of the vehicle are emptied, the driver is instructed to move the vehicle away from the Composting Site. Traffic signs/markers shall be provided as necessary to promote an orderly traffic pattern to and from the discharge area and to maintain efficient operation conditions.

E. Housekeeping, Litter, and Vector Control

Incoming wastes will be transported to the Composting Site in covered or enclosed vehicles. Outgoing transfer trailers will also be covered or enclosed. Throughout the day and at the end of each working day, facility personnel will police the area for litter. Mosquitoes and rodents shall be controlled so as to protect the public health and welfare.

F. Fire Control

In the event that a fire occurs, the local authorities will be notified immediately. The telephone numbers of local fire, police, ambulance and hospital facilities are posted in and around the facility at all times. Additionally, the White Oak Landfill facility keeps a water tank truck on site at all times. In the event of a fire at the facility the NCDENR will be notified within 24 hours and written notification will be submitted within 15 days.

G. Storm Water Management and Erosion Control

An erosion control permit submittal is pending and a copy of the erosion control permit will be provided to the NCDENR-DWM upon receipt. Standard erosion control practices, such as a sediment basin, silt fencing, vegetating slopes, and diversion ditches will be utilized at the site. Runoff from the composting areas will be diverted to an existing sediment basin and a proposed sediment trap.

H. Zoning

Haywood County has no zoning requirements for the Scrap Tire Collection Site property. A detailed discussion of the zoning requirements for Haywood County is included in the "White Oak Landfill, MSWLF Site Study", dated November 4, 1998.

Composting Operations Data Log

Windrow Date of Formation_____
(if more than one windrow is formed on the same date, add A,B,C designator. Note location of windrows for future identification. Add weight of materials if known.)

Materials used and source_____

_____

Date	Temperature Noted	Date	Temperature Noted
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Observations:_____

_____

Windrow Date of Formation_____
(if more than one windrow is formed on the same date, add A,B,C designator. Note location of windrows for future identification. Add weight of materials if known.)

Materials used and source_____

_____

Date	Temperature Noted	Date	Temperature Noted
_____	_____	_____	_____

Observations:_____

_____

Johnson Tomato Packing House Compost

Date of Transport to White Oak Landfill_____
(each truckload should have data kept)
Weight of Compost_____

Approximate Volume of Compost_____
(estimate length x width x depth of load of compost in truck)

Observations_____
(note materials in compost, condition of compost, location of disposal at WOLF. Does this material require additional composting?)

_____

_____

_____

Date of Transport to White Oak Landfill_____
(each truckload should have data kept)
Weight of Compost_____

Approximate Volume of Compost_____
(estimate length x width x depth of load of compost in truck)

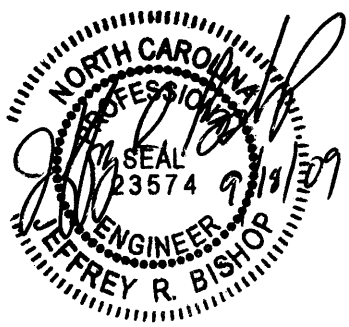
Observations_____
(note materials in compost, condition of compost, location of disposal at WOLF. Does this material require additional composting?)

SECTION 7
CL. & P CL.

CLOSURE/POST-CLOSURE PLAN

WHITE OAK MSW LANDFILL
PHASES 3 & 4
HAYWOOD COUNTY, NORTH CAROLINA

JEFFREY R. BISHOP, P.E.



McGill ASSOCIATES

Engineering • Planning • Finance
Asheville, North Carolina

September 2008
Revised February 2009
Revised September 2009

07518

CLOSURE AND POST-CLOSURE PLAN
White Oak MSW Landfill
Phases 3 and 4

The final cap system for the Phases 3 and 4 Expansion at the White Oak MSW Landfill will be constructed in a progressive manner. As substantial areas of the landfill are brought to final grade, the cap system will be constructed in order to minimize infiltration of stormwater and to reduce leachate production. The Phases 3 and 4 Expansion, which covers a total area of approximately 15.5 acres, is estimated to reach capacity in 2019.

1.0 CAP DESCRIPTION AND CONSTRUCTION

A detail of the final cap is shown on Sheet D2 of the permit drawings. The cross-section will consist of a one-foot layer of compacted on-site soils (intermediate cover), a compacted clay liner with a minimum thickness of 18 inches and a maximum permeability of 1.0×10^{-5} cm/sec, a 40-mil HDPE textured geomembrane, a double-sided geocomposite drainage layer, and a vegetative supportive layer with a minimum thickness of 24 inches.

1.1 Cap Foundation (intermediate cover)

The cap foundation cover (intermediate cover) is designed to minimize infiltration of stormwater into the landfill prior to placement of the barrier cap, and to provide a sound working platform over the municipal solid waste. The compacted intermediate cover will extend over the entire waste area and consist of compacted soil with a minimum thickness of 12 inches.

1.2 Clay Liner

The composite cap system consists of an 18-inch thick compacted clay layer and an overlying textured geomembrane. The clay liner is the first portion of the composite cap system. The function of the clay liner is to minimize surface water infiltration into the underlying waste cell. The clay liner must be constructed of clay soil with a minimum thickness of 18 inches and a maximum permeability of 1.0×10^{-5} cm/sec. The clay soil may consist of on-site soils, off-site soils, or a combination of the two. The soil may require the addition of bentonite to meet the permeability requirements. The design of the landfill cap provides for a minimum number of penetrations through the low permeable barrier cap. The only anticipated penetrations will be for leachate collection piping cleanouts and methane gas system wells. Details of the proposed composite cap system are shown on Sheets D1-D11 of the permit drawings.

1.2a - Construction Requirements

Construction methods for the compacted clay liner shall be based upon the type and quality of the borrow source and shall be verified in the field by constructing test pad(s). The CQA engineer shall ensure that the compacted clay liner installation conforms to the Design Study approved by the Division of Solid Waste (Division), including the following minimum requirements:

1. A test pad shall be constructed prior to beginning installation of the compacted clay liner and at any time when there is a significant change in soil material properties. The location, equipment, liner thickness, and subgrade slope and conditions shall be representative of full-scale construction. Acceptance and rejection criteria shall be based on results from the tests as specified in Section **1.2b**. For each lift, a minimum of three (3) locations shall be established for testing moisture content and density, and collecting a composite sample for recompacted lab permeability. In addition, at least one shelby tube sample, or another in-situ test approved by the Division, shall be collected or performed for each lift of the test pad constructed. These samples will be used for performing lab permeability tests.

2. Soil conditioning, placement, and compaction shall be maintained within the range identified in the moisture-density-permeability relation developed in accordance with Section **1.2b**.

3. The final compacted thickness of each lift shall be a maximum of six inches.

4. Prior to placement of successive lifts, the surface of the lift in place shall be scarified or otherwise conditioned to eliminate lift interfaces.

5. The final lift shall be adequately protected from environmental degradation.

1.2b - Construction Quality Assurance Requirements

clay liner - The project engineer shall ensure that the clay liner installation conforms to the Division approved Site Specific Construction Quality Assurance Plan. All (CQA) requirements for the clay liner installed as part of the landfill cap system will be the same requirements that the clay liner installed as part of the composite base liner system. The only difference is as follows:

- The clay liner portion of the cap system is required to have a permeability not greater than 1.0 x 10^{-5} cm/sec and must have a minimum thickness of 18 inches. The clay liner portion of the composite base liner is required to have a permeability not greater than 1.0 x 10^{-7} cm/sec and a minimum thickness of 24 inches, or a geosynthetic composite liner (GCL) system consisting of a minimum 18 inches of compacted soil with a permeability not greater than 1.0 x 10^{-5} overlain with a GCL material with a demonstrated hydraulic conductivity of not more than 5 x 10^{-9} cm/sec under the anticipated confining pressure.

1.3 Geomembrane Liner

The geomembrane liner is the second portion of the composite cap system. The geomembrane liner shall have a demonstrated vapor transmission rate of not more than 0.03 gm/m^2-day. The liner material and any seaming materials shall have chemical and physical resistance not adversely affected by environmental exposure, waste placement and leachate generation. The type of geomembrane used for constructing the composite cap system shall be in accordance with this section and approved by the Division.

i. High density polyethylene (HDPE) geomembrane liners shall have a minimum thickness of 40 mils.
ii. The minimum thickness of any geomembrane approved by the Division shall be greater than 30 mils.

geonet drainage layer - A double-sided, eight (8)-ounce geocomposite will be placed on top of the 40-mil textured geomembrane. The materials used for the geonet drainage layer shall comply with the following:

i. The chemical properties of the drainage layer materials shall not be adversely affected by waste placement or leachate generated by the landfill.
ii. The physical and hydraulic properties of the drainage layer materials shall promote lateral drainage of leachate through a zone of relatively high permeability or transmissivity under the predicted loads imposed by overlying materials.

1.3a - Construction Requirements

The project engineer shall ensure that the geomembrane installation conforms to the requirements of the manufacturer's recommendations and the Division approved plans including the following:

i. The surface of the supporting soil upon which the geomembrane will be installed shall be reasonably free of stones, organic matter, protrusions, loose soil, and any abrupt changes in grade that could damage the geomembrane;
ii. Field seaming preparation and methods, general orientation criteria, and restrictive weather conditions approved by the Division;
iii. Approved Anchor trench design;
iv. Critical tensile forces and slope stability;
v. Protection from environmental damage; and
vi. Physical protection from the materials installed directly above the geomembrane.

geonet drainage layer - The construction of the geonet drainage layer shall conform to the following:

i. The drainage layer materials shall be placed according to the Division approved plans and in a manner that prevents equipment from working directly on the geomembrane.
ii. The drainage layer materials shall be stable when placed on the slopes specified on the construction plans.

1.3b - Construction Quality Assurance Requirements

geomembrane liner - The project engineer shall ensure that the geomembrane installation conforms to the requirements of the manufacturer's recommendations and the Division approved Site Specific Construction Quality Assurance Plan.

geonet drainage layer - The project engineer shall ensure that the geonet installation conforms to the requirements of the manufacturer's recommendations and the Division approved Site Specific Construction Quality Assurance Plan.

1.4 Methane Gas Removal System

The proposed methane gas collection system for Phases 3 and 4 has been shown on Sheet C12 of the permit drawings. The proposed system will be connected to the proposed gas collection system proposed for the Phases 1 and 2. Haywood County is currently in the process of permitting a methane gas collection and combustion system at the White Oak Landfill. The proposed expansion of the system for Phases 3 and 4 will consist of vertical gas extraction wells, 8", 6" and 4" intermediate gas collection piping connecting the extraction wells, and 12" and 16" transmission headers located around the margin of Phase 1 where the transmission headers will connect to Phase 1 and 2 methane header pipes.

The methane extraction wells will be constructed prior to construction of the final cap, although well heads and collection lines will be raised as necessary during the final cap construction. A typical gas collection well has a radius of influence of approximately 100 to 125 feet. This results in approximately 14 wells for the Phases 3 and 4 area. The typical well penetrates the waste mass and allows a conduit for vertical migration of methane gas. The wells will be installed to a depth that is 10' above the top of stone leachate collection system layer. An HDPE boot will be placed at the area where the extraction well penetrates the geomembrane to retard surface water infiltration into the waste layers. A bentonite/soil mixture will also be placed and compacted around the vertical collection wells where the wells penetrate the clay liner.

1.4a - Materials Required

i. The gas collection laterals shall have a minimum nominal diameter of four inches and shall be constructed of SDR 17, HDPE pipe.
ii. The gas collection header shall have a minimum nominal diameter of 12 inches and shall be constructed of SDR 17, HDPE pipe.
iii. The gas extraction wells shall be constructed as shown on Sheet C12 and detail Sheets D1 through D11 of the permit Drawings.

1.4b - Construction Requirements

i. Gas collection piping shall be installed according to the Division approved plan.
ii. The location and grade of the piping network shall provide access for periodic cleaning.
iii. The minimum grade of gas system piping that is installed under or within the final cap system shall be three percent (3%).
iv. The gas system piping shall be constructed in such a manner to provide for gas condensate collection. This condensate shall be transported to the leachate storage tanks by pneumatic or electric and explosion-proof pumps.

1.4c - Construction Quality Assurance Requirements

The development of the gas collection system at the White Oak Landfill will be constructed in phases as sections of the landfill reach final approved grades. Haywood County is planning to install and methane gas collection and combustion system and will use the landfill gas from Phases 3 and 4. Haywood County plans to expend significant capital for developing the methane collection and combustion facility at the White Oak Landfill. Therefore, developing and maintaining a productive gas collection system is of utmost importance to Haywood County. Haywood County will make every effort to ensure that the gas collection materials and construction requirements described above are followed for the future construction of the gas collection system.

1.5 Final Cover

The final cover will be a total of 24-inches thick. The soil cover will be suitable to provide support for a vegetative cover and protect the low-permeability barrier.

1.5a - Materials Required

A grass cover is proposed for the Landfill to provide the required cover while minimizing cap maintenance. The surface will be prepared by fertilizing and placing seed in accordance with the North Carolina Erosion and Sediment Control Standards. The lower 12 inches of the final cover will be constructed of native soils. Although the material will not be required to have a specific classification or permeability, it should be a cohesive soil. The upper 6 inches of the final cover should be suitable for supporting vegetative growth. The materials used for the top portion of the final cover shall meet the following criteria:

i. **Uppermost soil**

Natural, friable, loamy soil, typical of local soil which produces heavy vegetative growth; free from subsoil, weeds, sods, stiff clay, stones larger than 1 inch, toxic substances, litter, or other foreign material harmful to plant growth; having a pH between 6.0 and 7.0.

GRADING ANALYSIS

Sieve	Minimum Percent Passing
2 inch	100
No. 4	90
No. 10	80

Topsoil shall contain sand, silt, and clay as required by AASHTO M146.

	Minimum Percent	Maximum Percent
Sand	20	75
Silt	10	60
Clay	5	30

ii. <u>Fertilizer and/or Compost</u>:

The uppermost soil material shall be tested prior to spreading to determine the amount of fertilizer and/or compost material that should be added to achieve optimum growth potential of the required vegetative cover.

The quality of fertilizer and/or compost and all operations in connection with the furnishing of this material shall comply with the requirements of the North Carolina Fertilizer Law and regulations adopted by the North Carolina Board of Agriculture.

Fertilizer and/or compost shall be 10-10-10 grade. Upon written approval of the Engineer a different grade of fertilizer may be used, provided the rate of application is adjusted to provide the same amounts of plant food.

During handling and storing, the fertilizer shall be cared for in such a manner that it will be protected against hardening, caking, or loss of plant food values. Any hardened or caked fertilizer shall be pulverized to its original conditions before being used.

iv. <u>Lime</u>:

The uppermost soil material shall be tested prior to spreading to determine the amount of lime that should be added to achieve optimum growth potential of the required vegetative cover.

The quality of lime and all operations in connection with the furnishing of this material shall comply with the requirements of the North Carolina Lime Law and regulations adopted by the North Carolina Board of Agriculture.

During the handling and storing, the lime shall be cared for in such a manner that it will be protected against hardening and caking. Any hardened or caked lime shall be pulverized to its original condition before being used.

Lime shall be agriculture grade ground dolumitic limestone. It shall contain not less than 85% of the calcium and magnesium carbonates and shall be of such fineness that at least 90% will pass a No. 10 sieve and at least 50% will pass a No. 100 sieve.

iv. Seed:

The quality of seed and all operations in connection with the furnishing of this material shall comply with the requirements of the North Carolina Seed Law and regulations adopted by the North Carolina Board of Agriculture.

Seed shall have been approved by the North Carolina Department of Agriculture or any agency approved by the Engineer before being sown, and no seed will be accepted with a date of test more than nine (9) months prior to the date of sowing. Such testing however, will not relieve the Contractor from responsibility for furnishing and sowing seed that meets these specifications at the time of sowing. When a low percentage of germination causes the quality of the seed to fall below the minimum pure live seed specified, the Contractor may elect, subject to the approval of the Engineer, to increase the rate of seeding sufficiently to obtain the minimum pure live seed contents specified, provided that such an increase in seeding does not cause the quantity of noxious weed seed per square yard to exceed the quantity that would be allowable at the regular rate of seed.

During handling and storing, the seed shall be cared for in such a manner that it will be protected from damage by heat, moisture, rodents, or other causes.

Seed shall be entirely free from bulblets or seed of Johnson Grass, Nutgrass, Sandbur, Wild Onion, Wild Garlic, and Bermuda Grass. The specifications for restricted noxious weed seed refers to the number per pound, singly or collectively, of Blessed Thistle, Wild Radish, Canada Thistle, Corncockle, Field Bindwee, Quackgrass, Dodders, Dock, Horsenettle, Bracted Plantain, Buckhorn or Wild Mustard; but in no case shall the number of Blessed Thistle or Wild Radish exceed 27 seeds of each per pound. No tolerance on weed seed will be allowed.

v. Mulch:

Straw mulch shall be threshed straw of oats, rye or wheat free from matured seed of obnoxious weeds or other species which would grow and be detrimental to the specified grass.

1.5b - Construction Requirements

Uppermost soil shall be placed according to the following requirements:

i. Use equipment and methods to prevent damage to other components of the final cap system such as the clay liner, 40-mil textured geomembrane, and gas collection piping.

ii. The uppermost soil shall be spread by utilizing small equipment with a relatively low ground pressure. This will reduce the potential of the underlying layers of the final cap being damaged. Prior to placing topsoil, shape the underlying soil layer to graded lines and cross sections to provide for 6 inches of compacted topsoil. Clear the underlying soil layer of materials larger than 2" in diameter.

iii. After alignment of the underlying soil, loosen and till to a depth of 6 inches by disking, harrowing, rototilling, or other approved methods to assure that the topsoil layer properly adheres to the underlying soil layer.

iv. After the condition of the underlying soil layer has been approved by the on-site CQA personnel, place and spread topsoil to achieve required depth after compaction; rake and remove materials larger than 2 inches. Compact with approved roller equipment, grade to finished tolerances, and prepare the seedbed in accordance with the approved Phases 3 and 4 Technical Specifications

Seed, fertilizer and lime shall be applied according to the following:

Seed shall be applied by means of a hydro-seeder or other approved methods. The rates of application of seed, fertilizer and limestone shall be as stated below, unless pre-construction testing is contrary to these rates and can be documented.

All rates are in pounds per acre:

Fertilizer and/or compost - 1000 lbs. per acre
Lime - 4,000 lbs. per acre
KY-31 Fescue - 100 lbs. per acre
Straw mulch – 60 to 80 bales

For summer seeding the following shall be added:

- German Millet - 10 lbs. per acre
- Sudangrass – 15 lbs. per acre

For winter seeding the following shall be added:

- Rye grain – 15 lbs. per acre

For steep slopes the following shall be added:

- Sericea Lespedeza – 40 lbs. per acre

Equipment to be used for the application, covering or compaction of limestone, fertilizer, compost, and seed shall have been approved by the Engineer before being used on the project. Approval may be revoked at any time if equipment is not maintained in satisfactory working condition, or if the equipment operation damages the seed. Limestone, fertilizer, compost, and seed shall be applied within 24 hours after completion of seedbed preparation unless otherwise permitted by the Engineer, but no limestone, fertilizer, or compost shall be distributed and no seed shall be sown when the Engineer determines that weather and soil conditions are unfavorable for such operations.

