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| Permit No. | Scan Date      | DIN   |
| 1812       | August 4, 2011 | 14706 |



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August 4, 2011  
Solid Waste Section  
Asheville Regional Office

August 3, 2011

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

Attention: Mr. Larry Frost  
[Larry.Frost@ncdenr.gov](mailto:Larry.Frost@ncdenr.gov)

**Reference: Operations Plan Modification**  
Industrial Landfill No. 1  
Duke Energy – Marshall Steam Station  
Terrell, North Carolina 28682  
S&ME Project No. 1356-08-122  
S&ME Engineering License No. F-0176

Dear Mr. Frost:

On behalf of Duke Energy (Duke), S&ME Inc., (S&ME) is pleased to submit this letter requesting that the North Carolina Department of Environment and Natural Resources (NCDENR) Division of Waste Management consider a modification to the existing Operations Plan at Duke's Marshall Steam Station, Industrial Landfill No. 1 (Permit No. 1812). We prepared this letter based on correspondence between Mr. Larry Frost of NCDENR and various Duke and S&ME personnel. The attached Operations Plan addresses operational subjects consisting of filling guidance, dust control, and acceptable wastes.

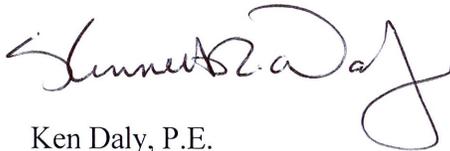
The Operations Plan text and figures are intended to suggest general operations concepts. The revised Operations Plan is provided as Attachment 1, and it provides more general language regarding filling guidance.

A Dust Control Plan has also been provided as Appendix III to the attached Operations Plan. The intent of the Dust Control Plan is to provide various dust control methods while eliminating the need for operational cover and alternative cover material demonstrations. NCDENR approved a similar Dust Control Plan for the Plant Allen RAB Ash Landfill in a letter dated May 17, 2011. The Industrial Landfill No. 1 is operated in a similar manner to the RAB Ash Landfill.

The landfill is currently permitted for the disposal of fly ash, bottom ash, flue gas desulfurization (FGD) gypsum, FGD clarifier sludge, asbestos material, land clearing and inert debris, coal mill rejects, waste limestone material, boiler slag, and construction and demolition waste generated at the Marshall Steam Station. We are requesting the addition of sand blast material, ball mill rejects, coal waste, and pyrites generated at the Marshall Steam Station as acceptable wastes to the landfill. The Operations Plan text is revised to accept or allow these materials.

We appreciate NCDENR's practicality and consideration of the proposed modification. Please contact us at your convenience with comments and questions.

Sincerely,  
S&ME, Inc.



Ken Daly, P.E.  
Project Engineer II



Kyle Baucom, E.I.  
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Attachments: Operations Plan, Revised August 3, 2011, Industrial Landfill No. 1,  
Marshall Steam Station, Permit No. 1812

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OPERATIONS PLAN  
INDUSTRIAL LANDFILL NO. 1  
PERMIT NO. 1812  
MARSHALL STEAM STATION  
TERRELL, NORTH CAROLINA  
S&ME Project No. 1356-08-122



Prepared for:  
Duke Energy Carolinas, LLC  
526 South Church Street  
Charlotte, North Carolina 28202



Prepared by:  
S&ME, Inc.  
S&ME Engineering License No. F-0176

9751 Southern Pine Boulevard  
Charlotte, North Carolina 28273

November 24, 2009

Revised February 3, 2010  
Revised February 28, 2011  
Revised August 3, 2011

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- I Emergency Action Plan (EAP)
- II Operations Quality Assurance Plan
- III Dust Control Plan

## 1. GENERAL FACILITY OPERATIONS

### 1.1 Overview

This Operations Plan is part of the Permit to Construct Application for the Industrial Landfill No. 1 at Marshall Steam Station and presents the landfill's operational requirements for: (1) general facility operations; (2) waste handling and landfill sequencing; and (3) environmental management. This Operations Plan was prepared consistent with the requirements of Rules .0505 of 15A NCAC 13B of the North Carolina Solid Waste Management Rules.

The Industrial Landfill No. 1 is owned by Duke Energy Carolinas, LLC (Duke Energy). The operations of the facility will be overseen by a Duke Energy Operations Manager or subcontracted to an outside company.

### 1.2 Contact Information

Correspondence and questions concerning the operation of the landfill should be directed to the appropriate entity as follows:

- ***OWNER***  
Duke Energy Carolinas, LLC – Marshall Steam Station  
8320 East NC Highway 150, Terrell, NC 28682  
(828) 478-7700  
Facility Contact: Coordinator Material Handling or Environmental Professional
- ***STATE REGULATORY AGENCY***  
North Carolina Department of Environment and Natural Resources  
  
Division of Waste Management, Solid Waste Section, Permitting Branch  
Asheville Regional Office  
2090 US Highway 70, Swannanoa, NC 28778  
(828) 296-4500  
Environmental Engineer: Larry Frost  
  
Division of Waste Management, Solid Waste Section, Field Operations Branch  
Asheville Regional Office  
2090 US Highway 70, Swannanoa, NC 28778  
(828)-296-4702  
Environmental Senior Specialist: Deb Aja

### 1.3 Safety

Landfill operations were developed considering the health and safety of the facility's operating staff. Duke Energy will provide each of the operating staff with site specific safety training prior to landfill operations and designate on-site safety protocols in

accordance to Duke Energy’s Safe Work Practices. An Emergency Action Plan (EAP) is included in Appendix I to provide guidance in the event of a slope failure.

#### **1.4 Access and Security Requirements**

Access roads to the landfill will be of all weather construction and maintained in good condition. To prevent unauthorized entry, access to the Duke Energy property is controlled by either perimeter fencing or steep terrain with dense vegetation. Site access into the plant is also controlled by a gate at the main entrance.

#### **1.5 Signs**

Signs providing the permit number, stating that no hazardous or un-permitted waste can be received, and other pertinent information will be posted at the site entrance. Traffic signs and markers will be provided as necessary to promote an orderly traffic pattern to and from the active disposal area and maintain efficient operating conditions. The entrance sign will state:

“Industrial Solid Waste Landfill Facility  
Permit No. 18-12  
No Hazardous or Un-Permitted Waste Allowed  
Contact Plant Coordinator Materials Handling or Environmental Professional  
(828) 478-7700”

#### **1.6 Dust Control**

Dust control is a critical component of operations at the landfill. Areas in need of dust control consist of both the active face and inactive areas within the landfill. Dust control will be implemented through various methods. Dust control performance will be monitored during operations. Dust control methods and monitoring procedures are described in further detail in the Dust Control Plan in Appendix III.

#### **1.7 Fire Control**

No open burning shall be permitted at the landfill. Ash is a non-combustible material and the threat of fire is minimal. However, if a fire occurs at the landfill the local fire department shall be notified and equipment and stockpiled soil shall be provided to control accidental fires. Any fire that occurs at the landfill shall be reported to the Division within 24 hours and a written notification will be submitted within 15 days by the Operations Manager.

#### **1.8 Training**

Due to the diversity and nature of job tasks required at the landfill, personnel should be adequately trained to handle facility operations and maintenance. The Operations Manager should have a general understanding of all the tasks required for site operations. Individuals performing the various tasks should have adequate training for the specific tasks they are assigned. Noteworthy operations and maintenance tasks to be addressed in training include:

- maintaining accurate records of waste loading (quantitative and qualitative);
- operating requirements for stormwater segregation from exposed waste areas;  
and
- operating and maintaining leachate collection system and leak detection system.

The facility operator will complete approved operator training courses in accordance with permit requirements.

### **1.9 Record Keeping**

An operating record will be maintained on-site and will include the following:

- Leachate Collection System (LCS) monitoring information;
  - Amounts of leachate generated and pumped to the active ash basin;
  - Line cleanout and camera monitoring documentation;
- Leak Detection System (LDS) monitoring information;
  - Documentation of an approved response action plan from the Division;
  - Records of the amount of liquids removed at each sump;
  - Notice of exceedence of action leakage rate for sumps (if any);
  - Preliminary assessment report for exceedence of action leakage rate (if any);
  - Reports documenting remedial actions (if any);
  - Line cleanout and camera monitoring documentation;
- Closure and post-closure LDS monitoring plan and results; and
- Operations Plan.

The above records will be kept in the operating record for the active life of the landfill and the post-closure care period. Information contained in the operating record must be furnished upon request to the Division or made available for inspection by the Division. Additional records kept on-site will include:

- Facility Permits;
  - Solid waste facility permits;
  - Erosion and Sediment Control Plan;
- Record of the amount of solid waste received summarized on a monthly basis based on scale records;
- Documentation of weekly LCS/LDS system performance observations;
- Documentation of erosion and sediment control observations;
- Regulatory agency inspection reports;
- Site Suitability Study;
- Permit to Construct Application;
- Employee training program and records; and
- Site drawings and specifications.

## **1.10 Erosion and Sedimentation Control**

Erosion and sedimentation control (E&SC) responsibilities during operations shall consist of monitoring E&SC stormwater conveyance features and surface erosion.

### *1.10.1 E&SC Features Monitoring*

E&SC features include rain gutters, road ditches, outlet protection aprons, downchute piping, and direct runoff to perimeter ditches. Prior to landfill closure, E&SC features shall be checked weekly. During post closure, E&SC features shall be checked quarterly and after a 1-inch rainfall event. Sediment shall be removed from structures to their original dimensions when conditions warrant. Necessary repairs shall be made as soon as practical.

Prior to closure, channels shall be monitored after each runoff event. Following closure, channels shall be checked after each 1-inch rainfall event. Riprap-lined channel sections and outlet protection aprons shall be checked for washouts. Riprap shall be added to these areas as needed to maintain the integrity of the structure.

### *1.10.2 Surface Erosion Monitoring*

Vegetative ground cover sufficient to control erosion must be provided within 15 working days or 90 calendar days upon completion of any phase of landfill development as per the North Carolina Erosion and Sedimentation Control Guidelines. Seedbed preparation, seeding, soil amendments, and mulching for the establishment of vegetative ground cover shall be applied in accordance with Figure 11: Seeding Specification.

Slopes shall be periodically checked for erosion and vegetative quality, fertilized, and mowed at least once a year. A slope or portion thereof shall be identified as needing maintenance if it meets any one of the following conditions:

- Exposed waste on exterior slopes;
- Bare spots larger than 25 square feet;
- Bare spots make up more than 2% of total seeded area;
- Rills exceeding 4 inches in depth;
- Areas of cracking, sliding, or sloughing; or
- Areas of seepage.

Slopes identified as needing maintenance shall be repaired as soon as practical and as appropriate to correct deficiencies. Repair activities may include re-dressing the slope, filling in low areas, and/or seeding in accordance with Figure 11: Seeding Specification. In the event that cracking, sliding, sloughing, or seepage is identified on slopes, a slope failure identification criteria is met, and the Notification Sequence provided in the EAP included in Appendix I should be followed accordingly.

## 2. WASTE HANDLING AND LANDFILL SEQUENCING

### 2.1 Landfill Capacity

The landfill is comprised of phases, which are further subdivided into cells. Phase 1 of the landfill consists of Cells 1, 2, 3, and 4 and has an operational life of approximately 5.2 years. Landfill sequencing is further described in Section 2.4 of this Operations Plan. The whole landfill is estimated to have a storage life of approximately 24.3 years, based on a projected disposal rate of 738,000 tons per year.

The landfill capacity was estimated using the proposed grading and closure plans in conjunction with the anticipated annual disposal rates. The volume of Phase 1 available for waste placement, which consists of the airspace between the protective cover soil and the proposed top of waste, was estimated to be on the order of 3,829,020 cubic yards. Landfill capacity is further described in Section 7.1 of the Engineering and Facility Plan.

### 2.2 Waste Acceptance, Disposal, and Screening Requirements

The landfill will only accept fly ash, bottom ash, flue gas desulfurization (FGD) gypsum, FGD clarifier sludge, asbestos material, land clearing and inert debris, coal mill rejects, waste limestone material, boiler slag, construction and demolition waste, sand blast material, ball mill rejects, coal waste, and pyrites generated at the Marshall Steam Station. The landfill owner or operator shall notify the Division within 24 hours of attempted disposal of any wastes the landfill is not permitted to receive. Hazardous, liquid, or infectious wastes shall not be disposed of in the landfill. The removal of waste from the landfill is prohibited unless the owner or operator approves and the removal is not performed on the working face.

