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Solid Waste Section

Asheville Regional Office

CLOSURE/POST-CLOSURE PLAN

WHITE OAK MSW LANDFILL

MSW PHASES 1 – 3

PERMIT NO. 44-07

**SANTEK ENVIRONMENTAL OF NORTH CAROLINA, LLC.
HAYWOOD COUNTY, NORTH CAROLINA**

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Engineering • Planning • Finance
Asheville, North Carolina

July 2013

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CLOSURE/ POST-CLOSURE PLAN

White Oak MSW Landfill

MSW Phases 1 - 3

Permit No. 44-07

Santek Environmental of North Carolina, LLC.

Haywood County, North Carolina

July 2013

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CLOSURE/POST-CLOSURE PLAN

White Oak MSW Landfill

MSW Phases 1 - 3

The final cap system for the MSW Phases 1 through 3 at the White Oak MSW Landfill will be constructed once the landfill's permitted airspace has been completely utilized. The cap system will minimize infiltration of stormwater into the waste mass and reduce leachate production. The MSW Phases 1 through 3 Area consists of approximately 30.3 acres and is estimated to reach capacity in 2017.

1.0 CAP DESCRIPTION AND CONSTRUCTION

The final cap 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. A detail of the final cap is shown on the attached Figure 1.

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 landfill gas system extraction wells, as shown on Figures 1 and 2.

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 Waste Management (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. The requirements for the clay liner installed as part of the landfill cap system are as follows:

- The clay liner portion of the cap system is required to have a permeability not greater than 1.0×10^{-5} cm/sec;
- The minimum thickness of the clay liner portion of the cap system is 18 inches.

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 $0.03 \text{ gm/m}^2\text{-day}$. 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 stormwater runoff 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 Landfill Gas Removal System

See Figure 2 for the potential location of the future landfill gas (LFG) removal system infrastructure for Phases 1 - 3. Currently, there are approximately 12 passive vents within the MSW Phase 1 area. The future LFG removal system for Phases 1 - 3 will consist of vertical LFG extraction wells, lateral extraction wells where feasible, intermediate LFG collection piping (8", 6", 4") connecting the extraction wells, and 12" and 16" transmission headers located around the margin of Phases 1 - 3. The transmission headers will connect to the future flare station. The final field conditions will determine the location of the extraction wells, collection piping, and flare station.

The LFG 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 LFG collection well has a radius of influence of approximately 100 to 125 feet. This results in approximately 45 extraction wells for the Phases 1 - 3 Area, although the final number will vary based on the final field conditions. The typical well penetrates the waste mass and allows a conduit for vertical migration of LFG. New extraction wells will be installed to a depth that is 10' above the top of the 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. Where feasible, existing passive vents installed in the MSW Phase 1 area will be utilized in the future LFG removal system. There are approximately 10 existing passive LFG vents that may be incorporated into the LFG removal system. The existing LFG vents consist of perforated 12" PVC pipe and will be fitted with well heads at the time of construction of the LFG removal system infrastructure. Haywood County reserves the right to install a passive LFG venting system in lieu of an active LFG removal system if allowed by the Solid Waste and Division of Air Quality Rules.

1.4a - Materials Required

- i. The LFG collection laterals shall have a minimum nominal diameter of four inches and shall be constructed of SDR 17, HDPE pipe.
- ii. The LFG collection header shall have a minimum nominal diameter of 12 inches and shall be constructed of SDR 17, HDPE pipe.

iii. The LFG extraction wells shall be constructed as shown on Figure 1.

1.4b - Construction Requirements

- i. LFG 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 LFG system piping that is installed under or within the final cap system shall be three percent (3%).
- iv. The LFG system piping shall be constructed in such a manner to provide for LFG condensate collection. This condensate shall be transported to the leachate storage pond by pneumatic or electric and explosion-proof pumps.

1.4c - Construction Quality Assurance Requirements

The development of the LFG removal system at the White Oak Landfill will be constructed in phases as sections of the landfill reach final approved grades. The project engineer shall ensure that the LFG removal system installation conforms to the requirements of the manufacturer's recommendations and the Division-approved Site Specific Construction Quality Assurance Plan.