Limestone may be applied as a part of the seedbed preparation, provided it is immediately worked into the soil. If not so applied, limestone and fertilizer shall be distributed uniformly over the prepared seedbed at the specific rate of application and then harrowed, raked, or otherwise thoroughly worked or mixed into the seedbed.

Seed shall be distributed uniformly over the seedbed at the required rate of application, and immediately harrowed, dragged, raked, or otherwise worked so as to cover the seed with a layer of soil. The depth of covering shall be as directed by the Engineer. If two kinds of seed are to be used which require different depths of covering, they shall be sown separately.

When a hydraulic seeder is used for application of seed and fertilizer, the seed shall not remain in water containing fertilizer for more than 30 minutes prior to application unless otherwise permitted by the Engineer.

Immediately after seed has been properly covered the seedbed shall be compacted in the manner and degree approved by the Engineer.

Mulch shall be applied according to the following:

It shall be spread uniformly at the rate give above and in a continuous blanket over the areas specified.

Before mulch is applied on cut or fill slopes which are 3:1 or flatter, and ditch slopes, the Contractor shall remove and dispose of all exposed stones in excess of 2 inches in diameter and all roots or other debris which will prevent proper contact of the mulch with the soil.

Mulch shall be applied within 24 hours after the completion of the seeding unless otherwise permitted by the Engineer. Care shall be exercised to prevent displacement of soil or seed or other damage to the seeded area during the mulching operations.

Mulch shall be uniformly spread by hand or by approved mechanical spreaders or blowers that will provide an acceptable application. An acceptable application will be that which will allow some sunlight to penetrate and air to circulate but also partially shade the ground, reduce erosion, and conserve soil moisture.

Mulch shall be held in place by applying a sufficient amount of approved binding material to assure that the mulch is properly held in place. The rate and method of application of binding material shall meet the approval of the Engineer. Where the binding material is not applied directly with the mulch, it shall be applied immediately following the mulch operation.

The Contractor shall take sufficient precautions to prevent mulch from entering drainage structures through displacement by wind, water, or other causes and shall promptly remove any blockage to drainage facilities that may occur.

1.4c - Construction Quality Assurance Requirements

Haywood County will ensure that the materials described above are utilized for the final cover and that their placement is done in accordance with the above detailed Construction Requirements. The project engineer will ensure that the materials and methods described above are utilized to construct the final cover system, and that all requirements of the Site Specific Construction Quality Assurance Plan are met.

2.0 ON-SITE WASTE INVENTORY

At closure, the amount of waste on site is estimated to be:

Existing Phases 1 & 2	- 775,000 tons
Proposed Phases 3 & 4	- 660,000 tons
Total	1,435,000 tons

3.0 CLOSURE SCHEDULE

3.1 Notification of Division of Solid Waste

Prior to beginning closure of the White Oak MSW Landfill, the Haywood County will notify the Division of Solid Waste of the intent to close the landfill.

Probable Date of Closure: Summer 2020

3.2 Begin Closure

Haywood County will begin closure activities of the White Oak MSW Landfill unit no later than 30 days after the date on which the MSWLF unit receives the known final receipt of wastes or, if the MSWLF unit has remaining capacity and there is a reasonable likelihood that the MSWLF unit will receive additional wastes, no later than one year after the most recent receipt of wastes. Extensions beyond the one-year deadline for beginning closure may be granted by the Division if the owner or operator demonstrates that the MSWLF unit has the capacity to receive additional wastes and the owner or operator has taken and will continue to take all steps necessary to prevent threats to human health and the environment from the unclosed MSWLF unit.

Probable Date: Fall 2020

3.3 Completion of Closure

Haywood County will complete closure activities of the White Oak MSW Landfill in accordance with the closure plan within 180 days following the beginning of closure. Extensions of the closure period may be granted by the Division if the owner or operator demonstrates that closure will, of necessity, take longer than 180 days and they have taken and will continue to take all steps to prevent threats to human health and the environment from the unclosed MSWLF unit.

Probable Date: Summer 2021

3.4 Recording of Closure

Following closure of the White Oak MSW Landfill, Haywood County will record a notation on the deed to the White Oak MSW landfill facility property, or some other instrument that is normally examined during a title search, and notify the Division that the notation has been recorded.

The notation on the deed must in perpetuity notify any potential purchaser of the property that:

1. The land has been previously used as a landfill facility; and
2. Its use is restricted under the Division of Solid Waste approved Closure Plan

Probable Date: Fall 2021

3.5 Engineer's Certification

Following closure, Haywood County shall notify the Division of Solid Waste that a certification, signed by the project engineer verifying that closure has been completed in accordance with the closure plan, has been placed in the operating record.

4.0 POST CLOSURE PLAN

4.1 Inspections

Following closure of each MSWLF unit, the owner or operator shall conduct post-closure care for 30 years, except as provided under .1627(d)(2) of the Solid Waste Rules. Inspections of the final cover will be performed according to the table below and the condition of the facility will be recorded with notes, maps, and photographs. Since Haywood County intends to operate the White Oak Landfill after Phases 3 and 4 have reached capacity, landfill personnel will be on-site to perform inspections on a frequent basis.

The inspection will take notice of:

1. Eroded banks

2. Patches of dead vegetation
3. Animal burrows
4. Subsidence (settlement)
5. Cracks along the cover
6. Any areas of run-on or eroded run-off.

The inspector will note the condition of:

1. Concrete catch basins and stormwater control facilities
2. Leachate collection and removal pipes
3. Gas monitoring wells
4. Water monitoring wells

Areas showing subsidence, cracking, signs of erosion, or damage are to be repaired.

Schedule of Inspections

Years (following closure)	Minimum Yearly Inspections
0-2	4
2-30	2

4.2 Maintenance

The vegetative cover will be trimmed at least two times a year. In the early stages of development, fertilization and/or compost will be applied annually as needed.

The leachate collection and removal pipes will be flushed and pressure-cleaned annually.

The Gas Removal System will be flushed and pressure-cleaned annually.

Vegetative growth around gas collection wells will be cleaned away and all wells will be clearly marked to prevent accidental damage.

4.3 Monitoring

Explosive gas monitoring will take place on a quarterly basis according to the procedural outline contained in the Operation Plan.

Surface and ground water testing will take place semiannually or as directed by the Division of Solid Waste.

The leachate will also be sampled semi-annually to determine the quality and constituents present. Leachate will be analyzed for Appendix 1 constituents as well as BOD, COD, phosphate, nitrate, sulfate, and pH.

4.4 Leachate collection and treatment

Until it can be demonstrated that leachate concentrations become low enough so as not to pose a threat to human health or the environment, leachate collection and treatment shall continue in accordance with the requirements in Rules .1624 and .1626. Such a demonstration should address direct exposures of leachate releases to ground water, surface water or seeps. Indirect effects, such as accumulated leachate adversely affecting the chemical, physical, and structural containment systems that prevent leachate release, also should be addressed in the demonstration.

4.5 Planned use and personal contact

Preliminary proposals for the planned use of the facility, following Closure includes developing exercise and bike trails along the periphery of the landfill property and a light industry associated with the combustion of methane gas. Any alternate use of the landfill after closure has been completed will be approved by the Division of Solid Waste prior to implementation. The person to contact regarding the facility during the Post-Closure period is:

Haywood County Solid Waste Department
Mr. Stephen King, Solid Waste Director
278 Recycle Road
Clyde, North Carolina 28786
Telephone (828) 627-8042

4.6 Water Quality Monitoring Plan

A Design Hydrogeologic Report and Environmental Monitoring Plan for Phases 3 and 4 of the White Oak MSW Landfill was prepared by BLE, Inc. This includes discussion of the existing monitoring system, proposed monitoring system, additional well construction, water level monitoring, aquifer testing, and groundwater sampling and analysis.

4.7 Engineer's Certification

Following completion of the post-closure care period, Haywood County shall notify the Division of Solid Waste that a certification, signed by the project engineer verifying that post-closure care has been completed in accordance with this post-closure plan, has been placed in the operating record.

5.0 LEACHATE STORAGE CLOSURE PLAN

Haywood County shall complete the closure activities outlined in this plan within 180 days after liquid collection has ceased.

A. At closure, the liner and all solid waste shall be removed from the lagoon and connecting lines. The lagoon liner and all solid waste removed shall be properly handled and disposed of according to Federal and State requirements. All connecting lines shall be disconnected and securely capped or plugged.

B. The lagoon site will be modified to act as a stormwater management feature.

6.0 CLOSURE AND POST CLOSURE COST ANALYSIS AND SUMMARY

6.1 Closure Costs

Phases 3 & 4 (15.5 ACRES) - Closure

				Unit Cost	Total
Item 1	Earthwork				
a.	40,000 C.Y.	18" Clay		$20.00 /C.Y.	$800,000.00
b.	40,000 C.Y.	24" Vegetative Cover		$8.00 /C.Y.	$320,000.00
c.	30,000 C.Y.	12" Intermediate Cover		$5.00 /C.Y.	$150,000.00
Item 2	Geomembrane				
a.	700,000 S.F.	40 mil HDPE		$0.80 /S.F.	$560,000.00
b.	700,000 S.F.	8 oz. Double Sided Geone		$0.60 /S.F.	$420,000.00
Item 3	Sedimentation and Erosion Control				
a.	18 AC.	Grassing		$5,000.00 /AC.	$90,000.00
b.	200 Tons	Rip Rap		$75.00 /Tons	$15,000.00
c.	5,000 L.F.	Synthetic Lined Channels		$20.00 /L.F.	$100,000.00
Item 4	Engineering				
a.	Design & Permitting				$200,000.00
b.	Construction Quality Assurance				$225,000.00
Item 5	Contingency (10%)				$288,000.00
				Total	$3,168,000.00

6.2 Post-Closure Care Cost

b.		1 Each	Repair of Cap (1acre @ 1 foot depth)	$10,000.00 /Each	$10,000.00
c.		5 AC.	Reseeding	$1,200.00 /AC	$6,000.00
d.		1 Each	Leachate System Cleanin	$5,000.00 /Each	$5,000.00
Item 4	Miscellaneous				
a.	Electricity				$30,000.00
b.	Administration				$2,000.00
c.	Inspection				$2,500.00
Item 5	Contingency(10%)				$8,235.00
			Total Annual Post-Closure Care		$90,585.00
			Total Post-Closure Care Period (30 years)		$2,717,550.00

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7.0 FINANCIAL ASSURANCE

The Financial Assurance provision of Subtitle D provides that owner and operators of Municipal Solid Waste Landfills (MSWLF) must provide for certain minimum measures to insure that the funds to meet the requirements of the regulations governing closure, post-closure and corrective action activities are available in the event that these actions are not taken by the owner or operator. The regulations addressing financial assurance are embodied in North Carolina Rule .1628.

7.1 NORTH CAROLINA RULE .1628

In general, Rule .1628 provides that the owner and/or operator must:

1. Provide accurate cost estimates for the closure and post-closure care.
2. Select a mechanism for demonstrating financial assurance.
3. Maintain the selected mechanism in compliance with the provisions of Rule .1628 throughout the period for which the owner/operator is subject to the provisions of Subtitle D and Rule .1628.

The Rule provides for the following alternative mechanisms for demonstrating financial assurance:

1. Trust Fund.
2. Surety bond Guaranteeing Payment or Performance.
3. Letter of Credit.
4. Insurance.
5. Capital Reserve Fund.
6. Local Government Financial Test.
7. Multiple Mechanisms.

Haywood County has reviewed the requirements associated with each of these mechanisms and assessed the costs related to their use as the County's financial assurance mechanism. Although the relative cost of these mechanisms does not appear to vary significantly, there are various factors associated with their availability and practicality, which make certain of the mechanisms less attractive than others.

7.2 LOCAL GOVERNMENT FINANCIAL TEST

Therefore, Haywood County has elected to adopt the LOCAL GOVERNMENT FINANCIAL TEST. The Local Government Financial Test is attractive because the County's excellent financial conditions makes passing the test quite feasible. Haywood County has not had any difficulties passing the LOCAL GOVERNMENT FINANCIAL TEST in recent years and there are not any circumstances that would indicate that this would change.

02300.1 Scope of Work

The landfill cell shall include a 24-inch compacted clay liner or a geosynthetic clay liner (GCL) system that includes an 18-inch compacted clay liner overlain by a GCL material. The Contractor shall furnish all labor, material, supervision, and equipment to complete the Compacted Clay Liner for the cell, including hauling, sieving, raking, discing, compacting, drying, wetting, removal of rainwater and removal of all previously placed material rendered unsuitable due to weather conditions or construction operations, final grading and sealing and all necessary and incidental items as detailed or required to complete the compacted liner, all in accordance with the Contract Documents, and the Site Specific Construction Quality Assurance Plan.

02300.2 Materials

Soil that meets the following requirements of clay liner fill shall be used for construction of the Compacted Clay Liner:

Preconstruction Qualification			
Test	**ASTM Method**	**Frequency**	**Acceptable Values**
Natural Moisture Content	D2216	1/1,000 YD^3 or Change in Material	Reference
Grain Size Analysis	D422 or D1140	1/5,000 YD^3 or Change in Material	< 3" in the lower 18", < ¼" in the upper 6", < 5% greater than No. 4 sieve
Classification	D2487	1/5,000 YD^3 or Change in Material	CL,CH,ML,MH, or SM
Atterberg Limits	D4318	1/5,000 YD^3 or Change in Material	Plasticity Index (PI) > 10
Laboratory Compaction	D698 – Standard	1/5,000 YD^3 or Change in Material	95% Maximum Dry Density
Permeability ** 24-inch compacted clay liner	D5084	1/10,000 YD^3 or Change in Material	Less than or equal to 1 x 10^{-7} cm/sec
Permeability** 18-inch compacted clay liner utilized with GCL system	D5084	1/10,000 YD^3 or Change in Material	Less than or equal to 1 x 10^{-5} cm/sec

* Preconstruction test samples shall be taken from the borrow source and or clay stockpiled prior to construction.

** The Moisture-Density Curve shall show the region in which the required maximum permeability is met. A minimum of three (3) permeability tests shall be performed per curve to establish the zone of acceptable moistures and densities at which the required maximum permeability may be achieved. If the Contractor elects to run multiple curves to enlarge the zone of acceptance, all curves must be submitted.

All clay clods will be broken down with tillers and discs to provide a homogeneous clay soil.

The Compacted Clay Liner may consist of fill material modified by the addition of powdered bentonite in sufficient quantity to meet the specifications. Clay liner material modified with bentonite will be subject to the same testing criteria and frequencies as natural clay liner material, with the addition of percentage of bentonite used. If a bentonite admix is used, the mixing procedure shall be approved by the Engineer prior to construction. Material to be placed within the cell, either natural or augmented, shall have a minimum effective internal friction angle of twenty-five (25) degrees. The internal friction angle of the clay liner material shall be verified by the Contractor. The Contractor shall submit such verification prior to beginning construction. The test method used to verify the internal friction angle of the clay liner material shall be ASTM D4767 *Standard Test Method for Consolidated Undrained Triaxial Compression Test on Cohesive Soils.* The specimens must be compacted to design criteria for dry density and moisture content as determined by preconstruction testing. Test parameters require stepped confinement @ 1, 3, and 5ksf (nominally 5, 15 and 30 psi effective confining pressure).

Continuous and repeated visual inspection of the materials will be performed by the Contractor to ensure proper soils are being used. In addition, the Engineer will make frequent inspections of the clay liner placement operations and materials, and will consult with the Contractor on suitable liner fill and locations of such. All soil liner fill proposed shall be inspected by the Engineer prior to actual use.

02300.3 Construction

The following testing requirements and acceptable values shall apply to the construction of the Compacted Clay Liner unless specified otherwise as in the case of the construction of the required Test Pads:

Construction Testing			
Test	**ASTM Method**	**Frequency**	**Acceptable Values**
Field Density	D6938, D1556, D2973	1/10,000 FT^2/Lift	95% Maximum Dry Density
Field Moisture	D2216, D6938, D4643	1/10,000 FT^2/Lift	+0% - +5% optimum- Cell Floor +2% - +6% optimum – Side Slopes
Classification	D2487	1 per acre per lift	CL,CH,ML,MH, or SM
Permeability	Extracted per D1587 Tested per D5084	1/40,000 FT^2/Lift	Less than or equal to 1 x 10^{-7} cm/sec
Atterberg Limits	D4318	1/5,000 YD^3	Plasticity Index (PI) > 10
Grain Size	D422 or D1140	1/5,000 YD^3	< 3" in the lower 18", < ¼" in the upper 6", < 5% greater than No. 4 sieve
Soil Layer Thickness For 24-inch compacted clay liner	Observation, Field Measurement	Continuous Observation, Minimum of Five (5) per Lift	Minimum two (2) foot thick
Soil Layer Thickness For 18-inch compacted clay liner used with GCL	Observation, Field Measurement	Continuous Observation, Minimum of Five (5) per Lift	Minimum 18 inches thick

TEST PADS

Test pads, a minimum of 20 ft x 50 ft in area shall be constructed prior to beginning installation of the compacted clay liner and whenever there is a significant change in soil material properties or the borrow source is changed. The equipment used, liner thickness, subgrade slope, and all other conditions shall be representative of full scale construction. For each lift of the test pad, a minimum of three (3) test locations shall be established for testing moisture content and density. At least one (1) shelby tube sample for lab permeability testing and one (1) composite sample for recompacted lab permeability shall be obtained per lift/test pad. One test pad shall be constructed which shall be representative of the side slope clay liner and one for the cell floor. The test pads can be constructed independent of each other or in such a manner so that one

test pad lies on the cell bottom and the other test pad lies on the side slope. Compaction and soil moisture content shall be in accordance with the previously approved moisture-density-permeability relationship. Field moisture and density tests and laboratory permeability tests will be performed by the Resident CQA Engineer for each lift placed on the test pads to verify the construction method, equipment, and material necessary to achieve the required permeability not greater than 1.0×10^{-7} cm/sec for the 24-inch clay liner or 1.0×10^{-5} for the 18-inch clay liner associated with a GCL system. The Contractor shall allow sufficient time for construction and testing of the test pad prior to placement of the Compacted Clay Liner.

LINER CONSTRUCTION

Prior to fill placement, the prepared subgrade shall be proofrolled with a smooth-drum roller (minimum 20 tons) by a minimum of two passes in each direction. Proofrolling shall be conducted at the discretion of the Engineer or his representative. Any soft, saturated or yielding areas exhibited by pumping and/or rutting will require removal and replacement with the appropriate soil at no additional cost to the Owner.

02300.4 Final clay liner lift thickness, after compaction, shall be a maximum of six (6) inches. Thinner lifts are permissible to achieve design grade.

02300.5 Equipment or truck traffic shall not be permitted during the period between scarifying and compaction of a lift unless approved by the Engineer.

02300.6 After the lift to be compacted is conditioned, representative samples will be taken by the Resident CQA Engineer and tested for moisture content prior to any compactive efforts. If the moisture content is within the range specified by the moisture-density-permeability relation, compaction may begin. If the moisture content is outside of this range, the clay liner fill will be wetted or dried and reworked accordingly. The soil fill should be sprinkled or sprayed with water utilizing equipment creating a uniform application and dozed, wind-rowed, and/or disc-plowed to uniformly increase the moisture content of the soil if the material moisture content is too low. The soil fill shall be dozed, wind-rowed, and/or disc-plowed to help air dry the soil if the moisture content is too high.