The proposed landfill will be receiving a relatively consistent and homogeneous waste stream of combustion products residuals generated solely from the Marshall Steam Station. Waste will be hauled and disposed of by dedicated and consistent operators from the waste source to the landfill. As hauling and disposal operations are wholly contained within the site, random inspections are not proposed. Rather loads will be monitored continuously through operations. Based on the consistent and homogeneous waste stream it is anticipated that municipal solid waste, hazardous, liquid, or non-permitted wastes will be readily distinguished from the ordinary waste stream.

### 2.3 Operating Concepts

The primary objective of the landfill is to operate safely and efficiently while minimizing leachate generation and controlling stormwater. The landfill development will be sequenced in Phases as indicated on Figure 1. The Facility's final closure grading plan is presented on Figure 2. Landfilling operations will generally proceed from the north towards the south by the use of phases. In general, waste placement will be performed in 10-foot lifts with operations usually being focused within a particular cell area. Intermediate and final cover will be placed as appropriate. Soil diversion berms will be used to collect and divert the

non-contact stormwater runoff from exterior landfill slopes to areas where the runoff will be directed to an active ash basin. When the desired waste elevations are obtained within the cell, waste placement will move to the next cell where the process will be repeated.

## **2.4 Landfill Sequencing**

The general steps for the operation of the landfill are summarized below and are shown on the operations diagrams provided as Figures 3 through 10. These figures are intended to suggest general operations concepts, and the actual fill heights and grades may vary at the operator's discretion. In general, waste filling shall progress in approximate 10-ft thick operational lifts made up of approximately 1-ft thick compacted lifts. Waste placement shall be graded to shed contact water into the landfill cell. When the operator is ready to place intermediate cover soil, subject areas may be graded to shed stormwater runoff (that has not contacted waste) out of the landfill cell to the perimeter stormwater conveyance channels.

In general, waste filling shall progress from the high end toward the low end of each cell to promote management of contact and non-contact water. The landfill sump areas shall not be covered with waste during placement of the first two, 10-ft thick operational lifts. Rather the sump areas shall remain exposed to promote management of leachate and contact water, anticipated to be greater during early stages of landfill operations. After the first two, 10-ft thick operational lifts are placed, the sump areas may be covered with waste.

Three (3) chimney drains have been installed in each cell and shall be extended vertically along with the placement of each lift. Each chimney drain comprises a ten-foot long vertical, 18-inch-diameter, perforated, corrugated HDPE riser pipe surrounded by filter aggregate. At the base of the chimney drains, the riser pipe connects to a distribution pipe which conveys the flow from the riser pipe into the LCS, via infiltration through a constructed layer of drainage material. During operations, chimney drains may be modified with pipe fittings to allow the chimney drain pipe to drain contact water from the active face.

Landfill operations will begin in Cell 2 and proceed sequentially to Cell 1, Cell 3, and Cell 4. A conceptual waste filling sequence is illustrated in the attached Figures and summarized below only for the first steps of filling Cells 1 and 2. Operations personnel shall fill the remainder of the Cells following a sequence similar to the one illustrated for Cells 1 and 2.

Waste placement shall begin in Cell 2 and shall progress into Cell 1 as shown in Figures 3 and 4. The general waste filling sequence is described as follows.

- Step 1 (Figure 3): Place a 10-ft thick operational lift in Cell 2. Fill from west to east (uphill to downhill). Grade exposed waste areas to promote contact water drainage towards the chimney drains and/or sump within the landfill cell.

- Step 2 (Figure 4): Place a 10-ft thick operational lift in Cell 1. Fill from west to east (uphill to downhill). Grade exposed waste areas to promote contact water drainage towards the chimney drains and/or sump within the landfill cell.
- Step 3 (Figures 9 and 10): Extend the chimney drains in each cell consistent with the cross-sections provided in Figures 9 and 10.
- Step 4 (Figure 5): Continue to place lifts in the manner described in Steps 1 and 2. To minimize leachate generation, when large areas can be graded to the perimeter with operational cover, do so. Maintain separation by berms between exposed waste areas and areas covered with operational cover. Grade exposed waste areas to promote contact water drainage towards the chimney drains and/or sump within the landfill cells.

This general pattern of filling shall be repeated until the intermediate cover grading plan for Cells 1 and 2 as illustrated in Figure 6 is achieved. This general pattern of filling is also illustrated in the cross section provided in Figure 9. During filling, exterior stormwater conveyance features shall be constructed to manage non-contact stormwater runoff consistent with the Cell 1 and 2 Stormwater Management Plan (Engineering and Facility Plan Drawing C8).

When operations dictate, the operator may begin waste placement in subsequent Cells 3 and 4 in the same general pattern of filling and “piggyback” over Cells 1 and 2 as illustrated on Figure 7. The intermediate cover grading plan for Phase 1 is illustrated in Figure 8. Exterior stormwater conveyance features shall be constructed to manage non-contact stormwater runoff consistent with the Phase 1 Stormwater Management Plan (Engineering and Facility Plan Drawing C14).

## **2.5 Waste and Cover Material Placement**

Waste and cover material shall be placed to the lines and grades shown on the grading plans with slopes no steeper than 3 (horizontal) to 1 (vertical). The Cells 1 and 2 intermediate cover grading plan is provided in Figure 6. The Phase 1 intermediate cover grading plan is provided in Figure 8. Prior to waste placement, stakes indicating the limits of waste placement, as shown on the Engineering and Facility Plan Drawings, shall be located. Waste placement for the anticipated waste types is summarized in the following sub-sections.

The primary objective during operations is to manage and segregate contact leachate from non-contact stormwater runoff. Contact leachate should be contained within the landfill. In order to effectively manage leachate, the waste shall initially be placed from up-gradient to down-gradient to promote drainage to the sump. Waste placement on the first few operational lifts shall terminate up-gradient of the sump to leave this area exposed. As higher waste elevations are achieved, the waste may be placed in the sump area, as long as landfill surfaces are graded to promote proper drainage into the landfill.

A minimum five percent slope shall be graded on the landfill surface to promote surface water runoff. Waste shall not be disposed of in water.

#### ***2.5.1 Fly Ash, Bottom Ash, and FGD Gypsum***

Fly ash, bottom ash, and FGD Gypsum shall be compacted using compactors and dozers in approximate 1-foot lifts to achieve a vertical operational lift thickness of 10 feet. As the waste stream was assumed for design to be comprised predominantly of fly ash, QA monitoring and testing is proposed only for fly ash. Fly ash shall be placed and compacted in accordance with the quality assurance plan requirements outlined in Appendix II. Bottom ash and FGD Gypsum shall be placed and compacted as densely as practical and in-place density testing for bottom ash and FGD is not required.

#### ***2.5.2 Asbestos***

Asbestos waste shall be packaged in accordance with 40 CFR 61, and it shall be disposed of away from the working face or in an area not contiguous with other disposal areas. Separate areas shall be clearly marked so that asbestos is not exposed by future land-disturbing activities. From lift to lift, asbestos disposal areas can be relocated, provided that records of the areas are maintained. Asbestos material shall be covered with 6 inches of nonasbestos-containing material (i.e. soil, ash, gypsum) within a 24-hour period.

Asbestos material shall not be placed within 25 feet of the exterior slopes. Asbestos material shall be placed in relatively thin lifts limited to only a few feet thick. Asbestos material shall be compacted as densely as practical and specific monitoring and in-place density testing for asbestos materials is not required.

#### ***2.5.3 FGD Clarifier Sludge, Coal Mill Rejects, Waste Limestone Material, Boiler Slag, Sand Blast Material, Ball Mill Rejects, Coal Waste, and Pyrites***

FGD clarifier sludge, coal mill rejects, waste limestone material, boiler slag, sand blast material, ball mill rejects, coal waste, and pyrites will be spread in 6-inch lifts in the center of the operational area and shall not be placed within 25 feet of the exterior slopes. FGD clarifier sludge shall be blended with the other waste (i.e. ash) prior to placement of the next fill lift. FGD clarifier sludge, coal mill rejects, waste limestone material, boiler slag, sand blast material, ball mill rejects, coal waste, and pyrites shall be compacted as densely as practical and specific monitoring and in-place density testing of these materials is not required.

#### ***2.5.4 Construction and Demolition Waste and Land Clearing and Inert Debris***

The landfill may receive construction and demolition waste, land clearing waste, inert debris, untreated wood, and yard trash (leaves, sticks). These materials shall not be placed within 25 feet of the exterior slopes. This material shall be compacted as densely as practical and specific monitoring and in-place density testing of these materials is not required. Construction and demolition waste shall be covered with 6 inches of earthen

material (i.e. soil, ash, gypsum) when the disposal area exceeds one-half acre and at least once weekly.

### *2.5.5 Waste Stream Composition*

The waste stream was assumed for design to be comprised predominantly of ash. Should the waste stream change at some time during operations, the design slope stability analyses must be reviewed for the changed conditions. No quality assurance testing is specified for asbestos, FGD clarifier sludge, coal mill rejects, waste limestone material, boiler slag, construction and demolition waste, land clearing and inert debris, sand blast material, ball mill rejects, coal waste, or pyrites provided that these materials compose less than 15% of the monthly total waste tonnage.

### *2.5.6 Operational Cover*

Operational soil cover should be applied as needed for dust control and stormwater management. Operational soil cover should be applied at a thickness suited to its purpose. For example, operational soil cover may be applied thinner to provide dust control and it may be applied thicker to tolerate erosion when its purpose is stormwater management. Operational covers to provide dust control shall be as described in the facility Dust Control Plan in Appendix III.

### *2.5.7 Intermediate Cover*

A 12-inch thick intermediate cover layer shall be placed on areas where final grades have been reached or where waste placement will be inactive for 12 months or more.

## **2.6 Final Cover**

The final cover system for a completed phase will be finished within 180 days following the beginning of closure activities unless otherwise approved by the Division.

The proposed final cover will consist of a compacted intermediate soil cover, 40-mil LLDPE geomembrane liner, geocomposite drainage layer, an 18-inch thick earthen barrier layer, and a 6-inch earthen vegetative layer. A proposed alternative is to use a 50-mil structured geomembrane with an integral drainage layer overlain with a geotextile. The geomembrane will provide a barrier layer to reduce leachate generation. The vegetative layer will consist of on-site soil suitable for maintaining a grass cover and controlling erosion. Surface water that percolates through the vegetative layer and 18-inch thick earthen barrier layer will drain through the geocomposite drainage layer. The geocomposite will day-light periodically across the cover system and at the toe of the landfill final cover slope to provide drainage.

### 3. ENVIRONMENTAL MANAGEMENT

#### 3.1 Stormwater Collection and Conveyance

Stormwater runoff from the landfill will be directed via a system of rain gutters, tack-on benches, road ditches, downchute piping, and direct runoff to perimeter ditches surrounding the landfill limits. The perimeter ditches discharge directly to an active ash basin on the south side of the landfill. Final and interim E&SC plans are contained within the Permit to Construct Application.

During initial operations within the non-active cells, a geomembrane raincover may be used to reduce leachate generation and protect against erosion of the liner system protective cover layer prior to operations. The collected water can then be pumped into the active ash basin.

The stormwater collection and conveyance system shall be checked regularly and maintained such that necessary repairs will be made as early as practical.

#### 3.2 Leachate Collection System (LCS)

The leachate collection system (LCS) consists of a geocomposite drainage layer and a header pipe that provides gravity drainage of the leachate to sumps. From the sumps, the leachate is pumped by force main to the active ash basin which discharges in accordance with the plant's existing NPDES permit.

The general operation required to begin waste placement includes the activation of the LCS. This task is accomplished by removing and replacing the sacrificial geotextile filter in the sump area. The Operations Manager shall document LCS activation within each cell and file the documentation in the facility operation records. The design engineer will be on-site to monitor and document the removal and replacement of the sacrificial geotextile filter and the activation of the LCS in the sump area.

The LCS sump shall be equipped with a dedicated pump system. The LCS pump system contains one low-flow pump and one high-flow pump. The pump system shall operate automatically based on level switches with a low level cutoff and high level run-start activations. Additionally, a high level alarm shall be in place which will also have a high level activation. See the table below for LCS specific sump operations levels. The LCS system control panels will be equipped with visual and audible alarms programmed to activate at the programmed sump liquid level. The alarms will be equipped with a test function.

| <b>Pump</b> | <b>Low level cutoff</b> | <b>High level run-start</b> | <b>High level alarm activation</b> |
|-------------|-------------------------|-----------------------------|------------------------------------|
| Low-flow    | 12 inches               | 24 inches                   | 64 inches                          |
| High-flow   | 28 inches               | 46 inches                   |                                    |

### 3.2.1 *LCS Maintenance*

The maintenance of the leachate management system's physical facilities (consisting of HDPE piping, sumps, and pumps) and records will be performed by or under the direct supervision of Duke Energy.