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 18 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. Fertilizer and/or Compost:

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.

iii. Lime:

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 dolomitic 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 Bindweed, Quackgrass, Didders, 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 LFG removal 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 1 - 3 Technical Specifications
- i. 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 given 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.

1.5c - Construction Quality Assurance Requirements

The landfill operator 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	- 910,000 tons
Proposed Phases 1 - 3	- <u>525,000 tons</u>
Total	1,435,000 tons

3.0 CLOSURE SCHEDULE

3.1 Notification of Division of Waste Management

Prior to beginning closure of the White Oak MSW Landfill, Haywood County or the Landfill Operator will notify the Division of Waste Management (Division), Solid Waste Section of the intent to close the landfill.

Probable Date of Notification of Closure: June 2017

3.2 Begin Closure

Haywood County or the Landfill Operator 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 of Closure: December 2017

3.3 Completion of Closure

Haywood County or the Landfill Operator 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 of Completion of Closure: June 2018

3.4 Recording of Closure

Following closure of the White Oak MSW Landfill, Haywood County or the Landfill Operator 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 Waste Management, Solid Waste Section approved Closure Plan.

Probable Date: December 2018

3.5 Engineer's Certification

Following closure, Haywood County or the Landfill Operator shall notify the Division 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 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.

4.1 North Carolina Solid Waste 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 mechanisms less attractive than others.

4.2 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 condition makes passing the test quite feasible. Haywood County has not encountered any difficulties passing the LOCAL GOVERNMENT FINANCIAL TEST in recent years and there are not any circumstances that would indicate that this would change.

5.0 POST-CLOSURE PLAN

5.1 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.

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. LFG monitoring wells
4. Groundwater 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
3-30	2

5.2 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 video-inspected and/or cleaned as noted in the Engineering Plan for the Facility.

The LFG Removal System will be inspected yearly and cleaned on an as-needed basis.

Vegetative growth around LFG collection wells will be cleaned away and all wells will be clearly marked to prevent accidental damage.

5.3 Monitoring

Explosive gas monitoring will occur on a quarterly basis according to the procedural outline contained in the Landfill Gas Monitoring Plan.

Surface and ground water testing will occur semiannually or as directed by the Division of Waste Management, Solid Waste Section.

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.

5.4 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.

5.5 Leachate Storage Closure Plan

Haywood County or the Landfill Operator shall complete the closure activities outlined in this plan within 180 days after liquid collection has ceased, as follows:

- 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.

5.6 Planned Use and Personnel 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 Waste Management, Solid Waste Section 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

5.7 Water Quality Monitoring Plan

A Design Hydrogeologic Report and Environmental Monitoring Plan for Phases 3 and 4 of the White Oak MSW Landfill were prepared by BLE, Inc. at the time of the Permit to Construct MSW Phase 3 in 2009. The Plan includes discussion of the existing monitoring system, proposed monitoring system, additional groundwater monitoring well construction, water level monitoring, aquifer testing, and groundwater sampling and analysis.

5.8 Engineer's Certification

Following completion of the post-closure care period, Haywood County or the Landfill Operator shall notify the Division of Waste Management that a certification, signed by the project engineer and verifying that post-closure care has been completed in accordance with this post-closure plan, has been placed in the operating record.