02300.7 Each lift shall be thoroughly compacted to satisfy moisture and density controls through field testing before a subsequent lift is placed.

02300.8 Compaction of lifts shall be as follows:

1) Compaction of lifts shall be performed with an appropriately heavy, properly ballasted compactor. A minimum of four (4) passes will be required on each lift regardless of whether the lift meets density specifications. A pass is defined as one trip of the compacting equipment over the lift and back to the starting point by a single drum roller or one trip across the lift surface from one side to the other if the compacting equipment has front and back compacting rollers. This requirement is to allow thorough remolding of the soil by kneading action.

2) The daily work area shall extend a distance so as to maintain moist soil conditions (facilitate bonding) and continuous operations.

Desiccation and crusting of the lift surface shall be avoided as much as possible. Each lift shall be protected, at all times after placement, from desiccation and crusting.

3) If desiccation and crusting of the lift surface occurs before placement of the next lift, this area shall be scarified to a sufficient depth to mix with moist materials, or sprinkled with water and then scarified at the direction of the Engineer.

4) The transition between the bottom and side slopes shall be accomplished by compacting parallel (bottom to top) to the slope.

5) Dozer equipment shall not be used for primary compaction efforts.

6) The surface of the underlying lift shall be scarified a minimum of 2 inches prior to compaction of each subsequent lift (i.e., Lift 2 to Lift 3) to facilitate bonding of the lifts.

02300.9 During compaction of the soil liner material, the soil moisture content and dry density shall be maintained within the limits specified below.

1) To assure the moisture content and dry density requirements of the compacted soil are being satisfied, field and laboratory tests shall be made at minimal intervals as specified. Additional testing may be requested at the discretion of the Engineer.

2) Compaction moisture content shall be between 2 and 6 percent wet of optimum moisture content (OMC) on the side slopes.

3) The clay liner shall be compacted to a minimum of 95 percent of the maximum dry density. Where densities are less than 95 percent of the maximum dry density, the soil liner shall be recompacted and/or removed and reworked to meet density objectives.

02300.10 The clay liner, in addition to the other provisions of this section, shall have a permeability not greater than 1.0×10^{-7} cm/sec on thin wall tube samples taken from the completed clay liner for use with the 24-inch compacted clay liner or a permeability not greater than 1.0×10^{-5} cm/sec on thin wall tube samples taken from the completed clay liner for use with the 18-inch compacted clay liner associated with the construction of a GCL system. If representative permeability tests do not achieve the required permeability, the clay liner shall be reworked to meet permeability requirements regardless of its previously achieved density. Representative soil samples taken from the clay liner that fail laboratory permeability testing must be re-sampled until passing results are achieved. Each failing sample must be replaced by one successful sample. The Owner will pay

for the permeability testing at the frequency required by the Site Specific Construction Quality Assurance Plan. The Contractor will be responsible for all costs associated with re-sampling and re-testing for failing samples beyond a 5% failure rate by quantity. This includes the cost of lab and Construction Quality Assurance personnel. The minimum charge for re-sampling and re-testing for failing permeability tests exceeding 5% failure rate will be $500.00 per occurrence.

02300.11 Soil fill shall not be placed or compacted during sustained periods with air temperature below 32°F. Soil fill may be placed and compacted during periods of early morning and early evening freezing temperatures with warming trends above 45°F during the day. No fill shall be placed on frozen subgrade. If the clay liner or structural fill freezes or ices the fill section shall be rescarified and recompacted, at the discretion of the Engineer.

02300.12 During construction, finished lifts or sections of compacted clay liner shall be sprinkled with water a minimum of twice per day depending on weather conditions.

02300.13 At the end of each construction day's activities, completed lifts or sections of compacted clay liner shall be sealed by rolling with a rubber tired or smooth drum rollers and sprinkled with water as needed.

02300.14 The compacted clay liner shall be a minimum of twenty-four (24) inches at a permeability no greater than 1.0×10^{-7} cm/sec, or eighteen (18) inches at a permeability no greater than 1.0×10^{-5} cm/sec when used with an overlying GCL material. Thickness of the compacted soil liner on the side slopes shall be measured perpendicular to the slope face.

02300.15 The as-built thickness of the compacted clay liner shall be determined by survey methods (non-destructive) as described below. An individual lift may be sampled upon completion (but prior to subsequent lift placement) with an approved sampler or other investigative tool. Any penetration within any portion or lift of the clay liner shall be promptly backfilled by the Contractor with a 50/50 mix of hand tamped soil and bentonite fill. Samples of the in place compacted soil liner shall be tested and evaluated in accordance with provisions of the Construction Quality Assurance Plan. All test locations shall be filled with a homogeneous mixture of one part bentonite and three parts soil.

02300.16 After completion of a segment of compacted clay liner, but before installation of the geomembrane liner, the surface of the clay liner shall be surveyed by the Contractor to ensure the specified thickness of Compacted Clay Liner (24 inches, or 18 inches with GCL) has been achieved. The survey must be performed and stamped by a registered Professional Land Surveyor in the State of North Carolina. The survey

information shall be provided to the Engineer in a format pre-approved by the Engineer and acceptable to the North Carolina Department of Environment and Natural Resources, Division of Waste Management, Solid Waste Section. At a minimum, survey data shall be collected on a 50-foot grid and at least every 50-foot along all changes in grade.

02300.17 The surface of the compacted clay liner shall be smooth drum rolled and maintained free of rocks, organics, voids and sharp edges.

No vehicles other than a smooth-drum roller will be allowed on the Compacted Clay Liner once the Compacted Clay Liner has been approved. This includes equipment used to deploy geomembrane material. Any exceptions should have prior approval from the Project Engineer.

02300.18 The minimum interface friction angle between the Compacted Clay Liner and the 60 mil textured geomembrane shall be seventeen (17) degrees. This shall be verified by the Contractor and supporting documentation submitted to the Engineer prior to beginning construction.

The test method used to verify the interface friction angle between the clay liner and the 60-mil textured geomembrane shall be ASTM D5321 *Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by Direct Shear Method*. Soil specimens must be compacted to design criteria for dry density and moisture content as determined by preconstruction testing. Test parameters are to provide 3 points to range over minimum and maximum expected normal loads. Minimum will be a construction load of 260 psf. Maximum will be at the landfill's final filled condition or approximately 1,423 psf. The normal loadings used shall be 250, 750 and 1,500 psf.

END OF SECTION

SECTION 02320 GEOSYNTHETIC CLAY LINER (GCL)

02320.1 Scope of Work

The Contractor shall furnish all labor, materials, supervision and equipment to complete the Geosynthetic Clay Liner (GCL) including, but not limited to, anchor trench excavation and backfill, GCL panel layout, seam preparation, patching, and all necessary and incidental items required to complete the Work, in accordance with the Contract Documents and these Specifications.

02320.2 Submittals

A. Contractor shall furnish the following information:

1. Conceptual description of the proposed plan for placement of the GCL panels over the area of installation.
2. GCL manufacturer's Manufacturer's Quality Control (MQC) Plan for documenting compliance to Sections 02320.7 and 02320.8 of these specifications.
3. GCL manufacturer's historical data for a) 10,000-hour creep shear testing per Section 02320.7 E and b) seam flow data at 2 psi confining pressure per Section 02320.7 F.
4. The manufacturer's last 20 weekly values for index flux and permeability prior to the end of the production date of the supplied GCL.
5. A copy of GCL manufacturer's ISO quality Certificate of Registration.

B. At the Engineer's or Owner's request the Contractor shall furnish:

1. A representative sample of the GCLs.
2. A project reference list for the GCL(s) consisting of the principal details of at least ten projects totaling at least 10 million square feet in size.

C. Upon shipment, the Contractor shall furnish the GCL manufacturer's Quality Assurance/Quality Control (QA/QC) certifications to verify that the materials supplied for the project are in accordance with the requirements of this specification.

D. As installation proceeds, the Contractor shall submit certificates of subgrade acceptance, signed by the Contractor and CQA Inspector for each area that is covered by the GCL.

E. The friction angle between the non-woven cover geotextile on the GCL and the geomembrane and the woven base cover and the clay liner shall be a minimum of 20 degrees. The Contractor shall verify and submit to the Engineer proper documentation prior to beginning construction. The test method used to verify the interface friction angle between the 60-mil

geomembrane and the non-woven cover geotextile and the interface friction angle between the woven base cover and the clay liner shall be ASTM D 5321 *Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by Direct Shear Method.* Test parameters are to provide 3 points to range over minimum and maximum loads. Minimum will be a construction load of 260 psf. Maximum will be at the landfill's final filled condition or approximately 1,423 psf. The normal loadings shall be 250, 750 and 1,500 psf.

02320.3 Manufacturer's and Installer's Qualifications

A. GCL Manufacturer must have produced at least 300 million square feet of GCL within the past three years, including at least 30 million square feet with 3.5 lb/in peel strength.

B. The GCL Installer must either have installed at least 1 million square feet of GCL, **or** must provide to the Engineer satisfactory evidence, through similar experience in the installation of other types of geosynthetics, that the GCL will be installed in a competent, professional manner.

02320.4 Construction Quality Assurance (CQA)

A. All GCL sheet will be evaluated prior to and after installation.

B. The Owner and Engineer shall provide a third-party inspector for CQA of the GCL installation. The inspector shall be an individual or company who is independent from the manufacturer, Contractor and Installer, who shall be responsible for monitoring and documenting activities, related to the CQA of the GCL, throughout installation. The inspector shall have provided CQA services for the installation of the proposed or similar GCL for at least 5 completed projects totaling not less than 1 million square feet.

C. Testing of the GCL, as necessary to support the CQA effort, shall be performed by a third party laboratory retained by the Owner and independent from the GCL manufacturer, Contractor and Installer. The laboratory shall have provided GCL CQA testing of the proposed or similar GCL for at least 5 completed projects totaling not less than 1 million square feet.

D. The GCL Installer will be required to adhere to the requirements of the Site Specific Construction Quality Assurance Plan.

02320.5 Products

A. The GCL shall consist of a layer of granular sodium bentonite clay needlepunched between two geotextiles and shall comply with all of the criteria listed in this Section.

B. Bentonite shall be a high-swelling sodium bentonite, with a minimum swell index of 24 mL/2g and a maximum fluid loss of 18 mL. Bentonite shall be CG-50 granular bentonite, mined and processed by American Colloid Company, or an approved equal.

C. Bentonite shall have a granular consistency (1 percent max. passing a No. 200 sieve, to ensure uniform distribution throughout the GCL and minimal edge loss during handling and installation.

D. The cover geotextile shall be, at a minimum, a 6.0 oz/yd^2 non-woven geotextile. The base geotextile shall be, at a minimum, a 3.2 oz/yd^2 woven geotextile.

02320.6 Materials

A. Acceptable GCL products are Bentomat® ST, as manufactured by CETCO, 2870 Forbs Avenue, Hoffman Estates, Illinois 60192 USA (800-527-9948), or an engineer-approved equal.

B. The GCL shall meet, at a minimum, the properties shown in Table 1, Minimum Required Physical Properties of Geosynthetic Clay Liner.

C. The moisture content of the bentonite in the finished GCL shall be between 20 and 40 percent, to ensure uniform bentonite distribution, consistent needlepunch density, and adequate electrical conductivity to maximize leak location survey sensitivity.

D. GCL shall be needlepunch-reinforced, with a minimum peel strength of 3.5 lb/inch. To maximize large-displacement shear strength, GCL reinforcement shall be achieved solely through needlepunching, without any supplemental heat treatment.

E. The GCL shall have 10,000-hour test data for large-scale constant-load (creep) shear testing under hydrated conditions. The displacement shall be 0.11 in. or less at a constant shear load of 250 psf and a normal load of 500 psf.

F. The GCL shall have seam test data from an independent laboratory showing that the seam flow with a grooved cut in the nonwoven geotextile is less than 1 x 10^{-8} $m^3/m^2/s$ at 2 psi hydraulic pressure.

G. The minimum acceptable dimensions of full-size GCL panels shall be 150 feet in length.

H. A 6-inch overlap guideline shall be imprinted on both edges of the upper geotextile component of the GCL as a means for providing quality assurance of the overlap dimension. Lines shall be printed in easily visible, non-toxic ink.

Table 1
Minimum Required Physical Properties of Geosynthetic Clay Liner

MATERIAL PROPERTY	TEST METHOD	TEST FREQUENCY $ft^2(m^2)$	REQUIRED VALUES
Bentonite Swell Index[1]	ASTM D 5890	1 per 50 tonnes	24 ml/2g min.
Bentonite Fluid Loss[1]	ASTM D 5891	1 per 50 tonnes	18 ml max.
Bentonite Mass/Area[2]	ASTM D 5993	40,000 ft^2 (4,000 m^2)	0.75 lb/ft^2 (3.6 kg/m^2) min
GCL Tensile Strength[3]	ASTM D 6768	200,000 ft^2 (20,000 m^2)	30 lbs/in (53 N/cm) MARV
GCL Peel Strength[3]	ASTM D 6496	40,000 ft^2 (4,000 m^2)	3.5 lbs/in (6.1 N/cm) min
GCL Index Flux[4]	ASTM D 5887	Weekly	1×10^{-8} m^3/m^2/sec max
GCL Hydraulic Conductivity[4]	ASTM D 5887	Weekly	5×10^{-9} cm/sec max
GCL Hydrated Internal Shear Strength[5]	ASTM D 5321 ASTM D 6243	Periodic	500 psf (24 kPa) typ @ 200 psf

Notes

[1] Bentonite property tests performed at a bentonite processing facility before shipment to CETCO's GCL production facilities.

[2] Bentonite mass/area reported at 0 percent moisture content.

[3] All tensile strength testing is performed in the machine direction using ASTM D 6768. All peel strength testing is performed using ASTM D 6496.

[4] Index flux and permeability testing with deaired distilled/deionized water at 80 psi cell pressure, 77 psi headwater pressure and 75 psi tailwater pressure.

[5] Peak values measured at 200 psf normal stress for a specimen hydrated for 48 hours. Site-specific materials, GCL products, and test conditions must be used to verify internal and interface strength of the proposed design.

02320.7 Product Quality Documentation

The GCL manufacturer shall provide the Owner or other designated party with manufacturing QA/QC certifications for each shipment of GCL. The certifications shall be signed by a responsible party employed by the GCL manufacturer and shall include:

A. Certificates of analysis for the bentonite clay used in GCL production demonstrating compliance with the swell index and fluid loss values shown in Table 1, Minimum Required Physical Properties of Geosynthetic Clay Liner.

B. Manufacturer's test data for the finished GCL product demonstrating compliance with the values shown in Table 1, Minimum Required Physical Properties of Geosynthetic Clay Liner.

C. GCL lot and roll numbers supplied for the project (with corresponding shipping information).

02320.8 Product Labeling

A. Prior to shipment, the GCL manufacturer shall label each roll, identifying:

1. Manufacturer's name and address
2. Brand Product Code
3. Lot Number
4. Roll Number
5. Roll Length and width
6. Roll Weight

02320.9 Packaging

A. The GCL shall be wound around a rigid core whose diameter is sufficient to facilitate handling. The core is not necessarily intended to support the roll for lifting but should be sufficiently strong to prevent collapse during transit.

B. All rolls shall be labeled and bagged in packaging that is resistant to photodegradation by ultraviolet (UV) light.

02320.10 Accessory Bentonite

A. The granular bentonite sealing clay used for overlap seaming, penetration sealing and repairs shall be made from the same natural sodium bentonite as used in the GCL and shall be as recommended by the GCL manufacturer. Seaming of GCLs shall be conducted in accordance with the manufacturer's guidelines for each particular GCL.

02320.11 Shipping and Handling

A. The manufacturer assumes responsibility for initial loading the GCL. Shipping will be the responsibility of the party paying the freight. Unloading, on-site handling and storage of the GCL are the responsibility of the Contractor.

B. A visual inspection of each roll should be made during unloading to identify if any packaging has been damaged. Rolls with damaged packaging should be marked and set aside for further inspection. If the geotextile under the torn packaging sleeve is also torn, the outermost wrap of GCL on the roll should be unwound and discarded when the roll is installed. The roll should be marked accordingly so as to alert the Installer that the initial wrap should be cut away and discarded. Upon

inspection, at the time of installation, additional rolls may be required to be cut away and discarded. The packaging should be repaired prior to being placed in storage.

C. Rolls of GCL that are accidentally dropped and/or bent during unloading and/or transportation to the installation site should be marked and moved away from the storage site and/or installation site. These rolls will not be installed on the project.

D. The party responsible for unloading the GCL should contact the Manufacturer prior to shipment to ascertain the appropriateness of the proposed unloading methods and equipment.

02320.12 Storage

A. Storage of the GCL rolls shall be the responsibility of the Contractor. A dedicated storage area shall be selected at the job site that is away from high traffic areas and is level, dry and well drained.

B. Rolls should be stored in a manner that prevents sliding or rolling from the stacks and may be accomplished by the use of chock blocks. Rolls should be stacked at a height no higher than that at which the lifting apparatus can be safely handled (typically no higher than four).

C. All stored GCL materials and the accessory bentonite must be covered with a plastic sheet or tarpaulin until their installation.

D. The integrity and legibility of the labels shall be preserved during storage.

2320.13 GCL Placement

A. Any earthen surface upon which the GCL is installed shall be prepared and compacted in accordance with the Project Specifications and Drawings. The surface shall be smooth, firm, and unyielding, and free of:

1. Vegetation.
2. Construction Debris.
3. Sticks.
4. Sharp rocks.
5. Void spaces.
6. Ice.
7. Abrupt elevation changes.
8. Standing water.
9. Cracks larger than one-quarter inch (6 mm) in width.
10. Any other foreign matter that could contact the GCL.

B. Full length panels (150 feet long) will be used on all cell side slopes.

C. The Installer shall certify in writing that the surface on which the GCL will be installed is acceptable.

D. GCL rolls should be delivered to the working area of the site in their original packaging. Immediately prior to deployment, the packaging should be carefully removed without damaging the GCL. The orientation of the GCL (i.e., which side faces up) should be in accordance with the Engineer's recommendations.

E. Equipment which could damage the GCL shall not be allowed to travel directly on it. If the installation equipment causes rutting of the subgrade, the subgrade must be restored to its originally accepted condition before placement continues.

F. Care must be taken to minimize the extent to which the GCL is dragged across the subgrade in order to avoid damage to the bottom surface of the GCL. A temporary geosynthetic subgrade covering commonly known as a slip sheet or rub sheet may be used to reduce friction damage during placement.

G. The GCL panels shall be placed parallel to the direction of the slope.

H. All GCL panels should lie flat on the underlying surface, with no wrinkles or fold, especially at the exposed edges of the panels.

I. Only as much GCL shall be deployed as can be covered at the end of the working day with a geomembrane. The GCL shall not be left uncovered overnight. If the GCL is hydrated when no confining stress is present, it may be necessary to remove and replace the hydrated material. The project Engineer, CQA inspector, and GCL supplier should be consulted for specific guidance if premature hydration occurs.

02320.14 Anchorage

A. As directed by the Project Specifications and Drawings, the end of the GCL roll shall be placed in an anchor trench at the top of the slope or an equivalent runout design shall be utilized. When utilizing an anchor trench design, the front edge of the trench should be rounded so as to eliminate any sharp corners. Loose soil should be removed from the floor of the trench. The GCL should cover the entire trench floor but does not extend up the rear trench wall.