The sacrificial geotextile filter over the sump area may periodically need to be removed and replaced. The operator will know when the geotextile filter is clogged and needs removal and replacement when there are low head levels in the sump and simultaneously, ponded water in the sump area. Following removal, a new geotextile filter should be heat welded or trenched in along the edges of the sump.

From the sumps, leachate will be pumped to the active ash basin on-site which discharges in accordance with the plant's existing NPDES permit. Water leaving the active ash basin will be sampled in accordance with the requirements of the plant's NPDES discharge permit.

Periodic equipment maintenance shall be performed as recommended by the equipment manufacturer. Equipment maintenance will consist of checking pumps, flow meters, valves, connections, and other system equipment for leaks, corrosion, wear, scale build-up, improper functioning, and other improper operations. Appropriate corrective measures shall be taken when equipment is not operating properly.

Observations shall be made weekly to confirm proper LCS system performance. Weekly observations shall include, but not be limited to, checking pump function, verifying flow meter function, testing visual and audible alarms, and monitoring for leaks.

Clean-out pipes are located at the ends of the LCS leachate header pipes. LCS lines and sumps shall be cleaned out by the use of a clean-out snake or high pressure water flushing at least once a year and remote camera monitored at least once every five (5) years. Leachate line cleanout and camera monitoring will be documented in the operating record.

### 3.2.2 *LCS Record Keeping and Sampling*

Records shall be maintained documenting the amounts of leachate generated and pumped to the active ash basin as well as leachate line cleanout and camera monitoring.

Leachate from the LCS system will be sampled semiannually from dedicated sample ports located on the LCS system. The following constituents will be analyzed for semi-annually:

|             |         |          |
|-------------|---------|----------|
| Temperature | Arsenic | Barium   |
| Boron       | Cadmium | Chloride |
| Chromium    | Copper  | Fluoride |

|         |          |                        |
|---------|----------|------------------------|
| Iron    | Lead     | Manganese              |
| Mercury | Nickel   | Nitrate                |
| pH      | Selenium | Silver                 |
| Sulfate | Zinc     | Total Dissolved Solids |

### 3.2.3 Contingency Plan

In the unlikely event that leachate can not be pumped to the active ash basin (i.e. a power outage), leachate flow will be temporarily stored within the landfill until such time that pumping operations to the active ash basin can be restored. Please note that the design provides for redundant electrical supply, such that the system will switch to the backup power supply line in the event that primary power is lost. In such an event, the Division shall be notified in writing, within 30 days, about the events and corrective actions taken.

### 3.3 Leak Detection System (LDS)

A leak detection system (LDS) has been incorporated into the design of the landfill. The LDS consists of a secondary 60 mil HDPE liner system overlain by a secondary geocomposite drainage layer connected to an LDS sump. Flow collected in the sump will be transferred to the active ash basin via the leachate force main.

The LDS sump shall be equipped with a dedicated pump system. The LDS pump system contains one low-flow pump. The LDS pump system shall operate automatically based on level switches with a low level cutoff and a high level run-start activation. Additionally, a high level alarm shall be in place which will also have a high level activation. See the table below for LDS specific sump operations levels. The LDS system control panels will be equipped with visual and audible alarms programmed to identify sump liquid levels. The alarms will be equipped with a test function.

| <b>Pump</b> | <b>Low level cutoff</b> | <b>High level run-start</b> | <b>High level alarm activation</b> |
|-------------|-------------------------|-----------------------------|------------------------------------|
| Low-flow    | 12 inches               | 24 inches                   | 36 inches                          |

The LDS has been designed with an Initial Response Leakage Rate (IRLR) of 300 gallons per acre per day and an Action Leakage Rate (ALR) of 500 gallons per acre per day. Should fluid collected in the LDS exceed the IRLR or ALR based on routine flow meter readings, the owner or operator shall take steps as indicated in the facility's Response Action Plan presented in Section 3.3.3.

The management of the leak detection system's physical facilities (consisting of piping and flow meters) and monitoring records will be performed by or under the direct supervision of Duke Energy.

### *3.3.1 LDS Maintenance*

Periodic equipment maintenance shall be performed as recommended by the equipment manufacturer. Equipment maintenance will consist of checking pumps, flow meters, valves, connections, and other system equipment for leaks, corrosion, wear, scale build-up, improper functioning, and other improper operations. Appropriate corrective measures shall be taken when equipment is not operating properly.

Observations shall be made weekly to confirm the proper LDS system performance. Weekly observations shall include, but not be limited to, checking pump function, verifying flow meter function, testing visual and audible alarms, and monitoring for leaks.

Clean-out pipes are located at the ends of the LDS leachate header pipes. LDS lines and sumps shall be remote camera monitored at least once every five (5) years. LDS line camera monitoring will be documented in the operating record.

### *3.3.2 Record Keeping and Monitoring*

Flow will be measured at the discharge of the LDS sump by a totalizing flow meter. The facility shall maintain records of monthly flow rate data from the LDS sump from the activation of the cell drainage system and until the waste height reaches approximately 40 feet. From that point, flow rate data shall be collected on a quarterly basis until landfill closure.

During the post-closure care period, semi-annual monitoring is required. If the liquid level in the sump stays below the pump high level run-start (no pump flow) for more than 1 year, then flow rates can be recorded annually. However, if at any time during post-closure care the pump high level run-start level is exceeded on the semi-annual or annual schedules, the facility must return to monthly monitoring, until such time as the liquid level remains below the pump high-level run start activation level for two consecutive months.

The purpose of LDS monitoring is to monitor if the leakage rates have been exceeded. Specific leakage rates are identified in Section 3.3.3. To determine if exceedances of the leakage rates have occurred, the facility must convert monitored data to an average daily flow rate for the cell (in gallons per acre per day, gpad). For example, the average daily flow rate in gpad is equal to the total monthly flow rate divided by the number of days in the month, divided by the area of the cell in acres. For calculation purposes, cell areas are summarized for Cells 1 through 4 in the table below.

| <b>Cell</b> | <b>Areas</b> |
|-------------|--------------|
| Cell 1      | 9.9 acres    |
| Cell 2      | 9.6 acres    |
| Cell 3      | 7.2 acres    |
| Cell 4      | 9.1 acres    |

If a leakage rate is exceeded, then the Division must be notified as set forth in the Response Action Plan presented in Section 3.3.3.

### 3.3.3 Response Action Plan

The purpose of the Response Action Plan is to describe the necessary course of action in the event the Initial Response Leakage Rate (IRLR) and/or the Action Leakage Rate (ALR) are exceeded. If the IRLR is exceeded, steps 1 through 4 will be followed. Should the ALR also be exceeded steps 1 through 6 will be followed. The IRLR and ALR are referenced collectively as “leakage rates” in the following Response Action Plan steps.

The IRLR is 300 gallons per acre per day.

The ALR is 500 gallons per acre per day.

Monthly IRLR and ALR flow volumes are calculated in the table below, assuming a 30-day month.

| <b>Cell</b> | <b>Areas</b> | <b>IRLR<br/>(Daily Rate<br/>Per Acre)</b> | <b>IRLR<br/>(30-Day,<br/>Monthly<br/>Volume)</b> | <b>ALR<br/>(Daily Rate<br/>Per Acre)</b> | <b>ALR<br/>(30-Day,<br/>Monthly<br/>Volume)</b> |
|-------------|--------------|---|--|--|---|
| Cell 1      | 9.9 acres    | 300 gallons<br>per acre per<br>day        | 89,100   | 500 gallons<br>per acre per<br>day       | 148,500   |
| Cell 2      | 9.6 acres    |   | 86,400   |  | 144,000   |
| Cell 3      | 7.2 acres    |   | 64,800   |  | 108,000   |
| Cell 4      | 9.1 acres    |   | 81,900   |  | 136,500   |

If the monthly volumes exceed those for the IRLR and the ALR listed in the table above, the response action steps will include:

#### *Step 1 (IRLR and ALR):*

Review physical equipment (pump and flow meter) function and data to confirm flow readings. Review operations to evaluate where operating equipment may have contacted the landfill liner or how landfill operations may have influenced the exceedance.

If the exceedance is confirmed, the cell LDS flow shall be recorded daily. Should the daily monitored LDS flow exceed the IRLR or ALR after the initial exceedance, operational responses may include: the reduction of active face area; grading to provide improved drainage; and/or, the addition of intermediate soil cover.

*Step 2 (IRLR and ALR):*

Within 14 days of identifying that a leakage rate has been exceeded, the facility shall contact the Division in writing. Daily LDS flow recording shall continue. Should none of the daily measured LDS flow rates exceed the leakage rate within 14 days of initial identification of the exceedance, monthly LDS flow averaging shall resume.

*Step 3 (IRLR and ALR):*

Within 30 days of identifying that a leakage rate has been exceeded, the facility shall submit to the Division a written preliminary assessment which shall include at a minimum:

- the amount of the liquid exceedance including initial measurement and daily measurements, if necessary, to date;
- likely sources of the liquids;
- the possible leak location;
- the possible leak size;
- the probable cause of the leak; and
- an outline of the short-term actions being taken and planned.

*Step 4 (IRLR and ALR):*

To the extent practicable, evaluate the location, size and cause of the leak; and assess the potential for leakage escaping into the environment and its mobility. Leachate quality shall be sampled, including a chemical analysis of LDS fluids, to evaluate potential hazards (pH and RCRA metals).

*Step 5 (ALR Only):*

When the ALR is exceeded, establish whether or not the unit should be closed or receipt of waste should be curtailed; and conclude whether waste should be removed from the unit for inspection, engineered controls, or repair of the liner and drainage system. Evaluate and prepare to implement what other short-term or long-term measures shall be taken to mitigate or stop any leaks according to the stage (early operations, middle operations, or closed) of landfill development..

*Step 6 (ALR Only):*

Within 60 days of identifying that the ALR has been exceeded, submit to the Division the results of the evaluation performed in Step 4, any actions taken according to Step 5, and any further measures planned. For as long as there is an

exceedance of the action leakage rate, the owner or operator shall submit monthly reports to the Division summarizing the results of the remedial actions taken and further actions planned.