**6.0 CLOSURE, POST-CLOSURE, AND POTENTIAL
ASSESSMENT AND CORRECTIVE ACTION
COST ESTIMATES AND SUMMARY**

6.1 MSWLF Closure Cost Estimate

Phases 1 - 3 - 30.3 Acres

	<u>Unit Cost</u>	<u>Total Cost</u>
Item 1 - Erosion and Sedimentation Control		
35 Acres Grassing	\$2,000.00 /Acre	\$70,000
200 Tons Rip Rap	\$50.00 Ton	\$10,000
2,000 L.F. Synthetic Lined Channels	\$16.00 /L.F.	\$32,000
 Item 2 - Earthwork		
73,326 C.Y. 18-inch Low-Permeability Clay Cap	\$6.00 /C.Y.	\$439,956
97,768 C.Y. 24-inch Vegetative Cover	\$4.00 /C.Y.	\$391,072
 Item 3 - Geosynthetics		
1,319,868 S.F. 40 Mil HDPE	\$0.60 /S.F.	\$791,921
1,319,868 S.F. 8 oz. Double Sided Geonet	\$0.50 /S.F.	\$659,934
 Item 4 - Landfill Gas Extraction System		
1,800 VF Gas Wells	\$50.00 VF	\$90,000
5,000 LF Gas Collection Piping	\$46.00 LF	\$230,000
 Item 5 - Mobilization (3% of Construction Cost)		
1 LS	\$81,446.49 LS	\$81,446
	Subtotal Construction Costs	\$2,796,329
 Item 6 -		
a. Engineering Design & Permitting		\$100,000
b. Construcion Quality Assurance (QA/QC of liner & certification)		\$360,000
 Item 7 - Contingencies (@10% of Const. Cost)		<u>\$279,633</u>
	MSW Landfill Total Closure Cost	\$3,535,962

6.2 MSWLF Post-Closure Cost Estimate

MSW Phases 1 - 3, Total 30.3 Acres

	<u>Total Annual Cost</u>	<u>Total Post-Closure Cost</u>
Item 1 - Environmental Monitoring		
Semi-Annual Ground Water Monitoring - 13 Wells @ \$550.00/well/event x 2 events/yr x 30 years	\$14,300	\$429,000
Semi Annual Surface Water Monitoring - 6 points @ \$550/each/event x 2 events/yr x 30 years	\$6,600	\$198,000
Semi-Annual Leachate Monitoring - 1 sample @ \$550.00/each/event x 2 events/yr x 30 years	\$1,100	\$33,000
Methane monitoring - 7 wells x 4 events/yr. \$1,000/event x 30 years	\$4,000	\$120,000
Item 2 - Routine Cap Repairs		
1 acre repair, 1 foot depth, re-seeding, silt fence, twice a year	\$12,000	\$360,000
Item 3 - Grass Maintenance		
Cutting - 30 acres x \$800/event x 2 cuts/yr x 30 years	\$1,600	\$48,000
Re-seeding - 2 ac/yr @ \$1,500.00/ac x 30 years	\$3,000	\$90,000
Item 4 - Leachate Collection/Treatment		
Off-site treatment @ \$0.022/gal and \$179/load hauled to WWTF		
Year 1-5: gal. = 1" acre x 30.3 acres = 819,427 gal/yr x 5 years	\$18,027	\$90,135
Year 1-5 loads hauled to WWTF = 137 loads/year x 5 years	\$24,523	\$122,615
Year 6-30: gal.=1/4"acre x 30.3 acres=204,856 gal/yr x 25 years	\$4,507	\$112,675
Year 6-30 loads hauled to WWTF = 33 loads/year x 25 years	\$5,907	\$147,675
Leachate system maintenace including pump maintenance and leachate line cleaning, yearly average x 30 years	\$2,500	\$75,000
Item 5 - LFG Collection/Venting System Maintenance		
Includes transportation, labor, cleaning, caps, other miscellaneous maintenance, yearly average x 30 years	\$4,400	\$132,000
		\$1,958,100

6.3 Potential Assessment and Corrective Action Entire White Oak Landfill Facility

	<u>Unit Price</u>	<u>Total</u>
Item 1 Installation of 1 new ground water monitoring well at the compliance boundary (1 well each for MSWLF and CDLF).	\$5,000/well	\$10,000
Item 2 Appendix II background sampling of GW sampling network (4 events/sampling location X 2 locations)	\$550/well/event	\$4,400
Item 3 Submittal of assessment monitoring work plan (lump sum)	\$15,000	\$15,000
Item 4 Installation of additional ground water monitoring wells to characterize the nature and extent of the contaminant plume (8 wells)	\$5,000/well	\$40,000
Item 5 Appendix II background sampling of additional wells (8 wells @ 4 events/well)	\$550/well/event	\$17,600
Item 6 Report of findings of additional sampling events (lump sum)	\$15,000	\$15,000
Item 7 Assessment of Corrective Measures Report, including public notice and meetings (lump sum)	\$50,000	\$50,000
Item 8 Selection and Implementation of Remedy - Including Continued Monitored Natural Attenuation	\$500,000	\$500,000
Item 9 Installation of additional ground water monitoring wells to monitor the effectiveness of selected remedy (8 wells)	\$5,000/well	\$40,000
Item 10 Sampling and analysis of additional monitoring wells (8 wells X 4 events/well)	\$550/well/event	\$17,600
Item 11 Report of findings of additional sampling events and effectiveness/completion of action remedy (lump sum)	\$50,000	\$50,000
Item 12 10% Contingency		<u>\$75,960</u>
Total Potential Assessment and Corrective Measure Cost Estimate		\$835,560