02320.15 Seaming

A. The GCL seams are constructed by overlapping their adjacent edges. Care should be taken to ensure that the overlap zone is not contaminated with loose soil or other debris.

B. The minimum dimension of the longitudinal overlap should be 6 inches. If the GCL is manufactured with a grooved cut in the nonwoven geotextile that allows bentonite to freely extrude into the longitudinal overlap then no

supplemental bentonite is required for this overlap. If the GCL does not have a grooved cut in the nonwoven geotextile longitudinal overlap, then bentonite-enhanced seams are required as described below.

C. End-of-roll overlapped seams should be constructed with a minimum overlap of 24 inches. Seams at the ends of the panels should be constructed such that they are shingled in the direction of the grade to prevent the potential for runoff flow to enter the overlap zone. End-of-roll overlapped seams require bentonite-enhanced seams as described below.

D. Bentonite-enhanced seams are constructed between the overlapping adjacent panels as follows. The underlying edge of the longitudinal overlap is exposed and then a continuous bead of granular sodium bentonite is applied along a zone defined by the edge of the underlying panel and the 6-inch line. The granular bentonite shall be applied at a **minimum** application rate of one quarter pound per lineal foot. A similar bead of granular sodium bentonite is applied at the end-of-roll overlap.

E. Cyclical wetting and drying of GCL covered only with a geomembrane can cause overlap separation. The leachate collection system layer (16 oz/yd^2 non-woven geotextile, leachate collection piping and the 24 inch leachate drainage layer) should be placed without delay to minimize the intensity of wet-dry cycling. If there is the potential for unconfined cyclic wetting and drying over an extended period of time, the longitudinal seam overlaps should be increased based on the Engineer's recommendations.

F. To avoid seam separation, the GCL should not be put in excessive tension by the weight or expansion of textured geomembrane on steep slopes.

02320.16 Damage Repair

A. Slopes flatter than or equal to 10H:1V: If the GCL is damaged (torn, punctured, perforated, etc.) during installation, it may be possible to repair it by cutting a patch to fit over the damaged area. The patch shall be obtained from a new GCL roll and shall be cut to size such that a minimum overlap of 24 inches is achieved around all of the damaged area. Granular bentonite or bentonite mastic should be applied around the damaged area prior to placement of the patch. An adhesive will be used to affix the patch in place so that it is not displaced during geomembrane or cover material placement.

If the damaged area is along the side of the panel or at the Installers option, the panel may be cut off above and below the damaged area and a horizontal seam constructed in accordance with Section 02320.15.

B. Slopes steeper than 10H:1V: Patches will not be allowed on the slopes exceeding a 10H:1V slope.

02320.17 Cover Placement

A. Only as much GCL shall be deployed as can be covered at the end of the day with a properly installed (all seams completed) geomembrane.

B. The leachate collection system layer (16 oz/yd^2 non-woven geotextile, leachate collection piping and the 24 inch leachate drainage layer) should be placed on top of the geomembrane without delay to minimize the intensity of wet-dry cycling.

C. The 24 inch leachate drainage layer shall be pushed up slopes, not down slopes, to minimize tensile forces on the GCL.

D. Although direct vehicular contact with the GCL is to be avoided, lightweight, low ground pressure vehicles (such as 4-wheel all-terrain vehicles) may be used to facilitate the installation of any geosynthetic material placed over the GCL. The GCL supplier or CQA engineer should be contacted with specific recommendations on the appropriate procedures in this situation.

E. When a textured geomembrane is installed over the GCL, a temporary geosynthetic covering known as a slip sheet or rub sheet will be used to minimize friction during placement and to allow the textured geomembrane to be more easily moved into its final position.

02320.18 Geosynthetic Clay Liner Warranty

The installation of the Geosynthetic Clay Liner shall be warranted against defects in workmanship for a period of 1 year from the date of substantial project completion.

END OF SECTION

SECTION 13
P.T.C. DRAW

NOTE:
PROPOSED CONTOURS WITHIN PHASE 3 ARE TOP OF SUBGRADE ELEVATIONS.. (SEE LEGEND FOR ADDITIONAL CONTOUR DESCRIPTION)

SCALE: 1"=60'

SEASONAL HIGH WATER TABLE ELEVATIONS, TYP. (SEE FIGURE 07 OF DESIGN HYDROGEOLOGIC REPORT PREPARED BY BLE, INC.)

PROPOSED PHASE 3 SOIL STOCKPILE AREA

PROPOSED 20' WIDE GRAVEL ACCESS ROAD

PROPOSED PHASE 3 & 4 STOCKPILE

PROPOSED 20' WIDE GRAVEL ACCESS ROAD

EXISITING LEACHATE LAGOON

EXISITING CONCRETE FLUME

TEMPORARY LINER EDGE #1

TEMPORARY LINER EDGE #2

PERMANENT LINER EDGE #1

PERMANENT LINER EDGE #1

PHASE 4

PHASE 3

PHASE 1
Cell 1 Clay Grades

PHASE 1
Cell 4 Clay Grades

PHASE 2
Clay Grades

CONNECT PROPOSED PRIMARY GEOMEMBRANE TO EXISTING PHASE 1 GEOMEMBRANE

CONNECT PROPOSED PRIMARY GEOMEMBRANE TO EXISTING PHASE 1 GEOMEMBRANE

CONNECT PROPOSED PRIMARY GEOMEMBRANE TO EXISTING PHASE 2 GEOMEMBRANE

NOTES:
1. EXISTING SOLID CONTOURS SHOWN WITHIN PHASE 1&2 ARE APPROXIMATE ONLY. CONTRACTOR TO VERIFY ELEVATIONS IN FIELD PRIOR TO CONSTRUCTION.
⚠2. PROPOSED CONTOURS SHOWN WITHIN PHASE 3 WASTE LIMITS REPRESENT TOP OF SUBGRADE ELEVATIONS, EXCEPT IF ALTERNATE BASE LINER IS USED, THEN SUBGRADE IS 6" ABOVE GRADES SHOWN.
3. SEE SHEET C5 FOR STORMWATER PIPE INFORMATION.

LEGEND

- EXISTING CONTOUR
- PROPOSED GRADING
- GROUNDWATER CONTOUR
- BEDROCK
- PROPOSED STORM DRAIN
- EXISTING STORM DRAIN
- PHASE LINE
- CROSS-SECTION ALIGNMENT

NO.	DATE	BY	REVISION DESCRIPTION
⚠	9/11/09	KS	REVISED FOR ALTERNATE BASE LINER
1	2/27/09	KS	NCDENR LTR DATED JANUARY 27, 2009

McGill ASSOCIATES
ENGINEERING-PLANNING-FINANCE
55 BROAD STREET ASHEVILLE, NC PH. (828) 252-0575

CHARLES D. PHILLIPS
SEAL 23574
ENGINEER
NORTH CAROLINA

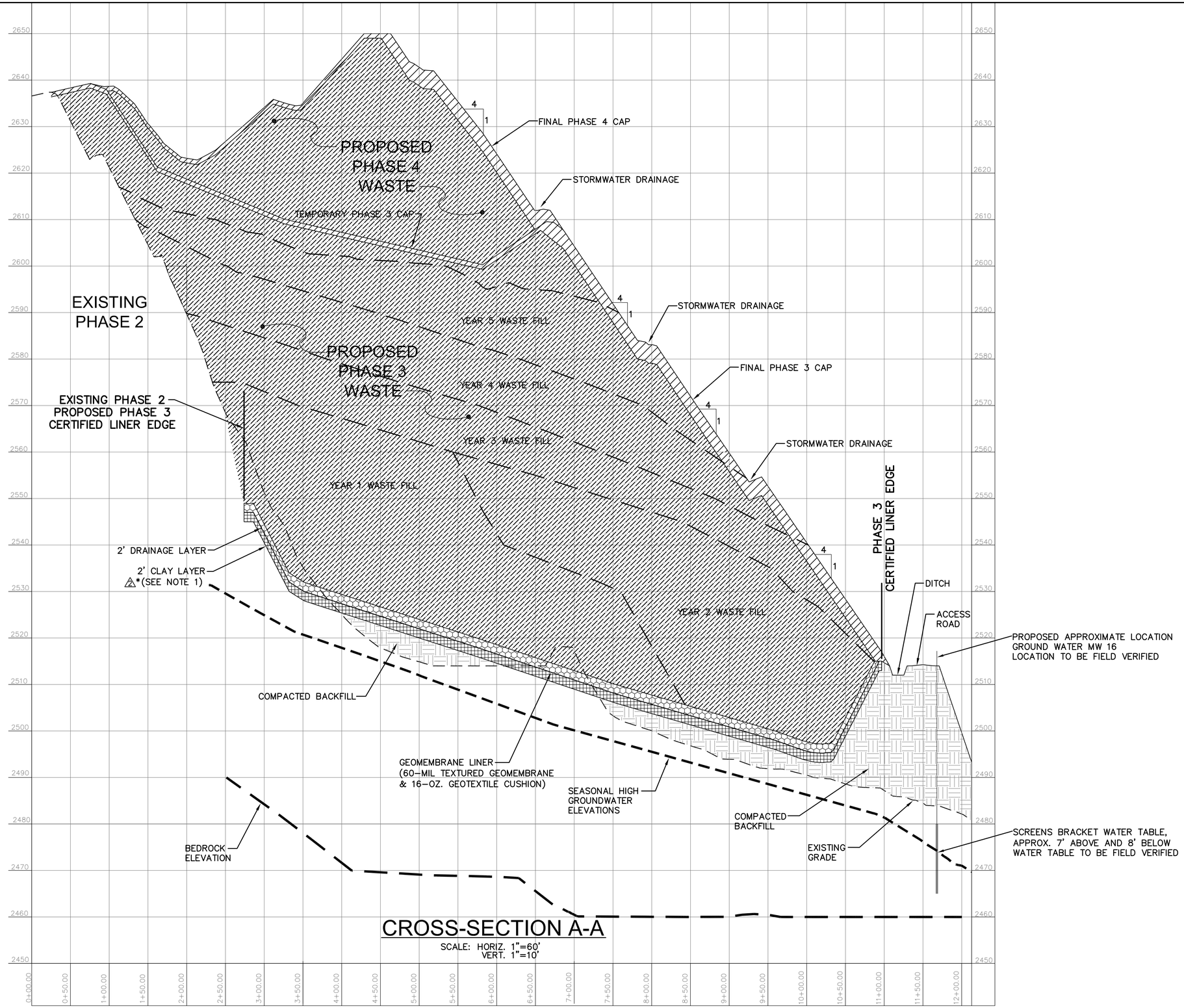
WHITE OAK MSW LANDFILL
PERMIT TO CONSTRUCT MSW PHASES 3 & 4
HAYWOOD COUNTY

HAYWOOD COUNTY, NORTH CAROLINA

JOB NO.: 07518
DATE: SEPTEMBER 2008
SCALE: AS NOTED
DESIGNED BY: DP,JH,KS
CADD BY: DP,JH,KS
DESIGN REVIEW: _____
CONST. REVIEW: _____
Q:\Jmp\07518\Permit-To-Construct\07C-Rev for 02-2-09\07518-C3A-Phase-3-Subgrade.dwg

PHASE 3 SUBGRADE ELEVATIONS

SHEET
C3A



CROSS-SECTION A-A

SCALE: HORIZ. 1"=60'
VERT. 1"=10'

△ NOTE 1:
IN LIEU OF 24" OF COMPACTED CLAY AT A MAXIMUM PERMEABILITY = $1X10^{-7}$cm/sec, AN ALTERNATE BASE LINER CONSISTING OF 18" OF COMPACTED CLAY AT MAXIMUM PERMEABILITY = $1X10^{-5}$cm/sec AND A GCL WITH A MAXIMUM PERMEABILITY = $5X10^{-9}$cm/sec MAY BE USED, AS SHOWN ON SHEET D2.

NO.	DATE	BY	REVISION DESCRIPTION
△2	9/11/09	KS	REVISED FOR ALTERNATE BASE LINER
1	2/27/09	KS	NCDENR LTR DATED JANUARY 27, 2009

McGill ASSOCIATES
ENGINEERING·PLANNING·FINANCE
55 BROAD STREET ASHEVILLE, NC PH. (828) 252-0575

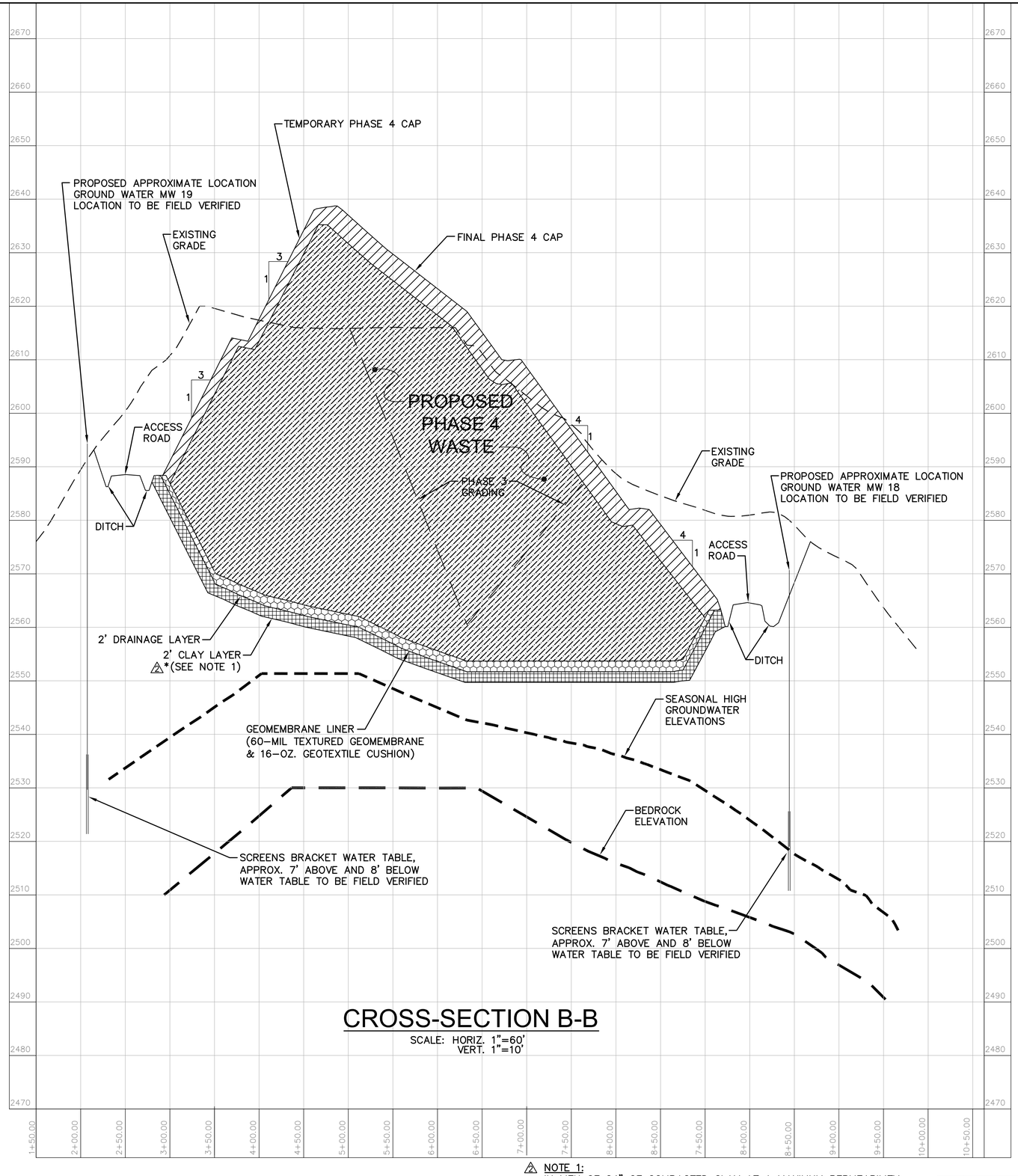
CHARLES K. KELLY SEAL 23574 ENGINEER REGISTERED PROFESSIONAL

WHITE OAK MSW LANDFILL
PERMIT TO CONSTRUCT
MSW PHASES 3 & 4
HAYWOOD COUNTY
HAYWOOD COUNTY, NORTH CAROLINA

JOB NO.: 07518
DATE: SEPTEMBER 2008
SCALE: AS NOTED
DESIGNED BY: DP, JH, KS
CADD BY: DP, JH, KS
DESIGN REVIEW: ———
CONST. REVIEW: ———
Q:\Mcgill\07518\Permit-To-Construct\PTC-Rev 1a (02-3-09)\07518-C-22-Cross-Section-A4.dwg

CROSS-SECTION A-A

SHEET
C22



CROSS-SECTION B-B

SCALE: HORIZ. 1"=60'
VERT. 1"=10'

⚠2 NOTE 1:
IN LIEU OF 24" OF COMPACTED CLAY AT A MAXIMUM PERMEABILITY = $1X10^{-7}$cm/sec, AN ALTERNATE BASE LINER CONSISTING OF 18" OF COMPACTED CLAY AT MAXIMUM PERMEABILITY = $1X10^{-5}$cm/sec AND A GCL WITH A MAXIMUM PERMEABILITY = $5X10^{-9}$cm/sec MAY BE USED, AS SHOWN ON SHEET D2.