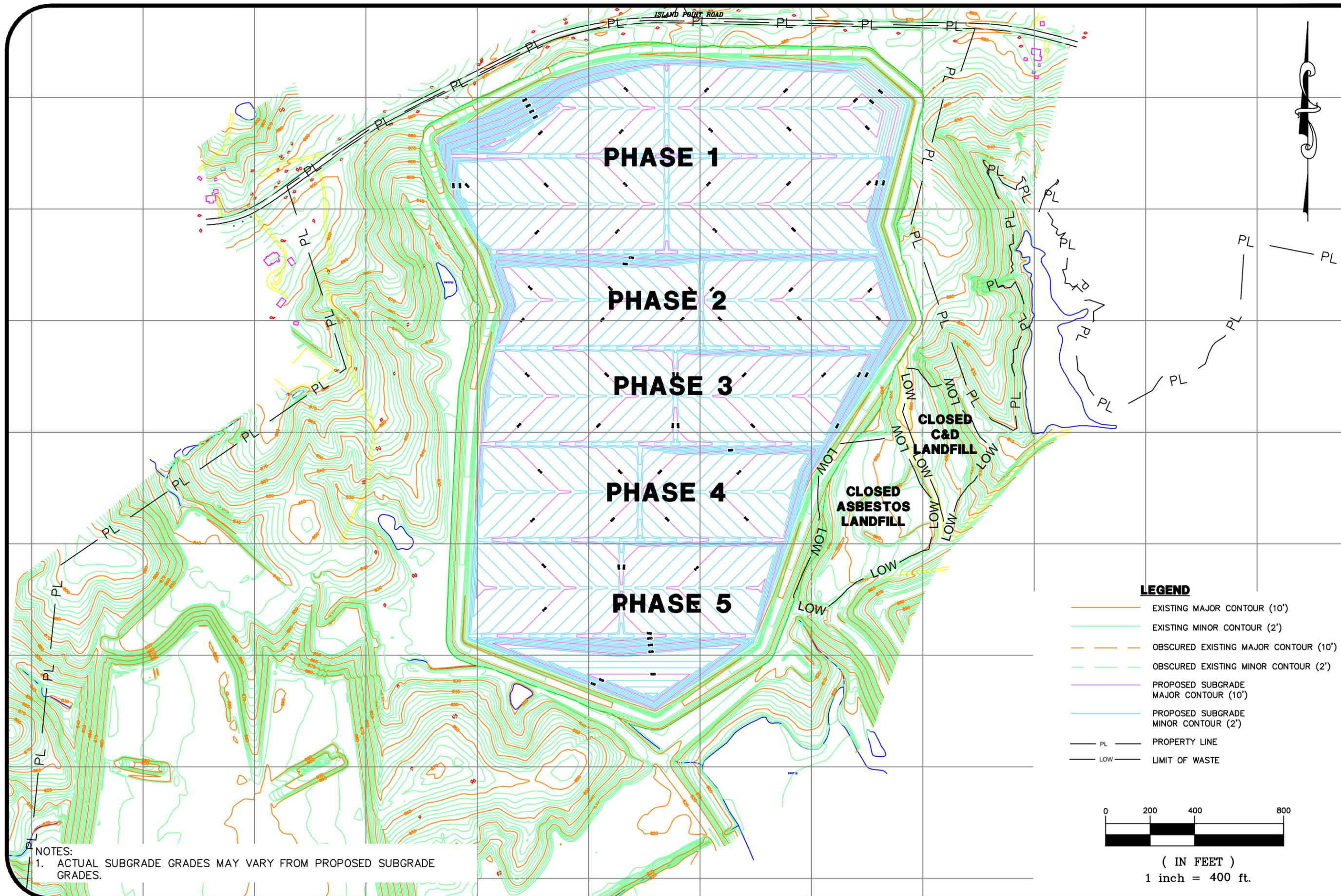
### **3.4 Landfill Gas Management**

Waste will consist of fly ash, bottom ash, flue gas desulfurization (FGD) gypsum, FGD clarifier sludge, asbestos material, land clearing and inert debris, coal mill rejects, waste limestone material, boiler slag, construction and demolition waste, sand blast material, ball mill rejects, coal waste, and pyrites generated at the Marshall Steam Station. The majority of the waste stream will consist of fly ash. The remaining small portion of the waste stream will consist of the other aforementioned waste products. Based on the nature of the waste it is not anticipated that methane or hydrogen sulfide gas will be generated or that odor will be an issue. Therefore, Duke Energy does not propose monitoring for landfill gas or providing landfill gas management measures.

In the event that methane or hydrogen sulfide gases are noticed during ordinary operations, actions will include monitoring for the presence of gas in the field with gas monitoring equipment and the final closure and post-closure plan will be developed to address gas management.

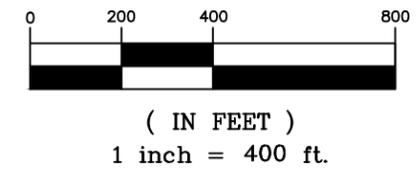
# FIGURES





NOTES:  
 1. ACTUAL SUBGRADE GRADES MAY VARY FROM PROPOSED SUBGRADE GRADES.

- LEGEND**
- EXISTING MAJOR CONTOUR (10')
  - EXISTING MINOR CONTOUR (2')
  - - - - - OBSCURED EXISTING MAJOR CONTOUR (10')
  - - - - - OBSCURED EXISTING MINOR CONTOUR (2')
  - PROPOSED SUBGRADE MAJOR CONTOUR (10')
  - PROPOSED SUBGRADE MINOR CONTOUR (2')
  - PL — PROPERTY LINE
  - LOW — LIMIT OF WASTE

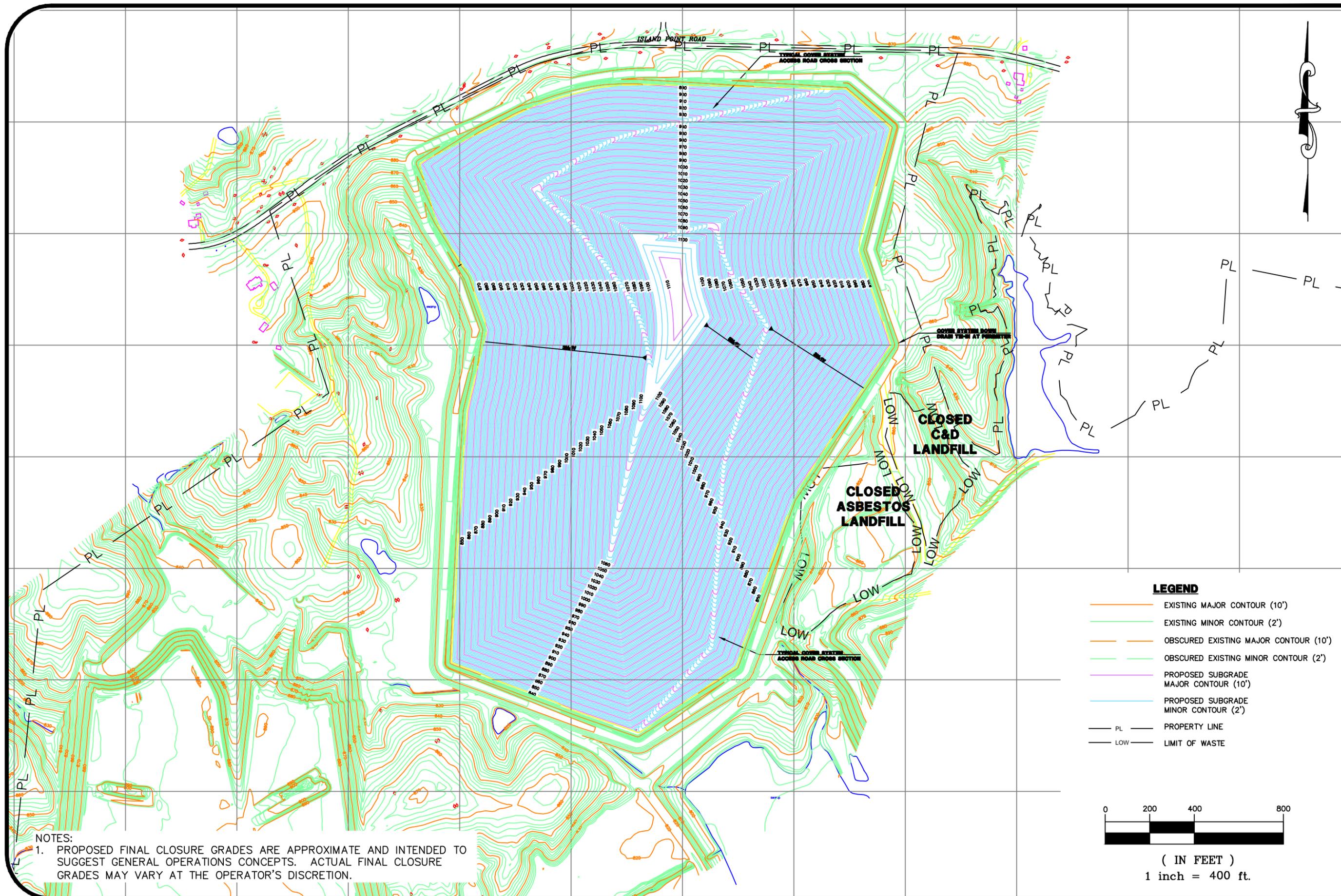


SCALE: 1" = 400'  
 PROJECT NO. 1356-08-122  
 ENGINEERING LICENSE NO. F-0176  
 DATE: 07-27-11  
 DRAWN BY: CLD  
 CHECKED BY: KRD

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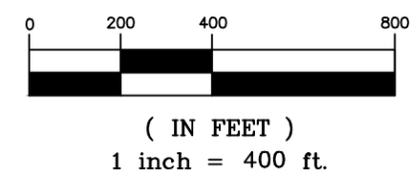
**SUBGRADE GRADING PLAN  
 INDUSTRIAL LANDFILL NO. 1**  
 MARSHALL STEAM STATION  
 TERRELL, NORTH CAROLINA

FIGURE NO.  
**1**



NOTES:  
 1. PROPOSED FINAL CLOSURE GRADES ARE APPROXIMATE AND INTENDED TO SUGGEST GENERAL OPERATIONS CONCEPTS. ACTUAL FINAL CLOSURE GRADES MAY VARY AT THE OPERATOR'S DISCRETION.

- LEGEND**
- EXISTING MAJOR CONTOUR (10')
  - EXISTING MINOR CONTOUR (2')
  - OBSCURED EXISTING MAJOR CONTOUR (10')
  - OBSCURED EXISTING MINOR CONTOUR (2')
  - PROPOSED SUBGRADE MAJOR CONTOUR (10')
  - PROPOSED SUBGRADE MINOR CONTOUR (2')
  - PL — PROPERTY LINE
  - LOW — LIMIT OF WASTE

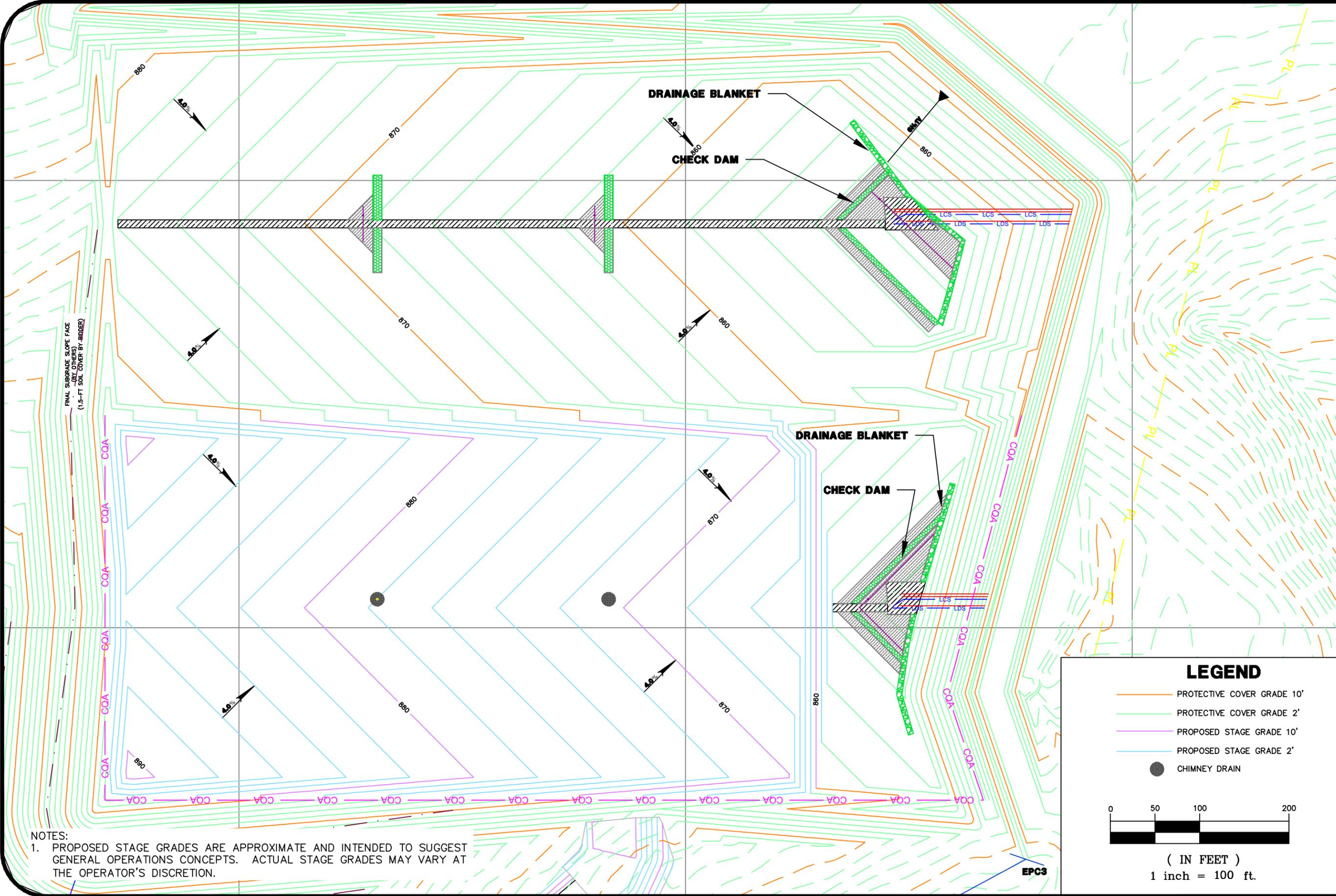


SCALE: 1" = 400'  
 PROJECT NO. 1356-08-122  
 ENGINEERING LICENSE NO. F-0176  
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**FINAL CLOSURE GRADING PLAN**  
**INDUSTRIAL LANDFILL NO. 1**  
 MARSHALL STEAM STATION  
 TERRELL, NORTH CAROLINA