6.4 Financial Assurance Summary

Total Closure Cost Estimate

MSW Phases 1 - 3 \$3,535,962

Total Post-Closure Care Period (30 Years) Cost Estimate

MSW Phases 1 - 3 \$1,958,100

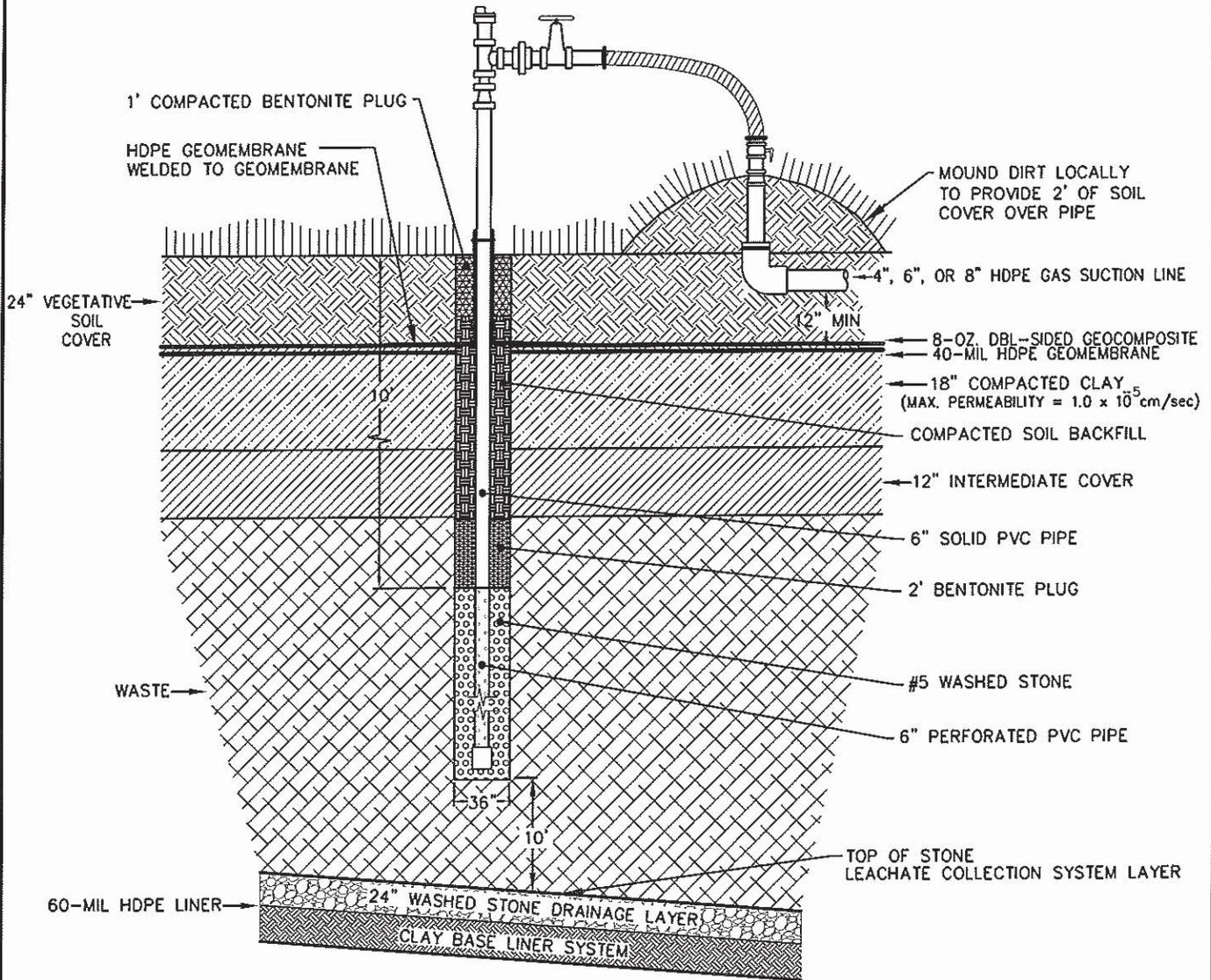
Total Potential Assessment and Corrective Measure Cost Estimate