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McGill ASSOCIATES
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55 BROAD STREET ASHEVILLE, NC PH. (828) 252-0575

JOB NO.: 07518
DATE: SEPTEMBER 2008
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CADD BY: DP,JH,KS
DESIGN REVIEW: _____
CONST. REVIEW: _____
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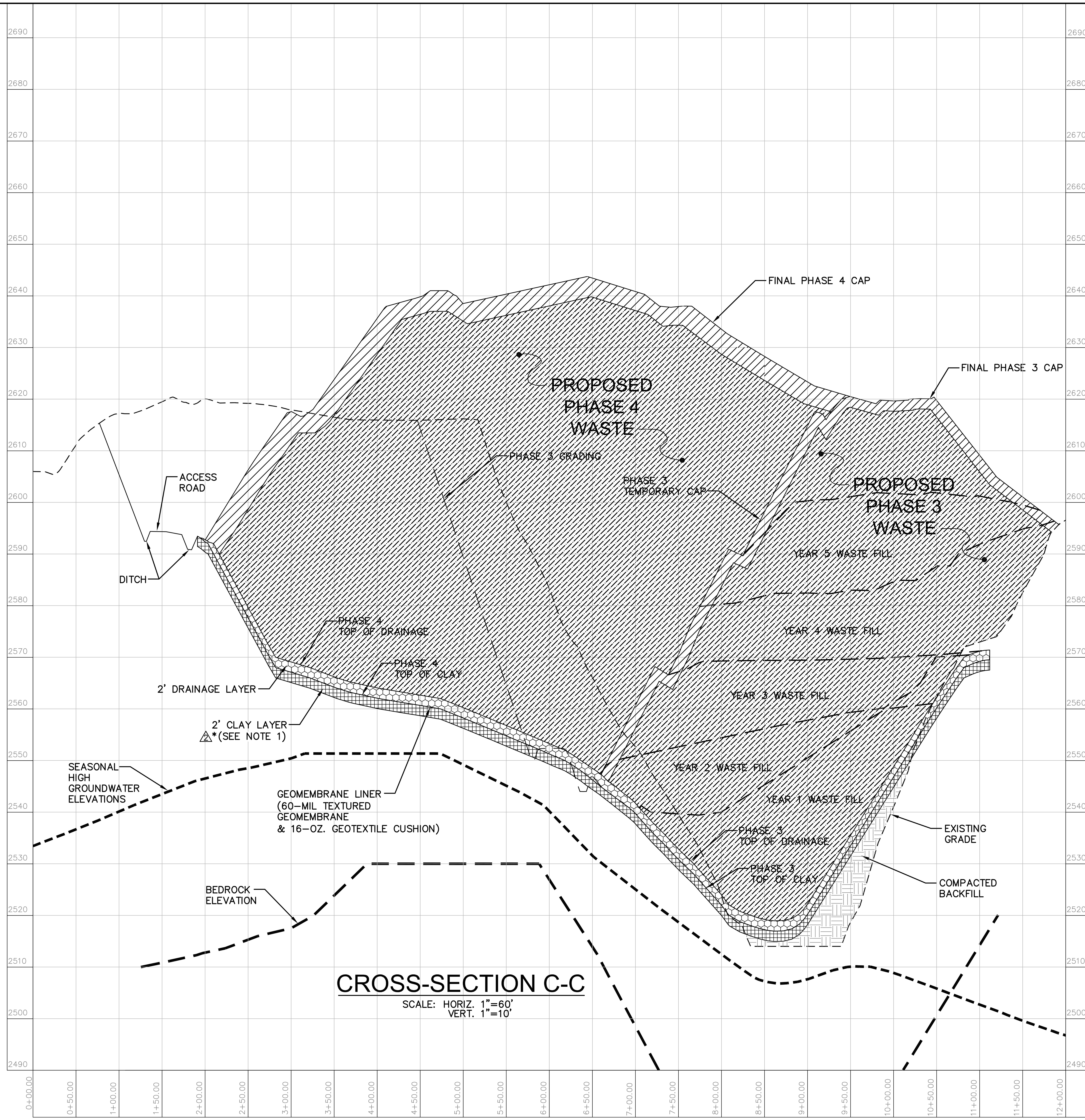
WHITE OAK MSW LANDFILL
PERMIT TO CONSTRUCT
MSW PHASES 3 & 4
HAYWOOD COUNTY
HAYWOOD COUNTY, NORTH CAROLINA

CROSS-SECTION B-B

SHEET
C23



CROSS-SECTION C-C

SCALE: HORIZ. 1"=60'
VERT. 1"=10'

NOTE 1:
IN LIEU OF 24" OF COMPACTED CLAY AT A MAXIMUM PERMEABILITY = $1X10^{-7}$cm/sec, AN ALTERNATE BASE LINER CONSISTING OF 18" OF COMPACTED CLAY AT MAXIMUM PERMEABILITY = $1X10^{-5}$cm/sec AND A GCL WITH A MAXIMUM PERMEABILITY = $5X10^{-9}$cm/sec MAY BE USED, AS SHOWN ON SHEET D2.

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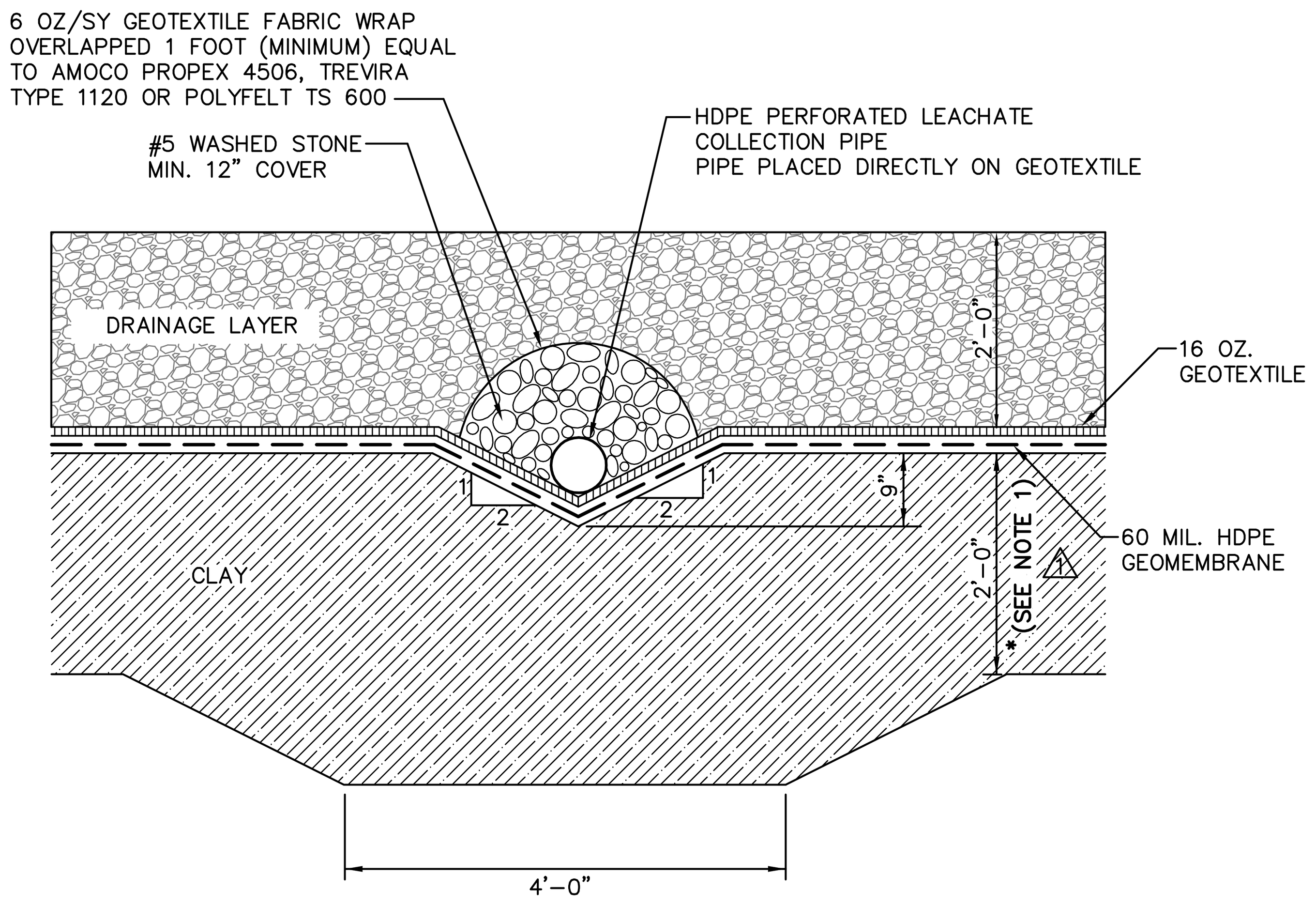
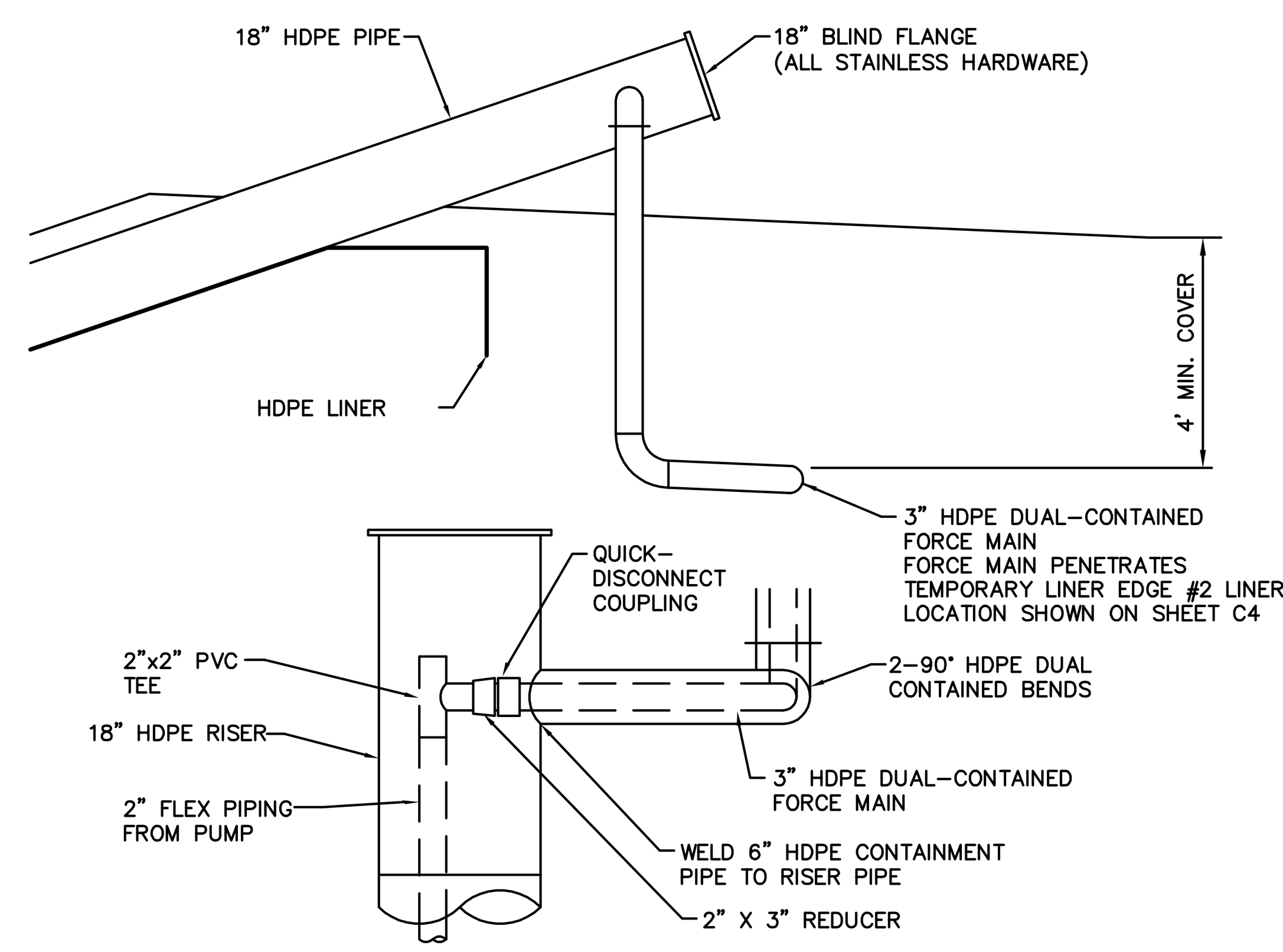
DESIGN REVIEW:
CONST. REVIEW:

CROSS-SECTION C-C

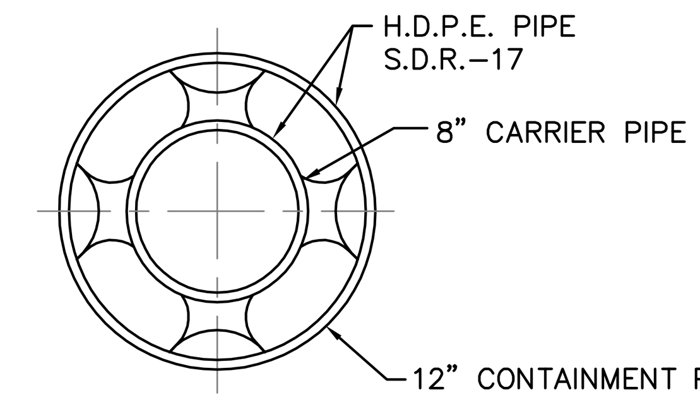
SHEET
C24



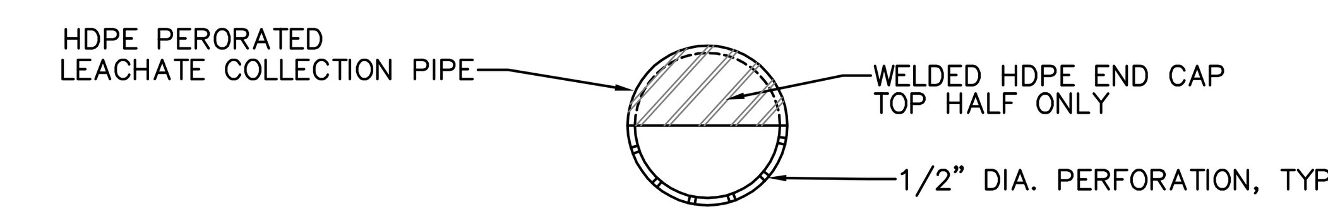
LEACHATE COLLECTION PIPE



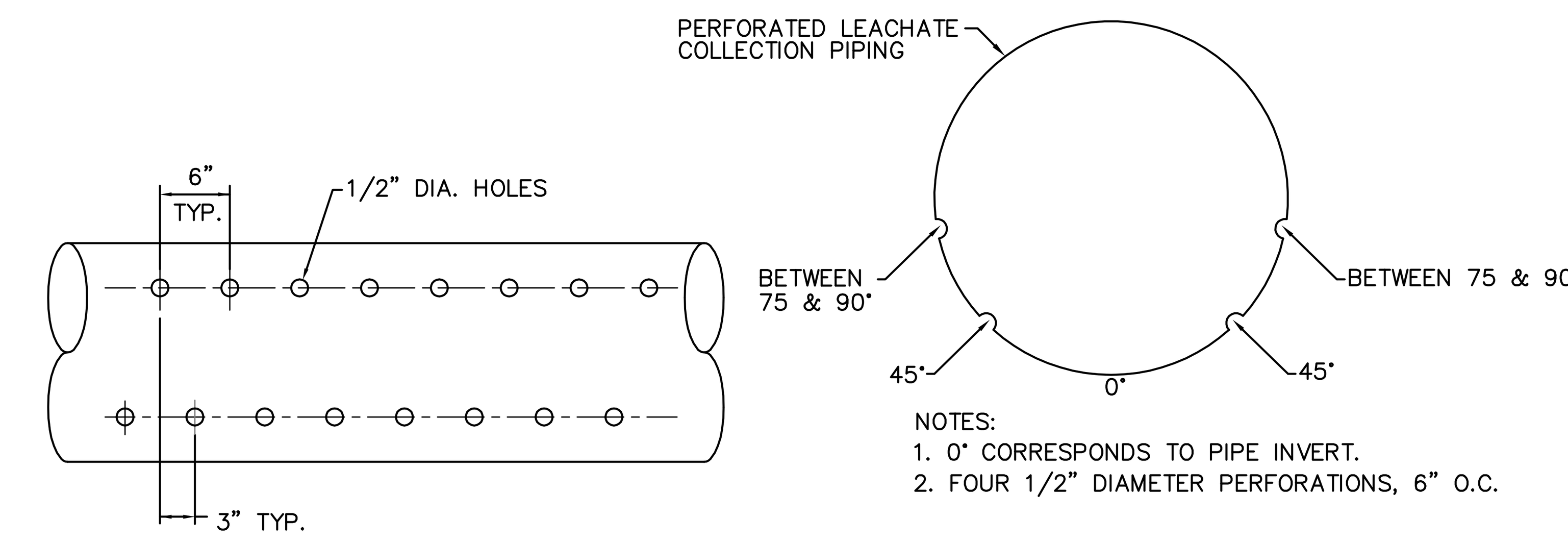
FORCE MAIN CONNECTION DETAILS



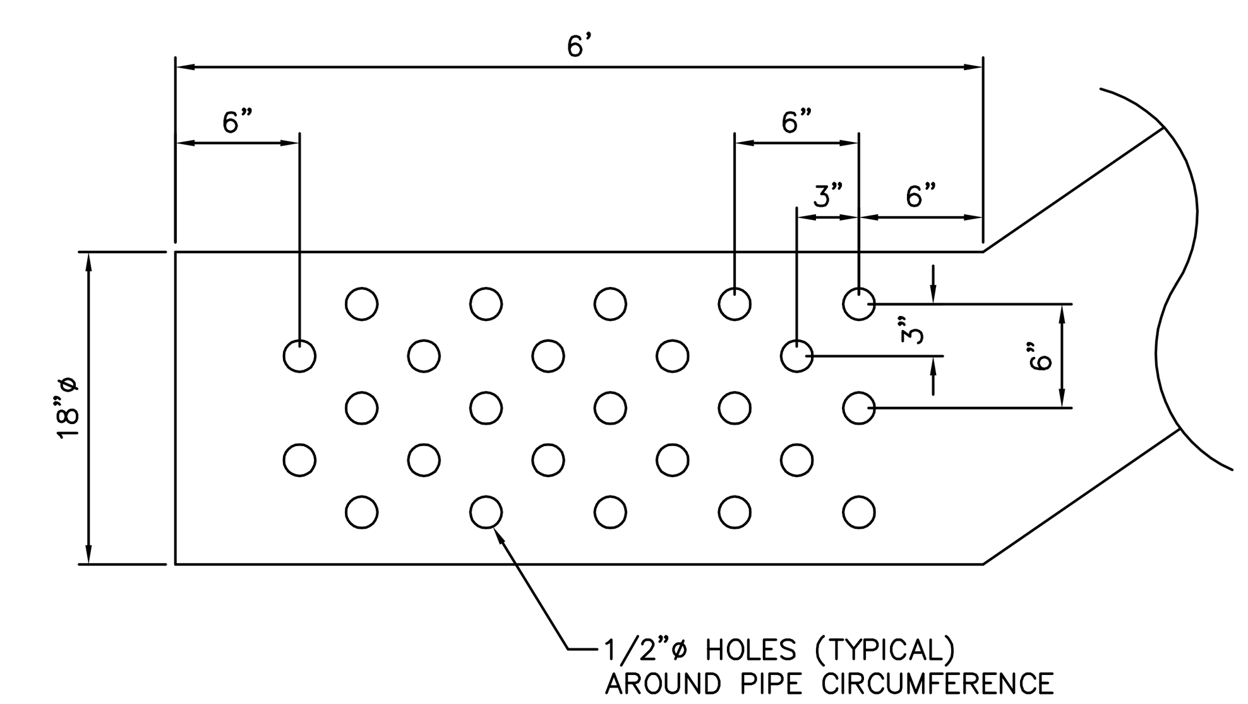
DUAL CONTAINED GRAVITY PIPE



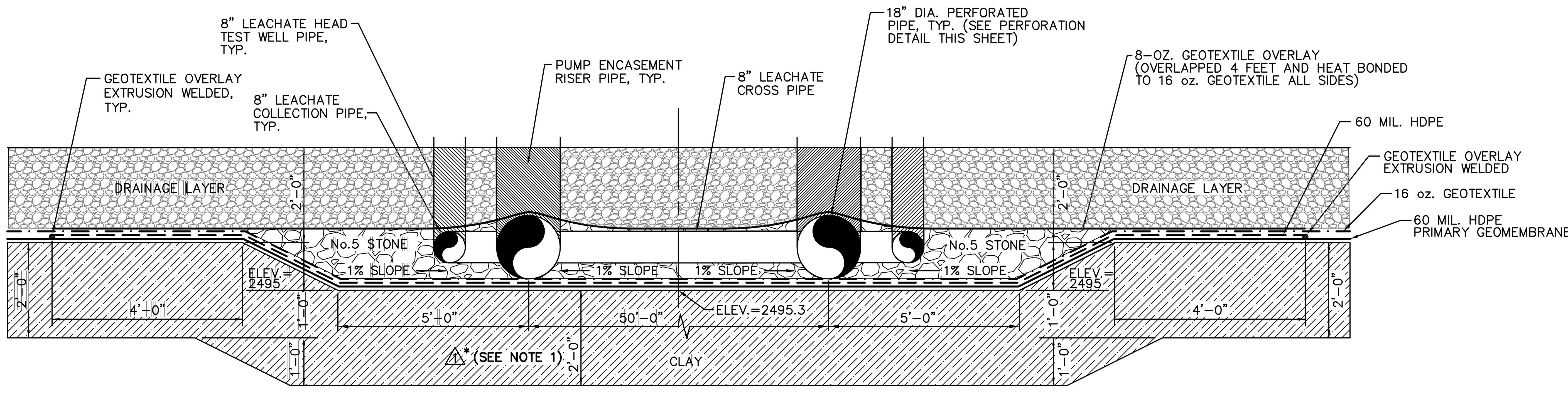
TYPICAL END SECTION
LEACHATE COLLECTION PIPE @ SUMP



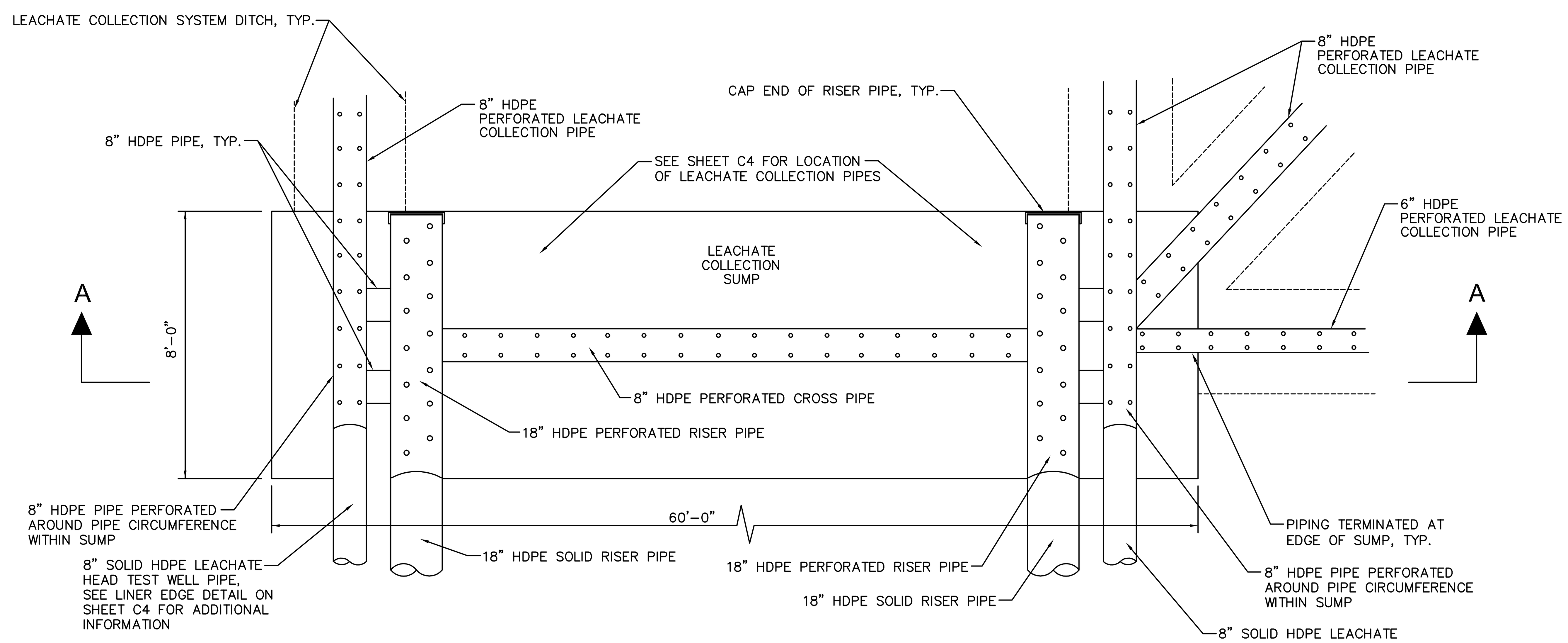
PERFORATED PIPE DETAIL
PERFORATION PATTERN DETAIL
LEACHATE COLLECTION SYSTEM PIPING



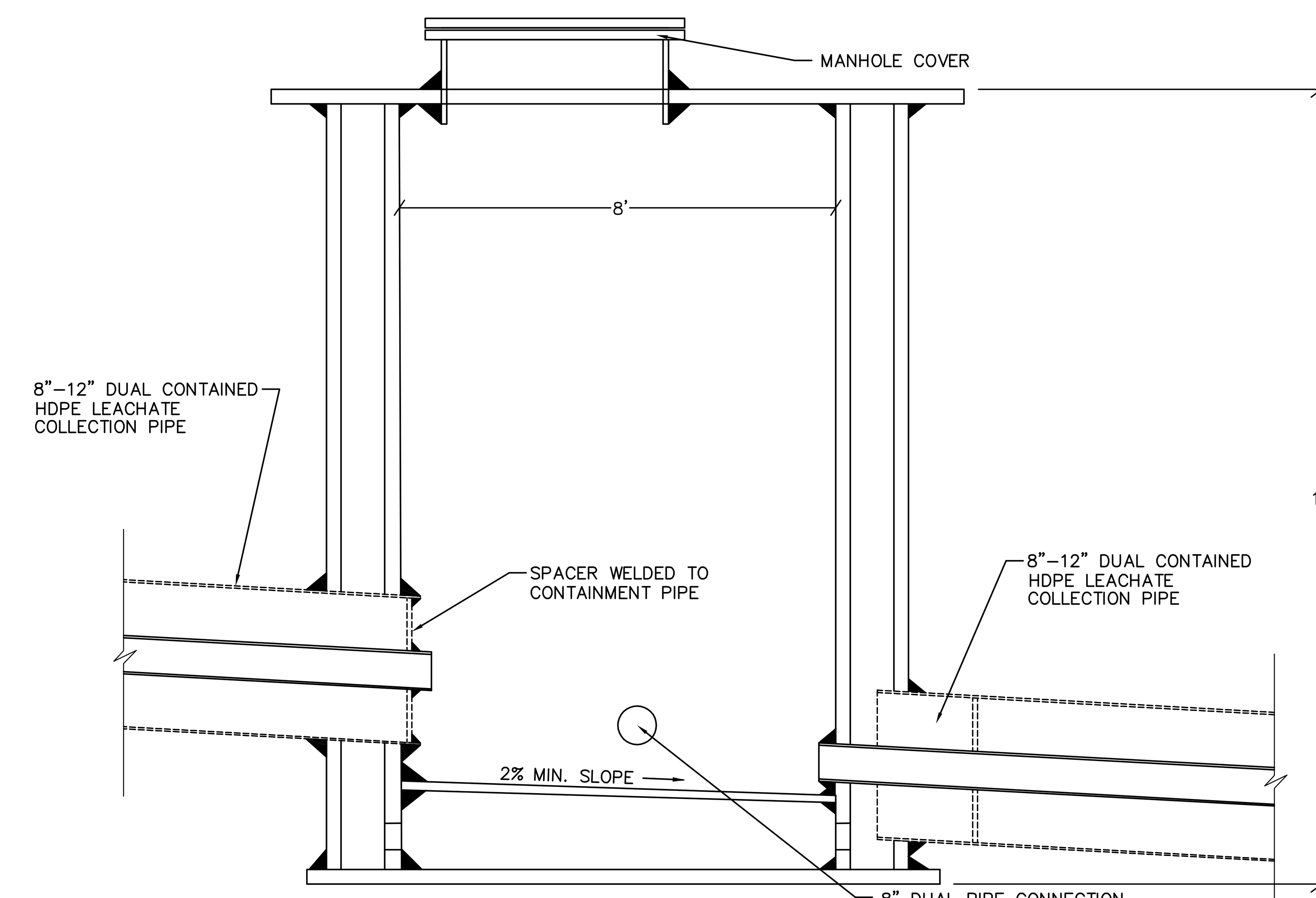
18" PIPE PERFORATION



PUMP STATION/RISER PIPE (SECTION A-A)
N.T.S.



LEACHATE COLLECTION PIPING
TERMINATION @ SUMP
N.T.S.



DUAL CONTAINED SUMP # 2
ELEVATION VIEW
N.T.S.

⚠ NOTE 1:
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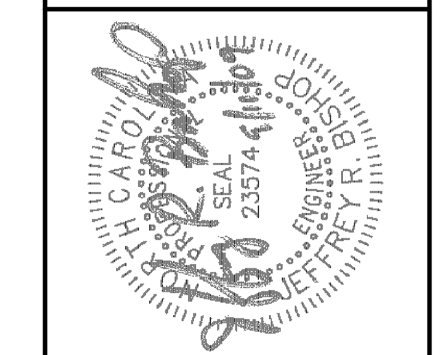
ENGINEERING·PLANNING·FINANCE
55 BROAD STREET ASHEVILLE, NC PH. (828) 252-0575

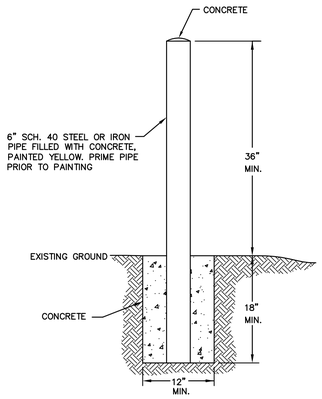


WHITE OAK MSW LANDFILL
PERMIT TO CONSTRUCT
MSW PHASES 3 & 4
HAYWOOD COUNTY
HAYWOOD COUNTY, NORTH CAROLINA

JOB NO.: 07518
DATE: SEPTEMBER 2008
SCALE: AS NOTED
DESIGNED BY: DP,JH,KS
CADD BY: DP,JH,KS
DESIGN REVIEW:
CONST. REVIEW:

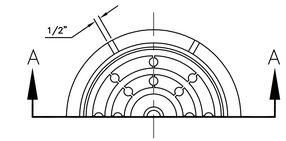
MISCELLANEOUS DETAILS

SHEET
D1

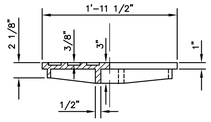


BOLLARD DETAIL

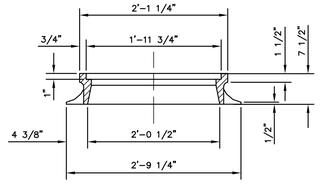
REVISION DATE - JANUARY 2, 2007



HALF PLAN OF MANHOLE RING & COVER



SECTION A-A MANHOLE COVER

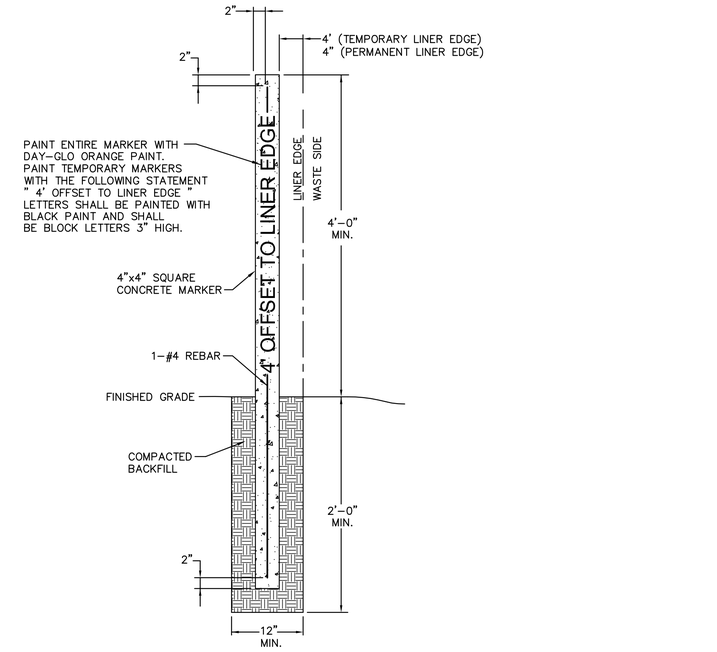


SECTION A-A MANHOLE RING

NOTE: TRAFFIC BEARING WATERTIGHT RING AND COVER. MINIMUM WEIGHT 315 POUNDS

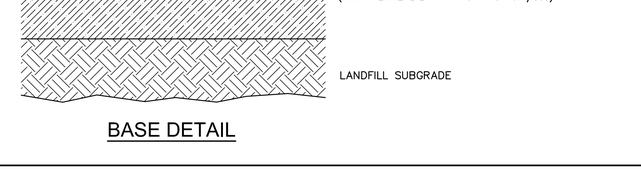
MANHOLE RING & COVER

REVISION DATE - JANUARY 2, 2007

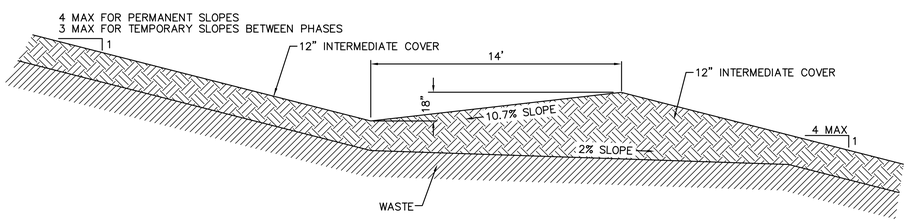


NOTES:
1. LINER EDGE MARKERS INSTALLED ALONG LINER EDGE AT 200' INTERVALS

PERMANENT/TEMPORARY LINER EDGE MARKER DETAIL

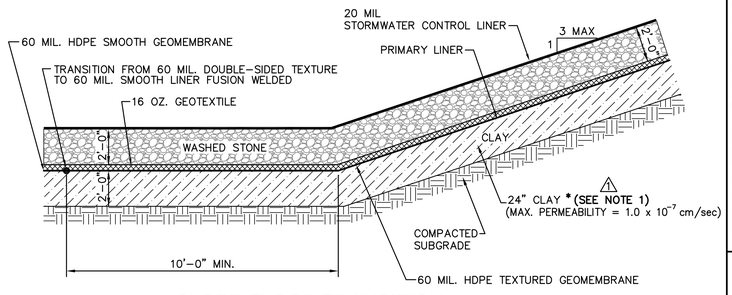


ALTERNATE BASE LINER DETAIL ⚠



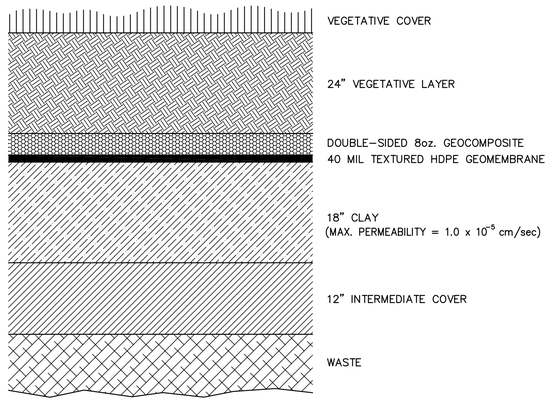
NOTE: FOR FINAL SLOPES SEE CAP DETAIL THIS SHEET FOR MATERIALS ABOVE 12" INTERMEDIATE COVER

CAP TERRACE DETAIL

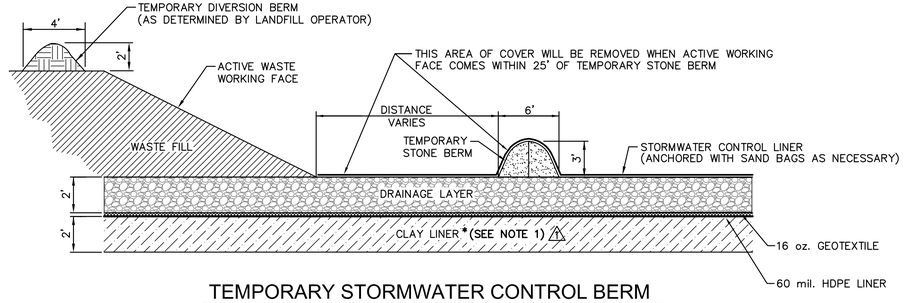


SLOPE-FLOOR TRANSITION (AT BOTTOM OF LANDFILL)

BASE DETAIL



CAP DETAIL



TEMPORARY STORMWATER CONTROL BERM

NO.	DATE	BY	REVISION DESCRIPTION
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McGill ASSOCIATES
ENGINEERING·PLANNING·FINANCE
55 BROAD STREET ASHEVILLE, NC PH. (828) 252-0575