FIGURE NO. **2**



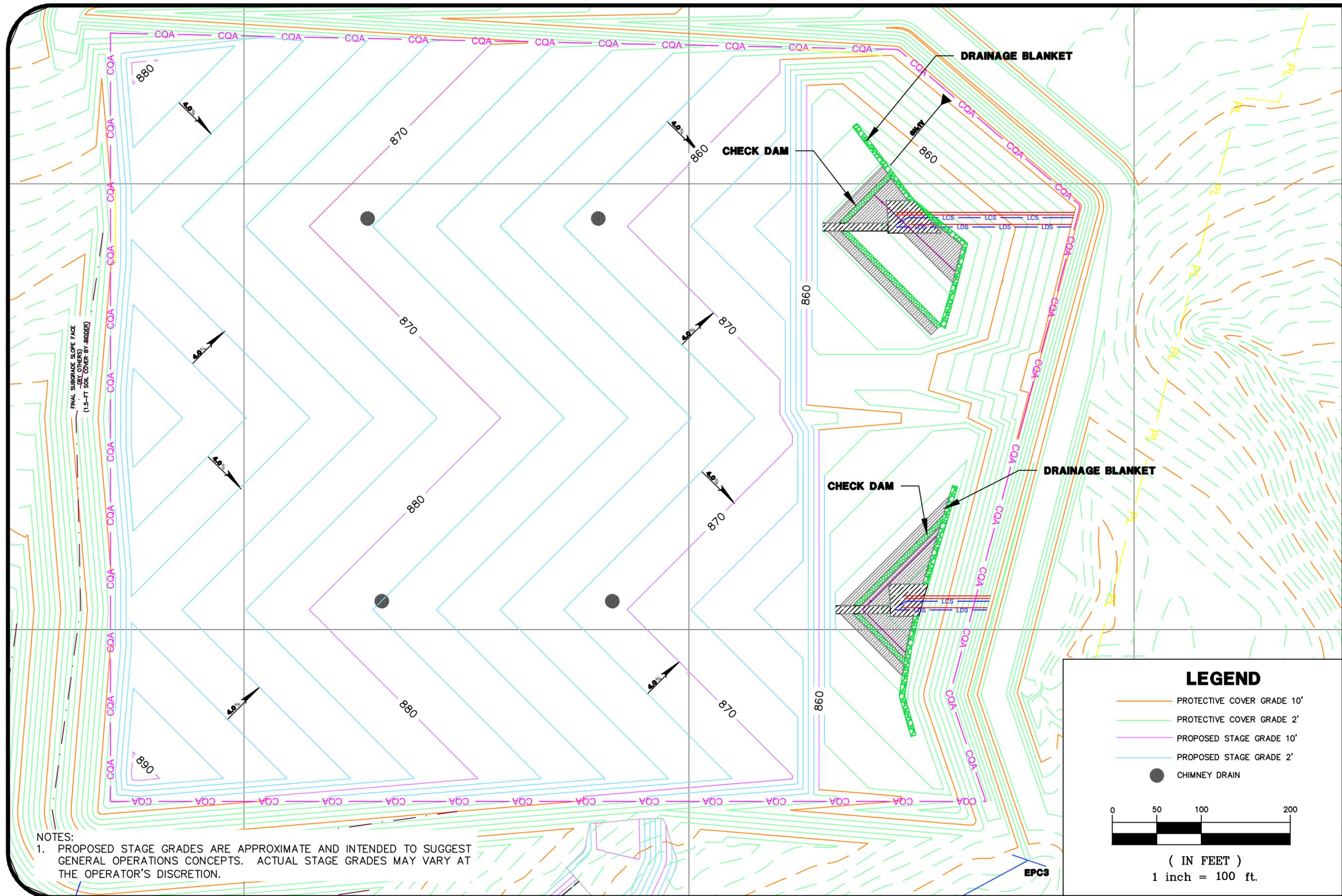
NOTES:  
 1. PROPOSED STAGE GRADES ARE APPROXIMATE AND INTENDED TO SUGGEST GENERAL OPERATIONS CONCEPTS. ACTUAL STAGE GRADES MAY VARY AT THE OPERATOR'S DISCRETION.

**LEGEND**

- PROTECTIVE COVER GRADE 10'
- PROTECTIVE COVER GRADE 2'
- PROPOSED STAGE GRADE 10'
- PROPOSED STAGE GRADE 2'
- CHIMNEY DRAIN

0 50 100 200  
 ( IN FEET )  
 1 inch = 100 ft.

|   |  |   |                 |
|---|--|---|-----------------|
| <b>CELL 2 - FILL STEP 1</b>                       |  | SCALE: 1" = 100'  | DATE: 07-27-11  |
| <b>INDUSTRIAL LANDFILL NO. 1</b>                  |  | PROJECT NO. 1356-08-122   | DRAWN BY: CLD   |
| MARSHALL STEAM STATION<br>TERRELL, NORTH CAROLINA |  | ENGINEERING LICENSE NO: F-0176  | CHECKED BY: KRD |
|   |  | 9751 SOUTHERN PINE BLVD.<br>CHARLOTTE, N.C. 28273<br><b>S&amp;ME</b><br>WWW.SMEINC.COM<br>(704)523-4726                 |                 |
| <b>FIGURE NO. 3</b>                               |  | C:\1356\DUKE ENERGY\08-122 Marshall ILF#\DWG\Industrial Landfill #1\PTC\op plans\Revised Ops Plan (July 2011)\FIG 3.dwg |                 |



NOTES:  
 1. PROPOSED STAGE GRADES ARE APPROXIMATE AND INTENDED TO SUGGEST GENERAL OPERATIONS CONCEPTS. ACTUAL STAGE GRADES MAY VARY AT THE OPERATOR'S DISCRETION.

**LEGEND**

- PROTECTIVE COVER GRADE 10'
- PROTECTIVE COVER GRADE 2'
- PROPOSED STAGE GRADE 10'
- PROPOSED STAGE GRADE 2'
- CHIMNEY DRAIN

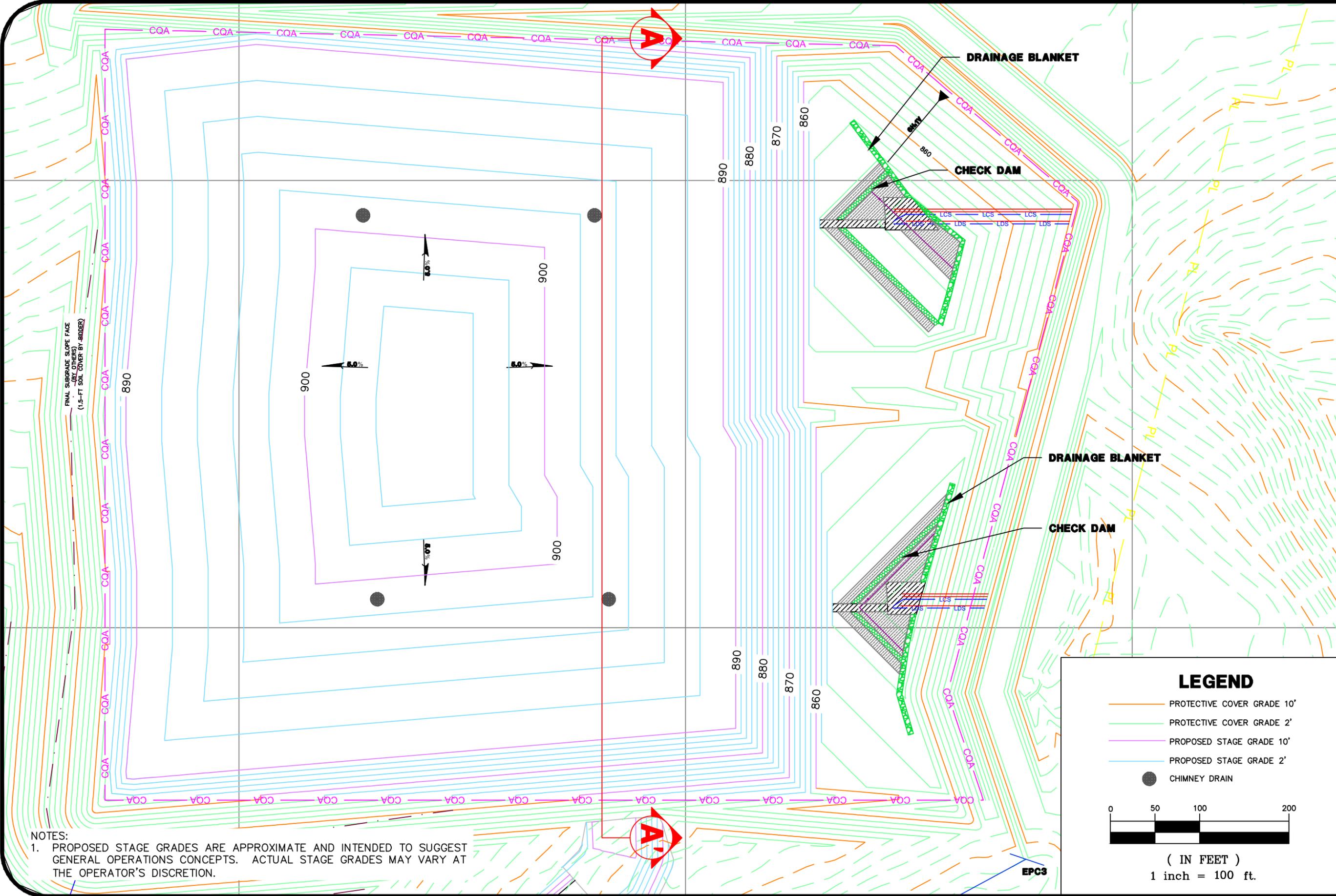
0 50 100 200  
 ( IN FEET )  
 1 inch = 100 ft.

|   |  |                                   |
|---|--|-----------------------------------|
| <b>CELL 1 - FILL STEP 2</b>                       |  | DATE: 07-27-11                    |
| <b>INDUSTRIAL LANDFILL NO. 1</b>                  |  | SCALE: 1" = 100'                  |
| MARSHALL STEAM STATION<br>TERRELL, NORTH CAROLINA |  | PROJECT NO.<br>1356-08-122        |
|   |  | ENGINEERING LICENSE NO:<br>F-0176 |
|   |  | DRAWN BY:<br>CLD                  |
|   |  | CHECKED BY:<br>KRD                |

FIGURE NO.  
**4**

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C:\1356\DUKE ENERGY\08-122 Marshall ILF#\DWG\Industrial Landfill #1\PTC\op plans\Revised Ops Plan (July 2011)\FIG 4.dwg



NOTES:  
 1. PROPOSED STAGE GRADES ARE APPROXIMATE AND INTENDED TO SUGGEST GENERAL OPERATIONS CONCEPTS. ACTUAL STAGE GRADES MAY VARY AT THE OPERATOR'S DISCRETION.