Estimated Amount: \$835,560. (note: use required minimum amount per the Solid Waste Rules) \$2,000,000

Total Financial Assurance \$7,494,062

WHITE OAK MSWLF PHASES 1 - 3

FINAL CAP WITH TYPICAL LFG COLLECTION WELLHEAD



NO.	DATE	BY	REVISION DESCRIPTION

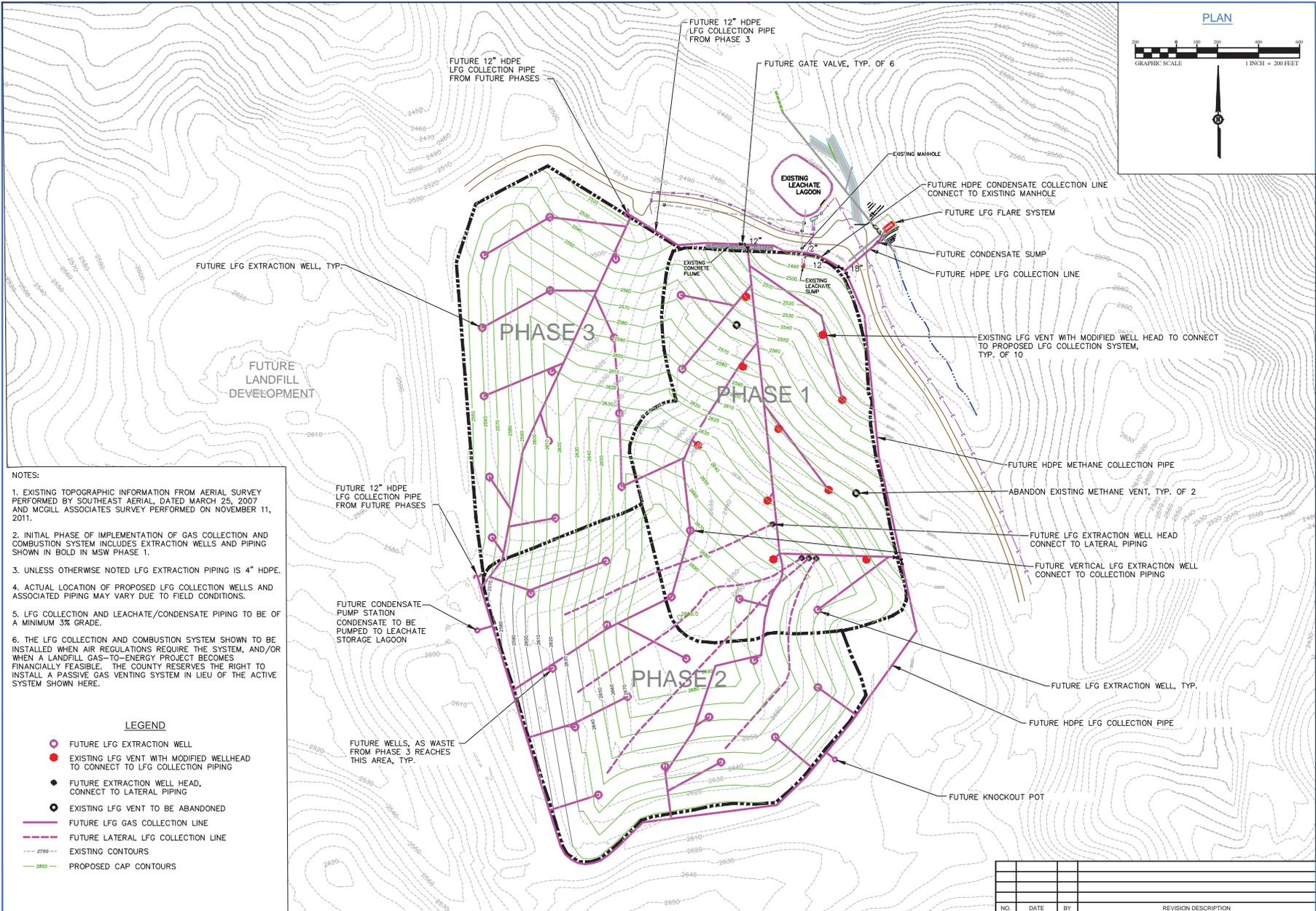
**FIGURE
1**

**FINAL CAP
DETAIL**

JOB NO: 13.00729
DATE: JULY 2013
SCALE: NTS
DESIGNED BY: DAP
CADD BY: EAP
DESIGN REVIEW: _____
CONST. REVIEW: _____
© 2013 (13.00729)
Final Rev

**WHITE OAK MSW LANDFILL, PHASES 1 - 3
CLOSURE/POST-CLOSURE PLAN
SANTEK ENVIRONMENTAL OF
NORTH CAROLINA, LLC.**
HAYWOOD COUNTY, NORTH CAROLINA

McGill
ASSOCIATES
ENGINEERING-PLANNING-FINANCE
35 BROAD STREET ASHEVILLE, NC TEL: (828) 252-0575



- NOTES:**
1. EXISTING TOPOGRAPHIC INFORMATION FROM AERIAL SURVEY PERFORMED BY SOUTHEAST AERIAL, DATED MARCH 25, 2007 AND MCGILL ASSOCIATES SURVEY PERFORMED ON NOVEMBER 11, 2011.
 2. INITIAL PHASE OF IMPLEMENTATION OF GAS COLLECTION AND COMBUSTION SYSTEM INCLUDES EXTRACTION WELLS AND PIPING SHOWN IN BOLD IN MSW PHASE 1.
 3. UNLESS OTHERWISE NOTED LFG EXTRACTION PIPING IS 4" HDPE.
 4. ACTUAL LOCATION OF PROPOSED LFG COLLECTION WELLS AND ASSOCIATED PIPING MAY VARY DUE TO FIELD CONDITIONS.