CARL E. JAMISON 23574 REGISTERED PROFESSIONAL ENGINEER NORTH CAROLINA

WHITE OAK MSW LANDFILL
PERMIT TO CONSTRUCT
MSW PHASES 3 & 4
HAYWOOD COUNTY
HAYWOOD COUNTY, NORTH CAROLINA

JOB NO.: 07518
DATE: SEPTEMBER 2008
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CONST. REVIEW: _____
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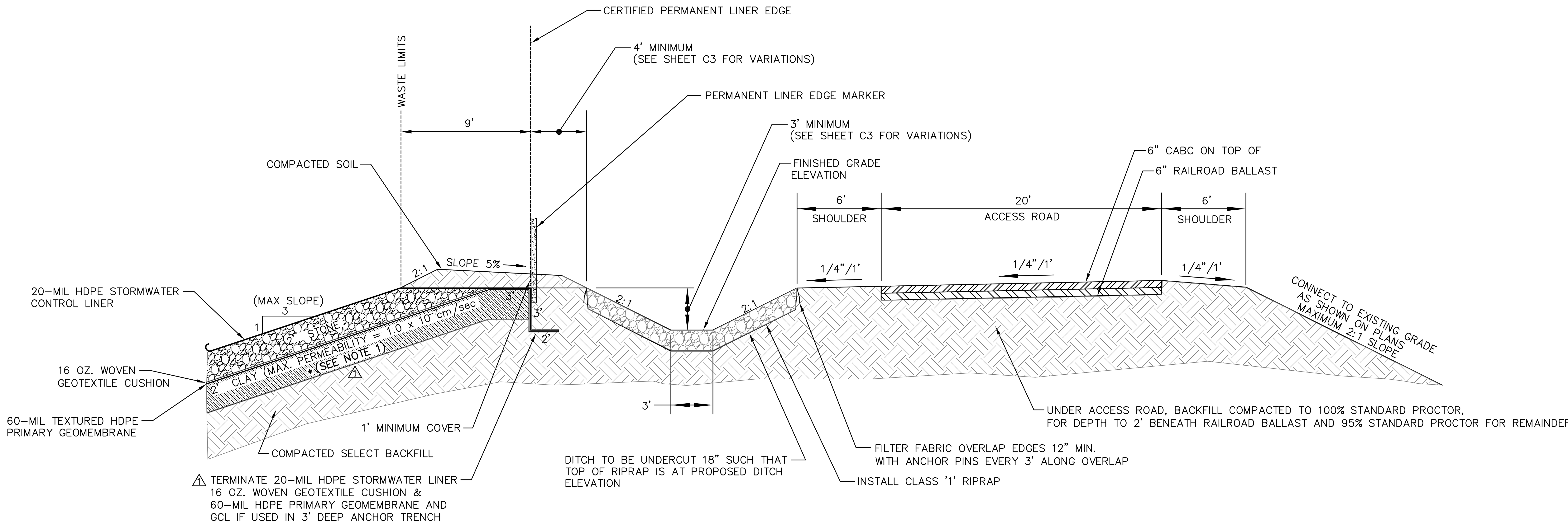
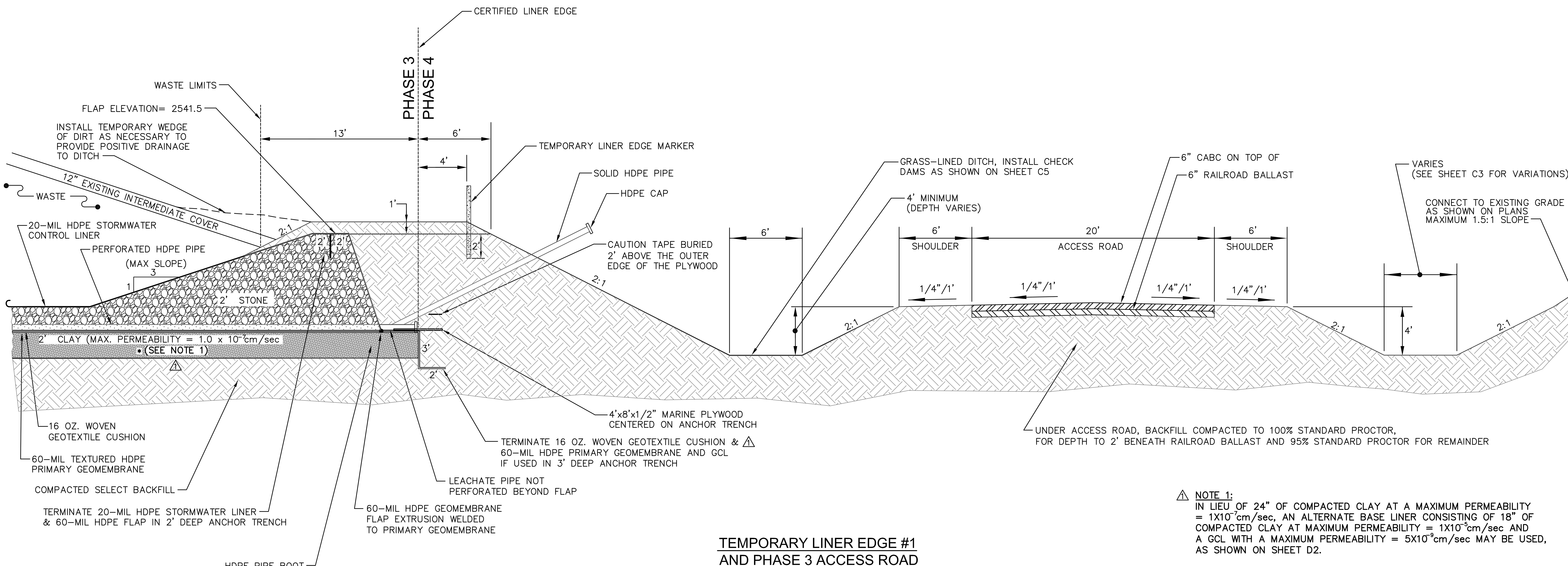
MISCELLANEOUS DETAILS

SHEET
D2



PERMANENT LINER EDGE #1

NTS



TEMPORARY LINER EDGE #1
AND PHASE 3 ACCESS ROAD

NTS

NOTE 1:
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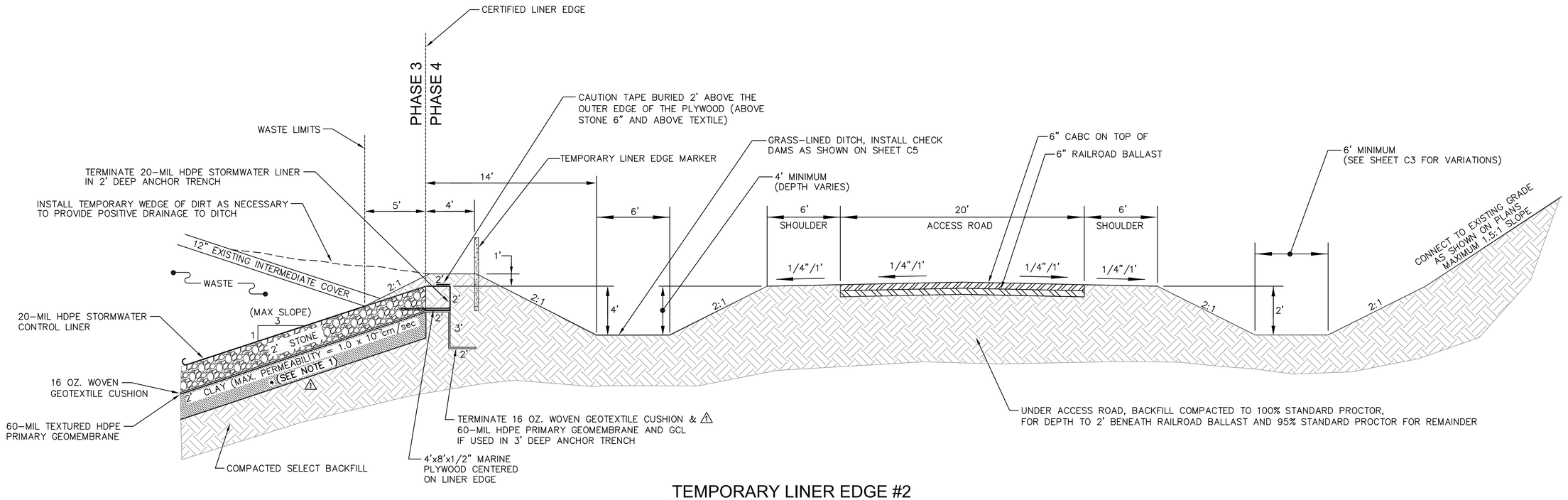
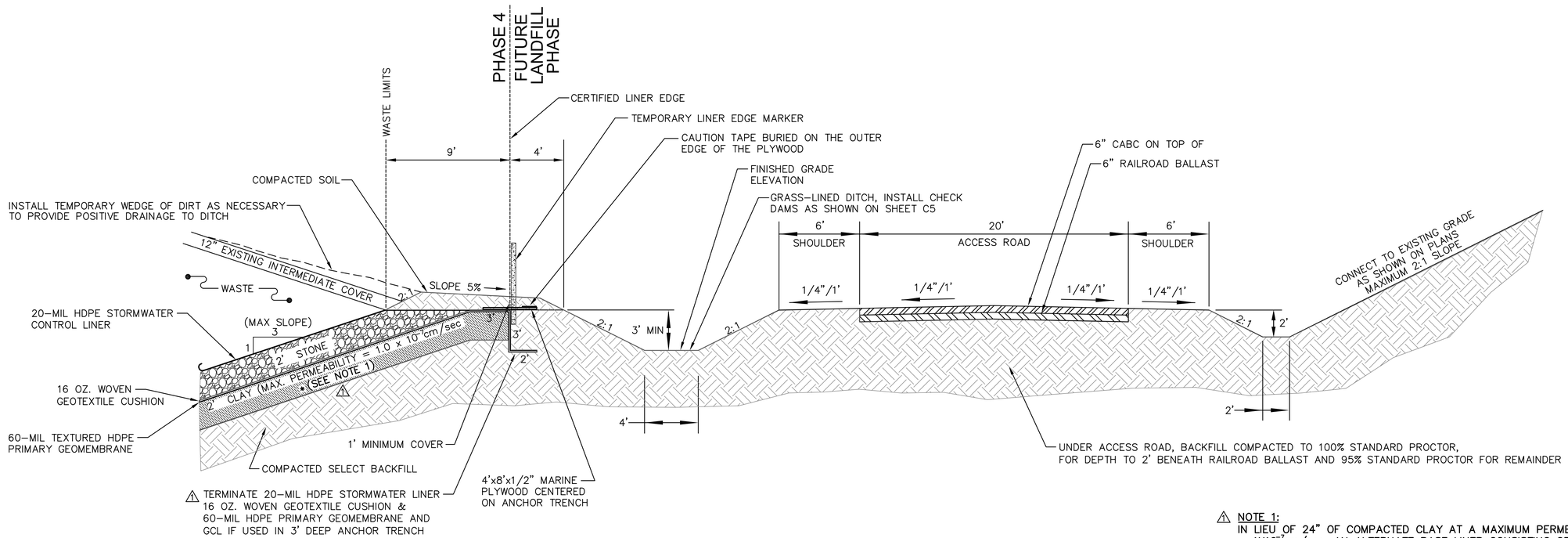
MISCELLANEOUS DETAILS

SHEET
D3



TEMPORARY LINER EDGE #2 AND PHASE 3 ACCESS ROAD

NTS



TEMPORARY LINER EDGE #3 AND PHASE 4 ACCESS ROAD

NTS

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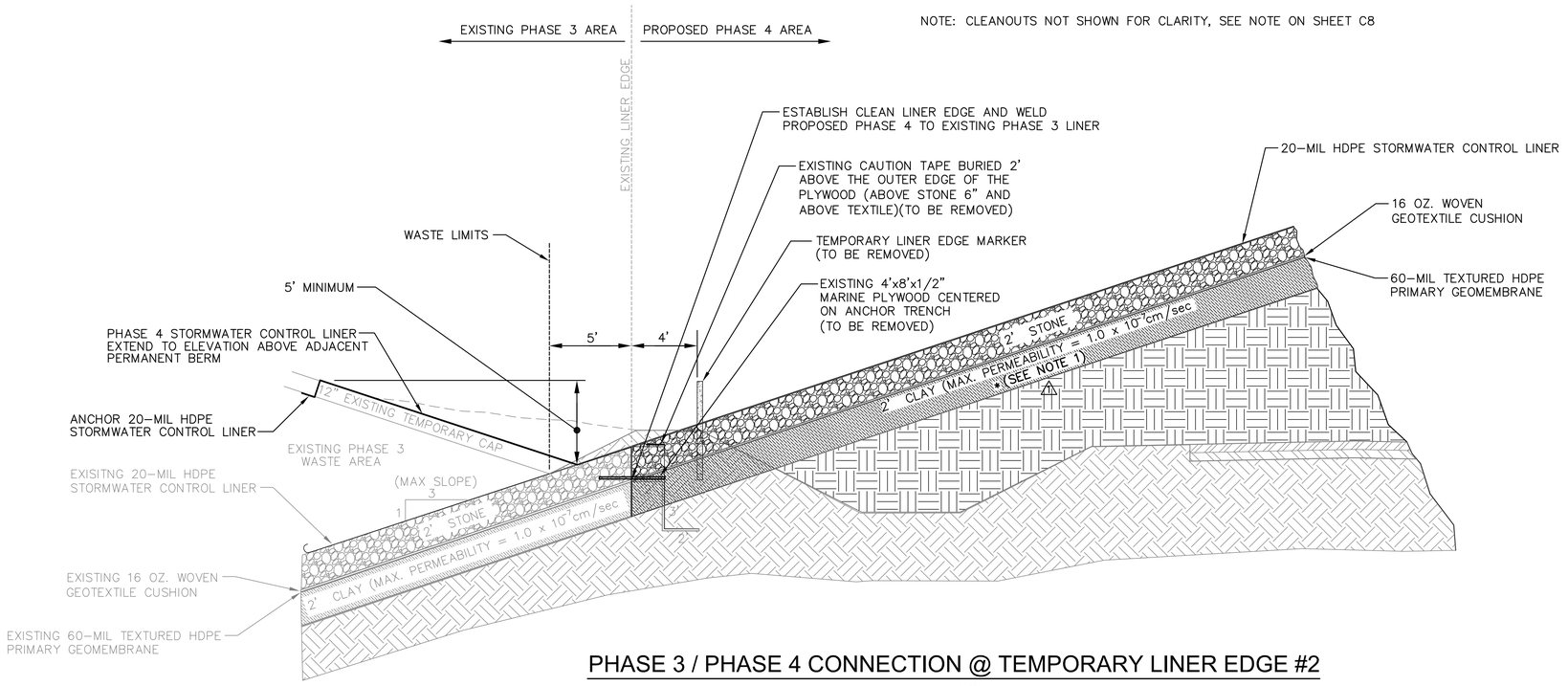
MISCELLANEOUS DETAILS

SHEET
D4



PHASE 3 / PHASE 4 CONNECTION @ TEMPORARY LINER EDGE #2

NTS

NOTE: CLEANOUTS NOT SHOWN FOR CLARITY, SEE NOTE ON SHEET C8

PROCEDURES FOR CONNECTION TO EXISTING LINER

1. REMOVE EXCESS SOIL BACKFILL ALONG EXISTING LINER EDGE TO PROVIDE ACCESS TO CUT AND REMOVE EXISTING FLAP.

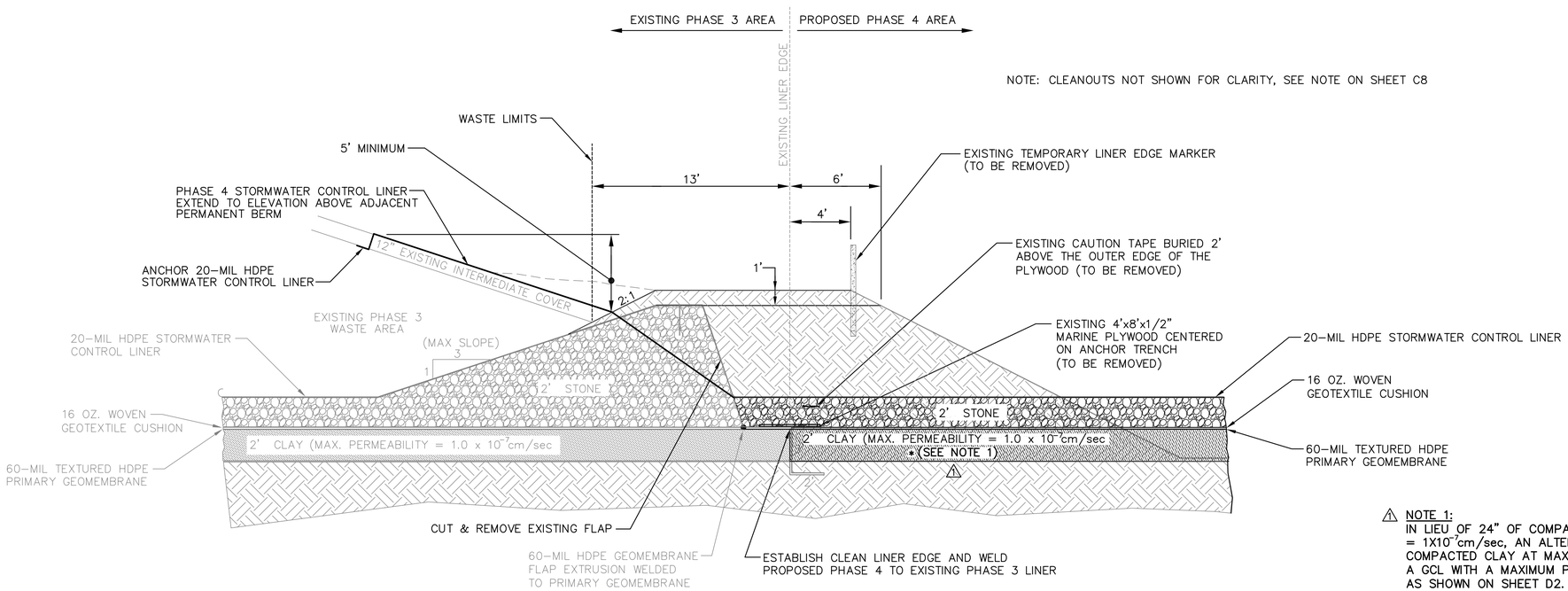
2. CONSTRUCT PHASE 4 SUBGRADE.

3. REMOVE EXISTING MARINE PLYWOOD AND FOLD BACK EXISTING PHASE 3 GEOMEMBRANE.

4. CONSTRUCT PHASE 4 CLAY LAYER, ENSURING SEAMLESS CONNECTION TO EXISTING PHASE 3 CLAY GRADES.

5. FOLLOWING APPROVAL OF PHASE 4 CLAY GRADES, INSTALL NEW HDPE LINER AND WELD TO EXISTING PHASE 3 LINER. THE CONTRACTOR MUST CREATE A CLEAN EDGE OF THE EXSITING LINER, FREE OF DIRT AND WRINKLES PRIOR TO WELDING THE NEW LINER.