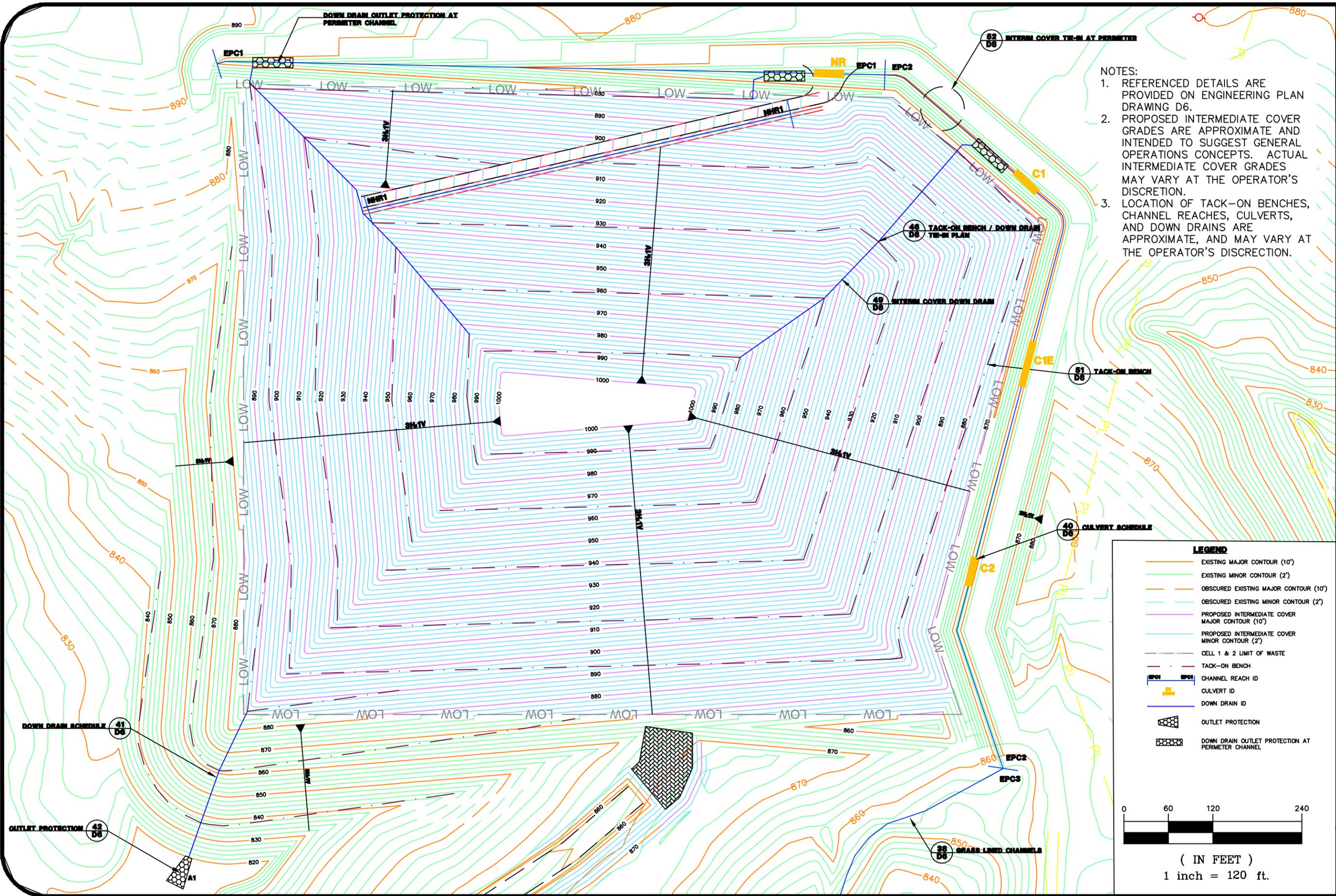
**LEGEND**

- PROTECTIVE COVER GRADE 10'
- PROTECTIVE COVER GRADE 2'
- PROPOSED STAGE GRADE 10'
- PROPOSED STAGE GRADE 2'
- CHIMNEY DRAIN

0 50 100 200

( IN FEET )  
 1 inch = 100 ft.

|   |   |  |
|---|---|--|
| <b>CELLS 1 AND 2 - FILL STEP 4</b><br><b>INDUSTRIAL LANDFILL NO. 1</b><br>MARSHALL STEAM STATION<br>TERRELL, NORTH CAROLINA | SCALE: 1" = 100'<br>PROJECT NO.<br>1356-08-122<br>ENGINEERING LICENSE NO:<br>F-0176                                     | DATE: 07-27-11<br>DRAWN BY:<br>CLD<br>CHECKED BY:<br>KRD |
|   | 9751 SOUTHERN PINE BLVD.<br>CHARLOTTE, N.C. 28273<br><b>S&amp;ME</b><br>WWW.SMEINC.COM<br>(704)523-4726                 |  |
| <b>FIGURE NO.</b><br><b>51</b>  | Q:\1356\DUKE ENERGY\08-122 Marshall ILF#\DWG\Industrial Landfill #1\PTC\op plans\Revised Ops Plan (July 2011)\FIG 5.dwg |  |



NOTES:  
 1. REFERENCED DETAILS ARE PROVIDED ON ENGINEERING PLAN DRAWING D6.  
 2. PROPOSED INTERMEDIATE COVER GRADES ARE APPROXIMATE AND INTENDED TO SUGGEST GENERAL OPERATIONS CONCEPTS. ACTUAL INTERMEDIATE COVER GRADES MAY VARY AT THE OPERATOR'S DISCRETION.  
 3. LOCATION OF TACK-ON BENCHES, CHANNEL REACHES, CULVERTS, AND DOWN DRAINS ARE APPROXIMATE, AND MAY VARY AT THE OPERATOR'S DISCRETION.

**LEGEND**

|  |   |
|--|---|
|  | EXISTING MAJOR CONTOUR (10')                      |
|  | EXISTING MINOR CONTOUR (2')                       |
|  | OBSCURED EXISTING MAJOR CONTOUR (10')             |
|  | OBSCURED EXISTING MINOR CONTOUR (2')              |
|  | PROPOSED INTERMEDIATE COVER MAJOR CONTOUR (10')   |
|  | PROPOSED INTERMEDIATE COVER MINOR CONTOUR (2')    |
|  | CELL 1 & 2 LIMIT OF WASTE                         |
|  | TACK-ON BENCH                                     |
|  | CHANNEL REACH ID                                  |
|  | CULVERT ID  |
|  | DOWN DRAIN ID                                     |
|  | OUTLET PROTECTION                                 |
|  | DOWN DRAIN OUTLET PROTECTION AT PERIMETER CHANNEL |



( IN FEET )  
 1 inch = 120 ft.

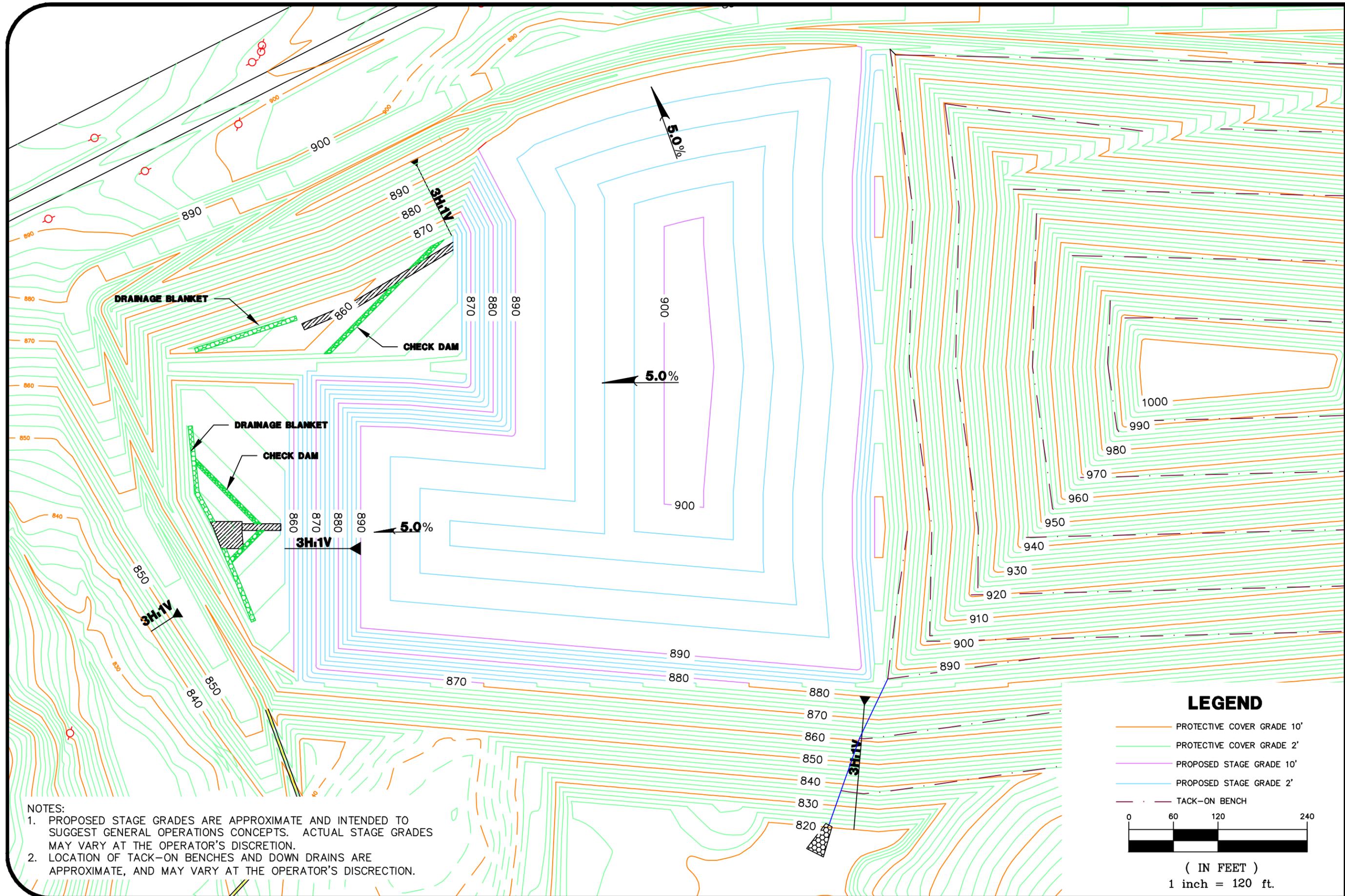
DATE: 07-27-11  
 DRAWN BY: CLD  
 CHECKED BY: KRD  
 SCALE: 1" = 120'  
 PROJECT NO. 1356-08-122  
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**CELL 1 & 2 INTERMEDIATE COVER INDUSTRIAL LANDFILL NO. 1**  
 MARSHALL STEAM STATION  
 TERRELL, NORTH CAROLINA

FIGURE NO. **6**

Q:\1356\DUKE ENERGY\08-122 Marshall ILF#1\DWG\Industrial Landfill #1\PTC\op plans\Revised Ops Plan (July 2011)\FIG 6.dwg



NOTES:  
 1. PROPOSED STAGE GRADES ARE APPROXIMATE AND INTENDED TO SUGGEST GENERAL OPERATIONS CONCEPTS. ACTUAL STAGE GRADES MAY VARY AT THE OPERATOR'S DISCRETION.  
 2. LOCATION OF TACK-ON BENCHES AND DOWN DRAINS ARE APPROXIMATE, AND MAY VARY AT THE OPERATOR'S DISCRETION.

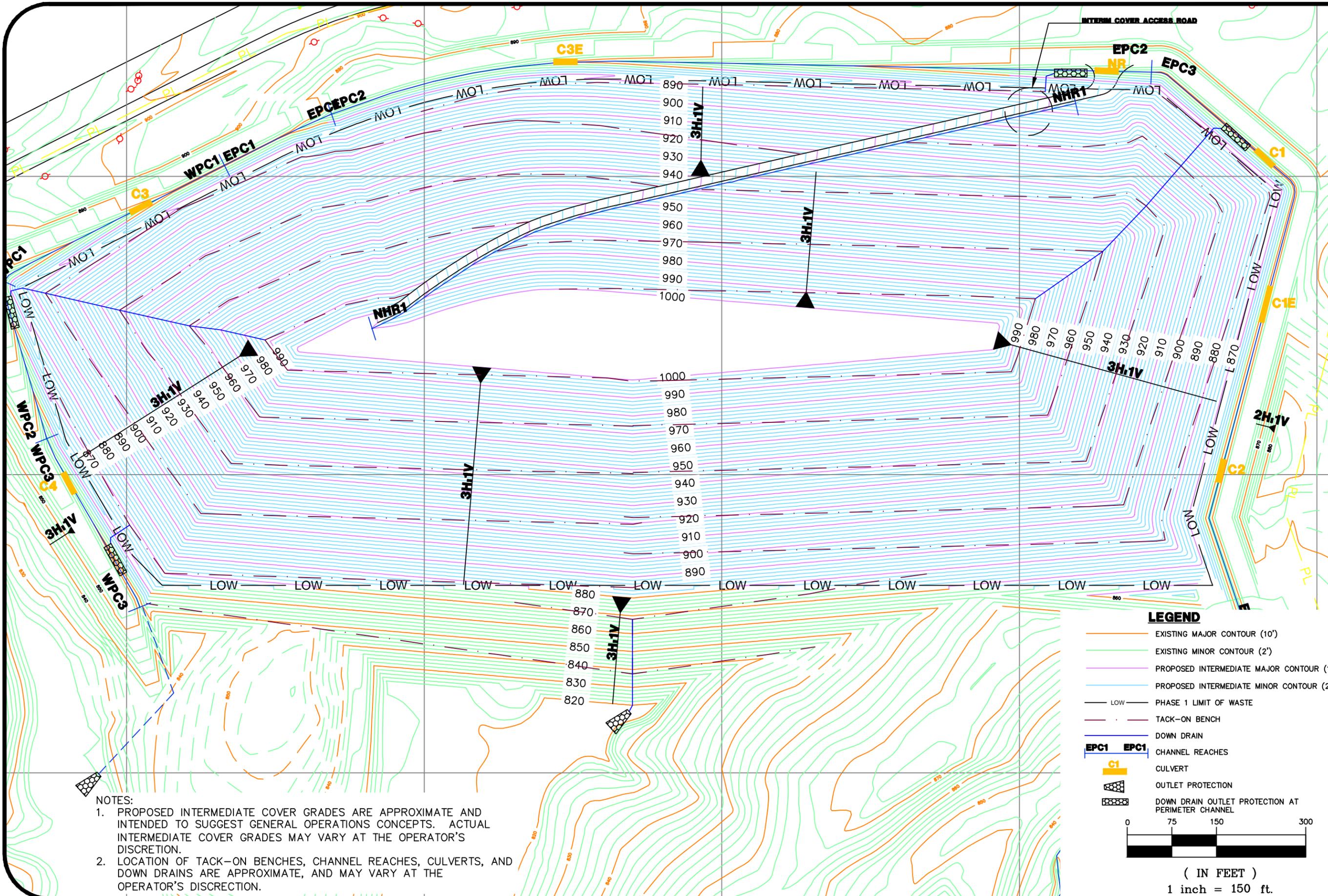
DATE: 07-27-11  
 DRAWN BY: CLD  
 CHECKED BY: KRD