 5. LFG COLLECTION AND LEACHATE/CONDENSATE PIPING TO BE OF A MINIMUM 3% GRADE.
 6. THE LFG COLLECTION AND COMBUSTION SYSTEM SHOWN TO BE INSTALLED WHEN AIR REGULATIONS REQUIRE THE SYSTEM, AND/OR WHEN A LANDFILL GAS-TO-ENERGY PROJECT BECOMES FINANCIALLY FEASIBLE. THE COUNTY RESERVES THE RIGHT TO INSTALL A PASSIVE GAS VENTING SYSTEM IN LIEU OF THE ACTIVE SYSTEM SHOWN HERE.

LEGEND

- FUTURE LFG EXTRACTION WELL
- EXISTING LFG VENT WITH MODIFIED WELLHEAD TO CONNECT TO LFG COLLECTION PIPING
- FUTURE EXTRACTION WELL HEAD, CONNECT TO LATERAL PIPING
- EXISTING LFG VENT TO BE ABANDONED
- FUTURE LFG GAS COLLECTION LINE
- - - FUTURE LATERAL LFG COLLECTION LINE
- - - EXISTING CONTOURS
- 2800 — PROPOSED CAP CONTOURS

NO.	DATE	BY	REVISION DESCRIPTION

FOR REGULATORY REVIEW

WHITE OAK MSW LANDFILL
CLOSURE/POST-CLOSURE PLAN
MSW PHASES 1-3
SANTEK ENVIRONMENTAL
OF NORTH CAROLINA, LLC.
HAYWOOD COUNTY, NORTH CAROLINA

JOB NO. 130728
DATE: JULY 2013
DESIGNED BY: DP
CHECKED BY: JLM
DESIGN REVIEW: JLM
CONST. REVIEW: JLM
FILE NAME: 130728.DWG
WWW.MCGILLASSOCIATES.COM

FINAL CAP GRADES AND LFG REMOVAL SYSTEM

FIGURE