6. OBTAIN FINAL CQA APPROVAL OF NEW LINER PRIOR TO INSTALLING DRAINAGE LAYER.



PHASE 3 / PHASE 4 CONNECTION @ TEMPORARY LINER EDGE #1

NTS

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CHARLES T. YOUNG 23574 ENGINEER LICENSE SEAL NORTH CAROLINA REGISTERED

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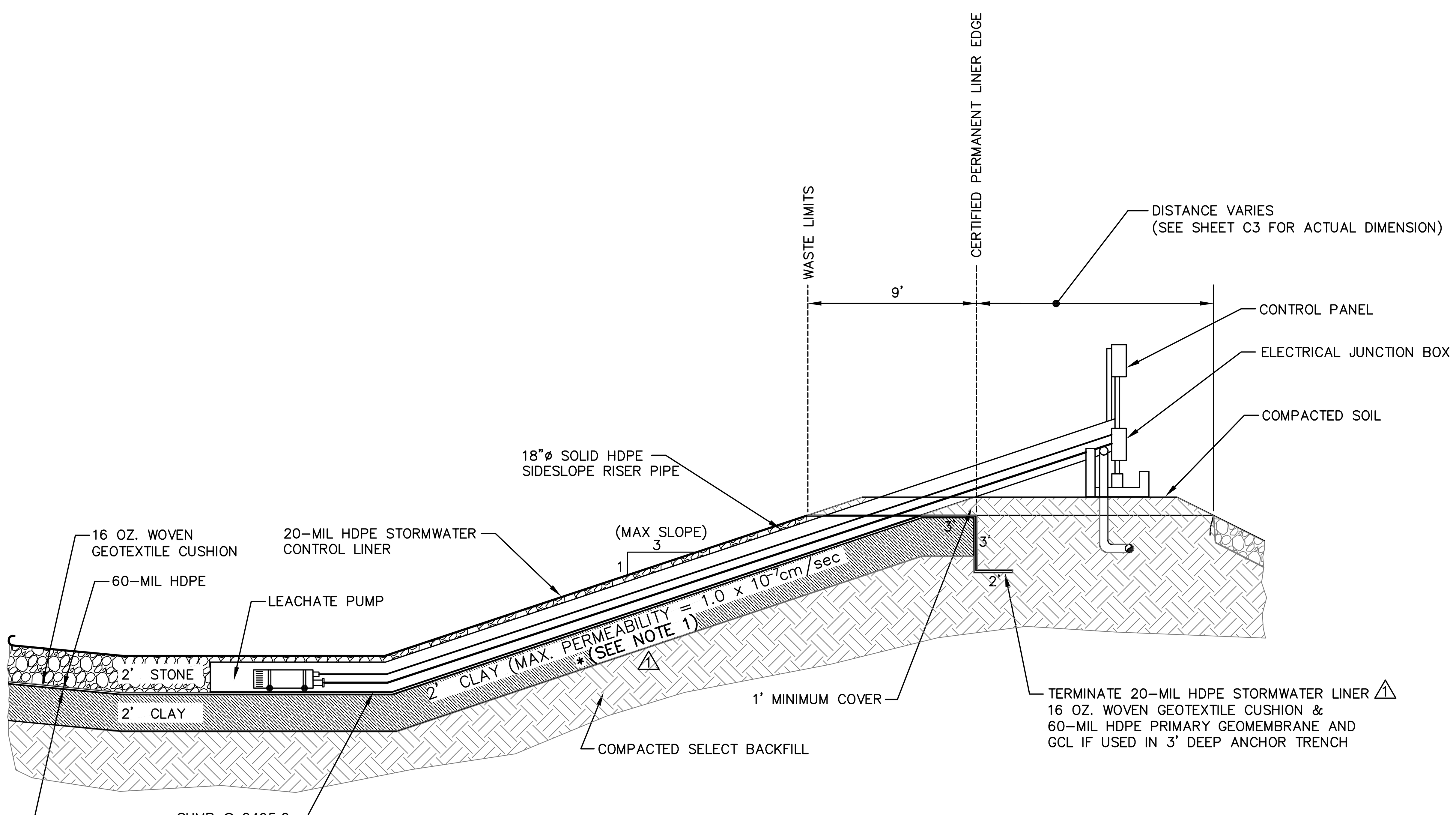
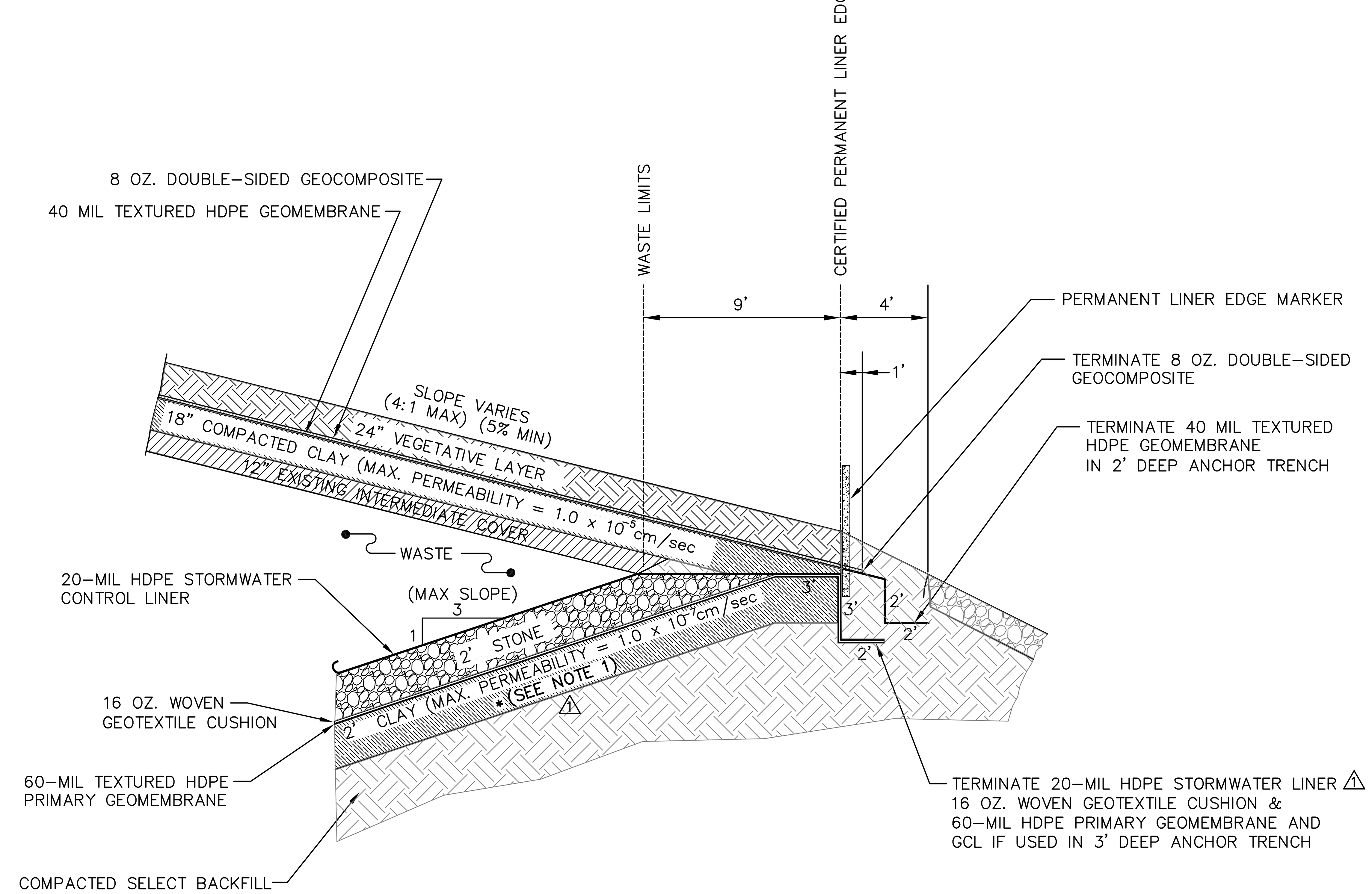
MISCELLANEOUS DETAILS

SHEET
D5



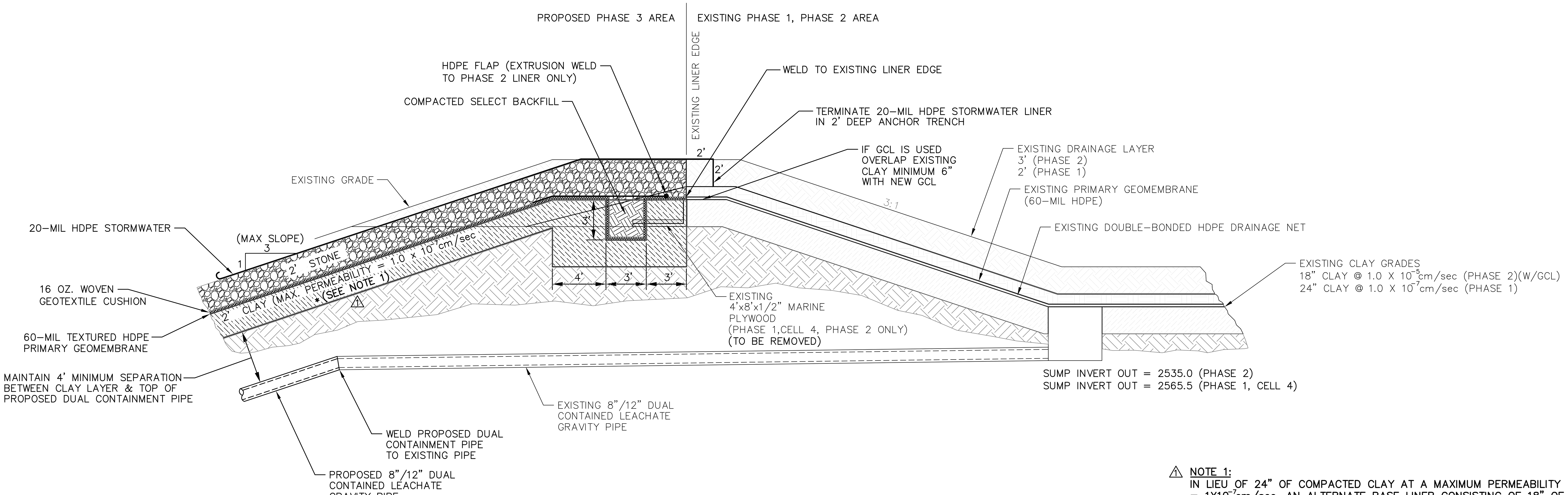
TYPICAL PUMP STATION/RISER PIPE DETAIL

NTS



FINAL FILL @ PERMANENT LINER EDGE #1

NTS



CONNECTION TO EXISTING PHASE 1 & PHASE 2 LINER EDGE

NTS

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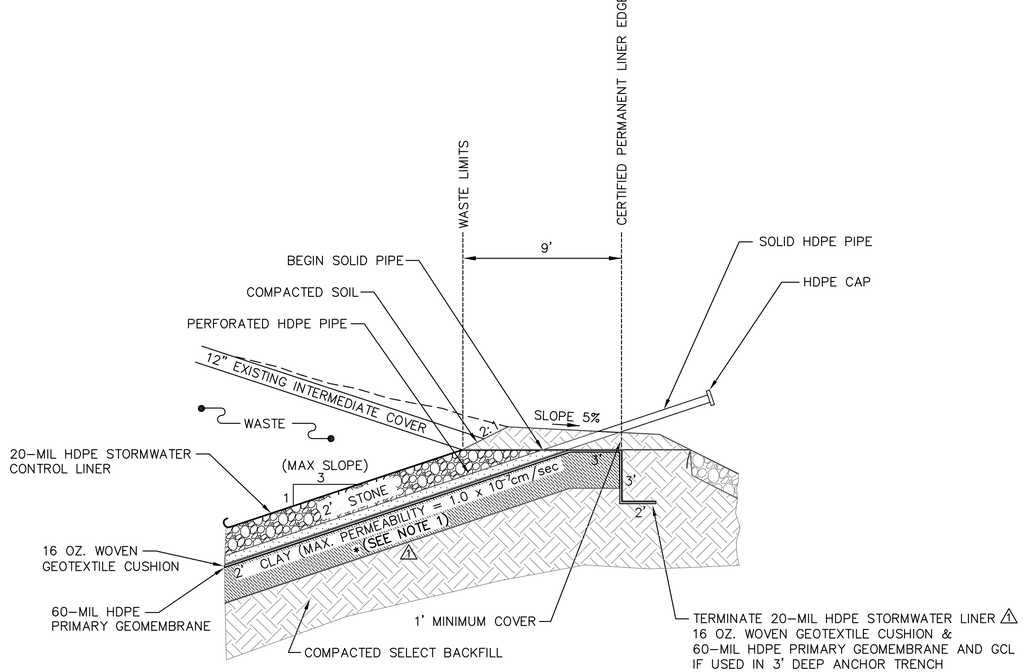
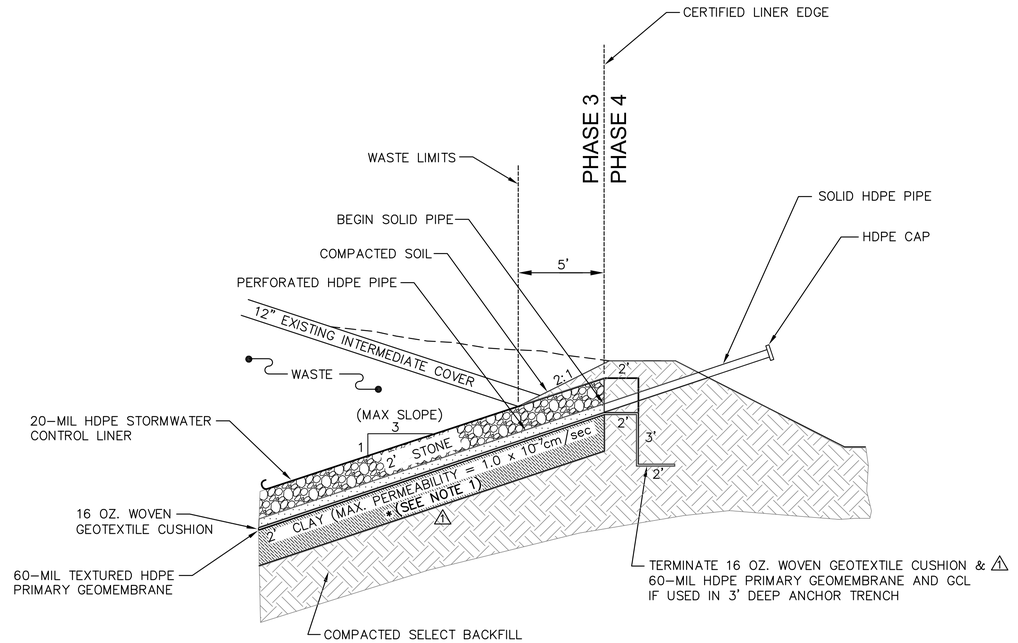
MISCELLANEOUS DETAILS

SHEET
D6



TYPICAL LEACHATE COLLECTION SYSTEM CLEANOUT @ TEMPORARY LINER EDGE #3

NTS



TYPICAL LEACHATE COLLECTION SYSTEM CLEANOUT @ TEMPORARY LINER EDGE #2

NTS

⚠1 NOTE 1:
IN LIEU OF 24" OF COMPACTED CLAY AT A MAXIMUM PERMEABILITY = $1X10^{-7}$cm/sec, AN ALTERNATE BASE LINER CONSISTING OF 18" OF COMPACTED CLAY AT MAXIMUM PERMEABILITY = $1X10^{-5}$cm/sec AND A GCL WITH A MAXIMUM PERMEABILITY = $5X10^{-9}$cm/sec MAY BE USED, AS SHOWN ON SHEET D2.

NO.	DATE	BY	REVISION DESCRIPTION
⚠1	9/11/09	KS	REVISED FOR ALTERNATE BASE LINER

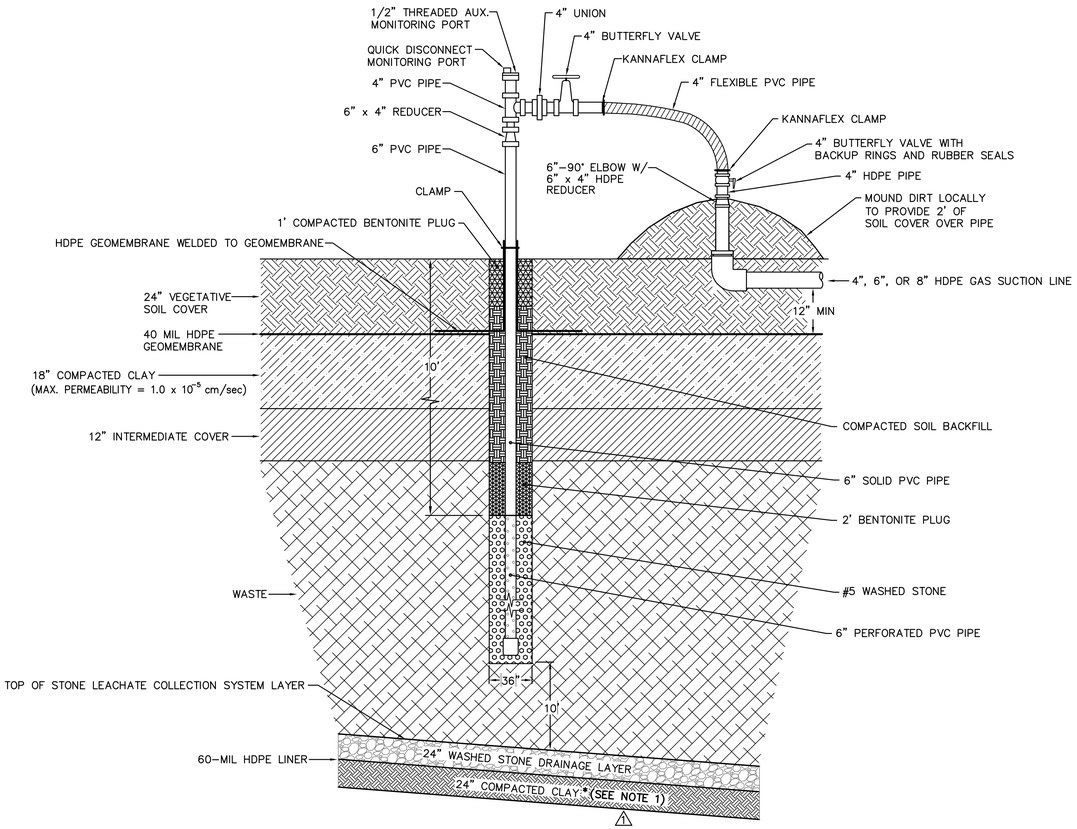
McGill ASSOCIATES
ENGINEERING·PLANNING·FINANCE
55 BROAD STREET ASHEVILLE, NC PH. (828) 252-0575

WHITE OAK MSW LANDFILL
PERMIT TO CONSTRUCT
MSW PHASES 3 & 4
HAYWOOD COUNTY
HAYWOOD COUNTY, NORTH CAROLINA

JOB NO.: 07518
DATE: SEPTEMBER 2008
SCALE: AS NOTED
DESIGNED BY: DP,JH,KS
CADD BY: DP,JH,KS
DESIGN REVIEW: _____
CONST. REVIEW: _____
O:\Jobs\07518\Permit-To-Construct\PTC-Rev 1\2-1-09\ 07518-Miscellaneous-Details.dwg

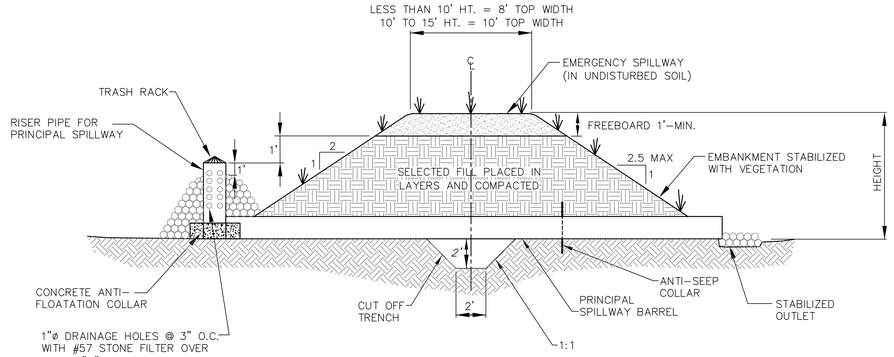
MISCELLANEOUS DETAILS

SHEET
D7



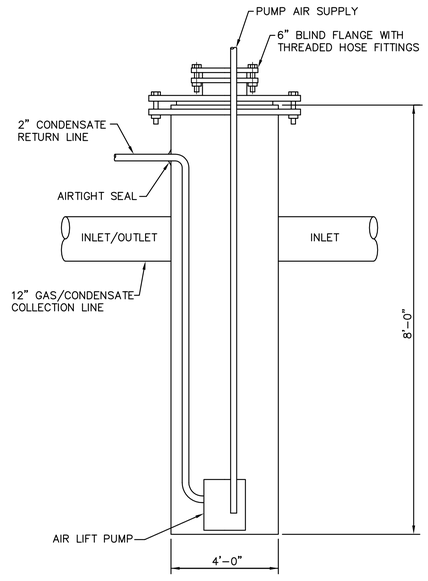
METHANE GAS EXTRACTION WELL

N.T.S.



SEDIMENT BASIN WITH RISER

REVISION DATE - JANUARY 2, 2007



NOTE: ALL AIR LINES AND PIPES ENTERING OR EXITING SUMP SHOULD BE SEALED PROPERLY TO MAINTAIN A CONTAINED SYSTEM.

GAS CONDENSATE SUMP

⚠ NOTE 1:
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NO.	DATE	BY	REVISION DESCRIPTION
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55 BROAD STREET ASHEVILLE, NC PH. (828) 252-0575

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 23574 JOHN E. MCGILL

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MISCELLANEOUS DETAILS

SHEET
D10