SCALE: 1" = 120'  
 PROJECT NO. 1356-08-122  
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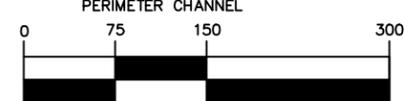
**CELLS 3 AND 4 FILLING INDUSTRIAL LANDFILL NO. 1**  
 MARSHALL STEAM STATION  
 TERRELL, NORTH CAROLINA

FIGURE NO. **7**



**LEGEND**

- EXISTING MAJOR CONTOUR (10')
- EXISTING MINOR CONTOUR (2')
- PROPOSED INTERMEDIATE MAJOR CONTOUR (10')
- PROPOSED INTERMEDIATE MINOR CONTOUR (2')
- LOW — PHASE 1 LIMIT OF WASTE
- - - TACK-ON BENCH
- DOWN DRAIN
- EPC1 EPC1 CHANNEL REACHES
- C1 CULVERT
- OUTLET PROTECTION
- DOWN DRAIN OUTLET PROTECTION AT PERIMETER CHANNEL

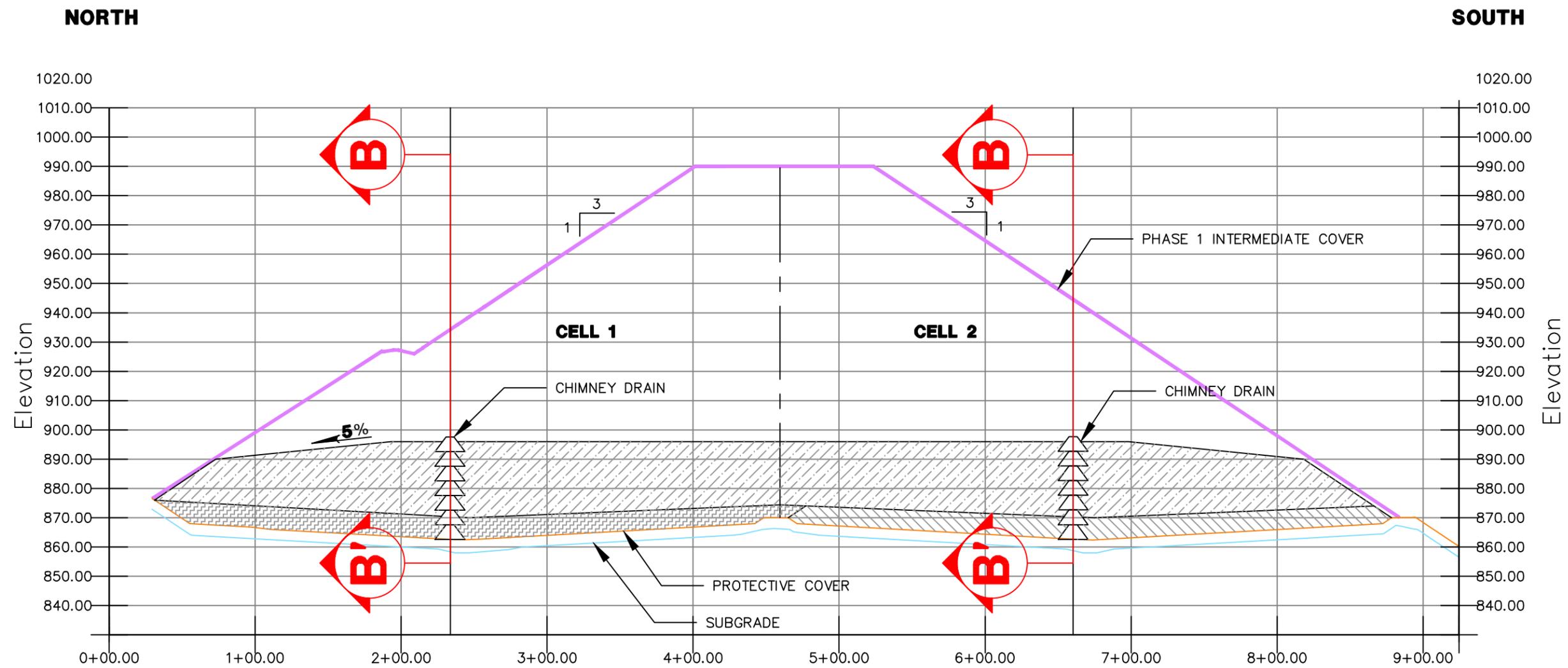


( IN FEET )  
1 inch = 150 ft.

- NOTES:**
1. PROPOSED INTERMEDIATE COVER GRADES ARE APPROXIMATE AND INTENDED TO SUGGEST GENERAL OPERATIONS CONCEPTS. ACTUAL INTERMEDIATE COVER GRADES MAY VARY AT THE OPERATOR'S DISCRETION.
  2. LOCATION OF TACK-ON BENCHES, CHANNEL REACHES, CULVERTS, AND DOWN DRAINS ARE APPROXIMATE, AND MAY VARY AT THE OPERATOR'S DISCRETION.

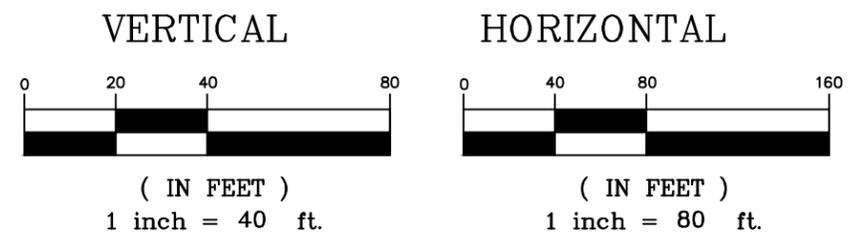
|  |   |
|--|---|
| <p><b>PHASE 1 INTERMEDIATE COVER<br/>INDUSTRIAL LANDFILL NO. 1</b></p> <p>MARSHALL STEAM STATION<br/>TERRELL, NORTH CAROLINA</p> | <p>DATE: 07-27-11</p> <p>DRAWN BY: CLD</p> <p>PROJECT NO. 1356-08-122</p> <p>ENGINEERING LICENSE NO. F-0176</p> <p>CHECKED BY: KR D</p> |
| <p>9751 SOUTHERN PINE BLVD.<br/>CHARLOTTE, N.C. 28273<br/>(704)523-4726</p> <p><b>S&amp;ME</b><br/>WWW.SMEINC.COM</p>            |   |
| <p>FIGURE NO. <b>08</b></p>  |   |

C:\Users\p1m\OneDrive\Documents\Projects\1356-08-122\1356-08-122-01.dwg (July 2011) FIG. 8.dwg



**NOTES:**

1. CELL 1 AND 2 FILLING SHALL PROGRESS IN 10-FT THICK OPERATIONAL LIFTS TO REACH PROPOSED INTERMEDIATE COVER GRADES IN A SEQUENCE SIMILAR TO THAT ILLUSTRATED HEREIN.
2. PROPOSED INTERMEDIATE COVER GRADES ARE APPROXIMATE AND INTENDED TO SUGGEST GENERAL OPERATIONS CONCEPTS. ACTUAL INTERMEDIATE COVER GRADES MAY VARY AT THE OPERATOR'S DISCRETION.
3. CHIMNEY DRAIN LOCATIONS MAY VARY AT THE OPERATOR'S DISCRETION TO HELP BETTER MANAGE CONTACT WATER.



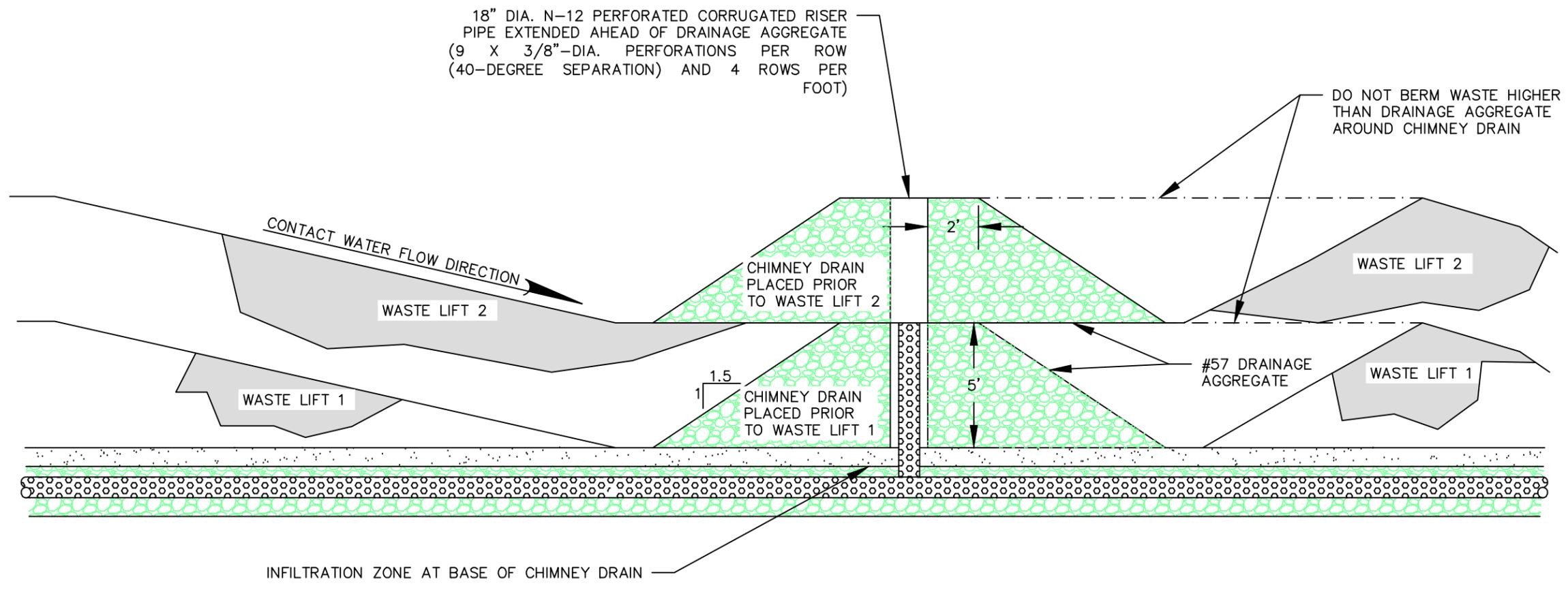
DATE: 07-27-11  
 DRAWN BY: CLD  
 CHECKED BY: KRD

SCALE: AS SHOWN  
 PROJECT NO. 1356-08-122  
 ENGINEERING LICENSE NO. F-0176

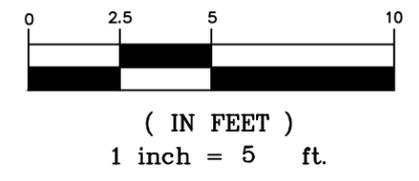


**CROSS SECTION A - A'**  
**INDUSTRIAL LANDFILL NO. 1**  
 MARSHALL STEAM STATION  
 TERRELL, NORTH CAROLINA

FIGURE NO.  
**9**



NOTES:  
 1. CHIMNEY DRAINS MAY BE MODIFIED WITH PIPE FITTINGS AT THE OPERATOR'S DISCRETION TO HELP BETTER MANAGE CONTACT WATER FROM THE ACTIVE FACE OF THE LANDFILL.



|                                |                 |
|--------------------------------|-----------------|
| SCALE: AS SHOWN                | DATE: 07-27-11  |
| PROJECT NO. 1356-08-122        | DRAWN BY: CLD   |
| ENGINEERING LICENSE NO. F-0176 | CHECKED BY: KRD |

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**CROSS SECTION B - B'**  
**INDUSTRIAL LANDFILL NO. 1**  
 MARSHALL STEAM STATION  
 TERRELL, NORTH CAROLINA

FIGURE NO.  
**10**

**DEFINITION**

Contralling runoff and erosion on disturbed areas by establishing perennial vegetative cover with seed.

**PURPOSE**

To reduce erosion and decrease sediment yield from disturbed areas, and to permanently stabilize such areas in a manner that is economical, adapts to site conditions, and allows selection of the most appropriate plant materials.

**SPECIFICATIONS**

**SEEDBED REQUIREMENTS**

Establishment of vegetation should not be attempted on sites that are unsuitable due to inappropriate soil texture, poor drainage, concentrated overland flow, or steepness of slope until measures have been taken to correct these problems.

To maintain a good stand of vegetation, the soil must meet certain minimum requirements as a growth medium. The existing soil should have these criteria:

- Enough fine-grained (silt and clay) material to maintain adequate moisture and nutrient supply (available water capacity of at least .05 inches water to 1 inch of soil).
- Sufficient pore space to permit root penetration.
- Sufficient depth of soil to provide an adequate root zone. The depth to rock or impermeable layers such as hardpans should be 12 inches or more, except on slopes steeper than 2:1 where the addition of soil is not feasible.
- A favorable pH range for plant growth, usually 6.0 – 6.5.
- Free from large roots, branches, stones, large clods of earth, or trash of any kind. Clods and stones may be left on slopes steeper than 3:1 if they are to be hydro seeded.

If any of the above criteria are not met – i.e., if existing soil is too coarse, dense, shallow or acidic to foster vegetation – special amendments are required. The soil conditioners described below may be beneficial or, preferably, topsoil may be applied.

**SEEDBED PREPARATION**

Install necessary mechanical erosion and sedimentation control practices before seeding, and complete grading according to the approved plan.

Lime and fertilizer needs should be determined by soil tests. Directions, sample cartons, and information sheets are available through county Agricultural Extension offices. Testing is also done by commercial laboratories.

When soil tests results are not available, follow rates suggested in the seeding specifications shown at right. Application rates usually fall into the following ranges:

- Ground agricultural limestone:  
Light-textured, sandy soils: 1 to 1-1/2 tons/acre  
Heavy-textured, clayey soils: 2-3 tons/acre
- Fertilizer:  
Grasses: 800-1200 lb/acre of 10-10-10 (or the equivalent)  
Grass-legume mixtures: 800-1200 lb/acre of 5-10-10 (or the equivalent)

Apply lime and fertilizer evenly and incorporate into the top 4-6 inches of soil by disking or other suitable means. Operate machinery on the contour. When using a hydro seeder, apply lime and fertilizer to a rough, loose surface.

Roughen surfaces prior to seeding.

Complete seedbed preparation by breaking up large clods and raking into a smooth, uniform surface (slopes less than 3:1). Fill in or level depressions that can collect water. Broadcast seed into a freshly loosened seedbed that has not been sealed by rainfall.

**SEEDING**

Seeding dates given in the seeding mixture specifications are designated as "best" or "possible". Seedings properly carried out within the "best" dates have a high probability of success. It is also possible to have satisfactory establishment when seeding outside these dates. However, as you deviate from them, the probability of failure increases rapidly. Seeding on the last date shown under "possible" may reduce changes of success by 30-50%. Always take this into account in scheduling land-disturbing activities.

Use certified seed for permanent seeding whenever possible.

Labeling of non-certified seed is also required by law. Labels contain important information on seed purity, germination, and presence of weed seeds. Seeds must meet State standards for content of noxious weeds. Do not accept seed containing "prohibited" noxious weed seed.

Inoculate legume seed with the Rhizobium bacteria appropriate to the species of legume. Apply seed uniformly with a cyclone seeder, drop-type spreader, drill, cultipacker seeder, or hydro seeder on a firm, friable seedbed.

When using a drill or cultipacker seeder, plant small grains no more than 1 inch deep, grasses and legumes no more than 1/2 inch. Equipment should be calibrated in the field for the desired seeding rate.

When using broadcast-seeding methods, subdivide the area into workable sections and determine the amount of seed needed for each section. Apply one-half the seed while moving back and forth across the area, making a uniform pattern: then apply the second half in the same way, but moving at right angles to the first pass.

Mulch all plantings immediately after seeding.

**HYDRO SEEDING**

Surface roughening is particularly important when hydro seeding, as a roughened slope will provide some natural coverage for lime, fertilizer, and seed. The surface should not be compacted or smooth. Fine seedbed preparation is not necessary for hydro seeding operations: large clods, stones, and irregularities provide cavities in which seeds can lodge.

Rate of wood fiber (cellulose) application should be at least 2,000 lb/acre.

Apply legume inoculants at four times the recommended rate when adding inoculant to a hydro seeder slurry.

If a machinery breakdown of 1/2 to 2 hours occurs, add 50% more seed to the tank, based on the proportion of the slurry remaining. This should compensate for damage to seed. Beyond 2 hours, a full rate of new seed may be necessary.

Lime is not normally applied with a hydraulic seeder because it is abrasive. It can be blown onto steep slopes in dry form.

**MAINTENANCE**

Generally, a stand of vegetation cannot be determined to be fully established until soil cover has been maintained for one full year from planting. Inspect seeded areas for failure and make necessary repairs and reseeds within the same season, if possible.

Reseeding--If a stand has inadequate cover, re-evaluate choice of plant materials and quantities of lime and fertilizer. Re-establish the stand after seedbed preparation or over-seed the stand. Consider seeding temporary, annual species if the time of year is not appropriate for permanent seeding.

If vegetation fails to grow, soil must be tested to determine if acidity or nutrient imbalance is responsible.

Fertilization--On the typical disturbed site, full establishment usually requires re-fertilization in the second growing season. Fine turf requires annual maintenance fertilization. Use soil tests if possible or follow the guidelines given for the specific seeding mixture.

**TEMPORARY SEEDING SPECIFICATIONS**

**Seeding mixture (fall)**

| Species*    | Rate (lb/acre) |
|-------------|----------------|
| Rye (grain) | 120            |

**Seeding Mixture (late winter early spring)**

| Species*                   | Rate (lb/acre) |
|----------------------------|----------------|
| Rye (grain)                | 120            |
| Red clover or winter wheat |                |

Omit Annual Lespedeza when duration of temporary cover is not to extend beyond July.

**Seeding mixture (summer)**

| Species*      | Rate (lb/acre) |
|---------------|----------------|
| German Millet | 40             |

**Seeding dates (Piedmont)**

|                             |                     |
|-----------------------------|---------------------|
| Fall:                       | Aug. 15 – Dec. 30   |
| Late winter (early spring): | Jan. 1 – May 1 Late |
| Summer:                     | May 1 – Aug. 15     |

**Soil amendments**

Follow recommendations of soil tests or apply 2,000 lb/acre ground agricultural limestone and 750 lb/acre 10-10-10 fertilizer.

**Mulch**

Apply 4,000 lb/acre straw. Anchor mulch by tacking with asphalt, roving or a mulch anchoring tool. A disk with blades set nearly straight can be used as a mulch anchoring tool.

**Maintenance**

Re-fertilize if growth is not fully adequate. Reseed, re-fertilize and mulch immediately following erosion or other damage.

Pursuant to G.S. 113A-57(2), the angle for graded slopes and fills shall be no greater than the angle that can be retained by vegetative cover or other adequate erosion-control devices or structures. In any event, slopes left exposed will, within 21 calendar days of completion of any phase of grading, be planted or otherwise provided with temporary or permanent ground cover, devices, or structures sufficient to restrain erosion.

Pursuant to G.S. 113A-57(3), provisions for permanent groundcover sufficient to restrain erosion must be accomplished for all disturbed areas within 15 working days or 90 calendar days (whichever is shorter) following completion of construction or development.

\*REF: 6.10 A,B and C, NC Erosion and Sediment Control Planning and Design Manual, 2006

**PERMANENT SEEDING SPECIFICATIONS**

**Seeding mixture**

| Species         | Rate (lb/acre) |
|-----------------|----------------|
| Annual ryegrass | 40             |
| Foxtail millet  | 30             |
| Tall fescue     | 31             |
| Red top         | 21             |
| Durana clover   | 8              |

**Nurse plants**

Between May 1 and Aug. 15, add 10 lb/acre German millet or 15 lb/acre Sudan grass. Prior to May 1 or after Aug. 15, add 40 lb/acre rye (grain).

**Seeding dates**

|              | Best               | Possible          |
|--------------|--------------------|-------------------|
| Fall:        | Aug. 25 – Sept. 15 | Aug. 20 – Oct. 25 |
| Late winter: | Feb. 15 – Mar. 21  | Feb. 1 –Apr. 15   |

Fall is best for tall fescue and late winter for lespedezas. Over seeding of Kobe lespedeza over fall-seeded tall fescue is very effective.

**Soil amendments**

Apply lime and fertilizer according to soil tests, or apply 4,000 lb/acre ground agricultural limestone and 1,000 lb/acre 10-10-10 fertilizer.

**Mulch**

Apply 4,000-5,000 lb/acre grain straw or equivalent cover of another suitable mulching material. Anchor mulch by tacking with asphalt, roving, or netting. Netting is the preferred anchoring method on steep slopes.

**Maintenance**

Re-fertilize in the second year unless growth is fully adequate. May be mowed once or twice a year, but mowing is not necessary. Reseed, fertilize, and mulch damaged areas immediately.

Pursuant to G.S. 113A-57(3), provisions for permanent groundcover sufficient to restrain erosion must be accomplished for all disturbed areas within 15 working days or 90 calendar days (whichever is shorter) following completion of construction or development.

**GENERAL SEEDING SPECIFICATIONS**

DATE: 07-27-11

DRAWN BY:

CHR

CHECKED BY:

KRD

SCALE: N.T.S.

PROJECT NO.

1356-08-122

ENGINEERING LICENSE NO:

F-0176

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**SEEDING SPECIFICATION**  
**INDUSTRIAL LANDFILL NO.1**

MARSHALL STEAM STATION  
TERRELL, NORTH CAROLINA

FIGURE NO.

11

**APPENDIX I – EMERGENCY ACTION  
PLAN**



EMERGENCY ACTION PLAN (EAP)  
INDUSTRIAL LANDFILL NO. 1  
PERMIT NO. 1812  
MARSHALL STEAM STATION  
TERRELL, NORTH CAROLINA  
S&ME Project No. 1356-08-122  
S&ME Engineering License No. F-0176



Prepared for:  
Duke Energy Carolinas, LLC  
526 South Church Street  
Charlotte, North Carolina 28202



Prepared by:  
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November 24, 2009

Revised February 3, 2010  
Revised February 28, 2011  
Revised August 3, 2011

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## 1. STATEMENT OF PURPOSE

The purpose of this Emergency Action Plan (EAP) is to provide guidance to identify potential slope failure events of the landfill, and minimize their impacts within the Marshall Steam Station property owned by Duke Energy Carolinas, LLC (Duke Energy).

This EAP establishes slope instability identification criteria, identifies emergency response entities, identifies impacted areas, establishes procedures for notification and provides contact information for emergency notifications. This EAP provides a framework for consistent and appropriate response to slope failure events, should they occur. Implementation and familiarity with the elements of the EAP will reduce the risk associated with landfill operations and help to mitigate impacts resulting from slope failure events.

## 2. PROJECT DESCRIPTION & IMPACTS

The proposed landfill is located on the northern portion of the Duke Energy – Marshall Steam Station property approximately 1.5 miles north of the Marshall Steam Station in parts within the footprint of an inactive ash basin. Waste fill heights are expected to be on the order of 240 feet with slopes constructed at 3 (horizontal) to 1 (vertical) slopes.

The proposed landfill is bound by existing ground and an earthen dike at the southeast corner. Adjacent to the inactive ash basin to the east is a closed asbestos landfill. To the west of the proposed landfill is the existing structural fill area. To the north of the proposed landfill is Island Point Road. Impacted areas are located on Duke Energy's Marshall Steam Station property.

## 3. SLOPE FAILURE IDENTIFICATION CRITERIA

### 3.1 Alert Status

The following conditions indicate a potential emergency situation. If one or more of these conditions are observed, the owner should initiate Notification Sequence 1 immediately:

- i. cracking on landfill slope faces;
- ii. bulging on landfill slope faces;
- iii. wet spots, seepage, or flow emerging from or near the landfill slope faces; and
- iv. shallow sloughing up to about three feet deep.

While under Alert Status, the owner shall continuously monitor slope conditions of the landfill. The owner shall communicate regularly with North Carolina Department of Environment and Natural Resources (NCDENR) personnel and the Engineer. The owner shall evaluate if conditions warrant a transition to Emergency Status, and notify the emergency management authorities.

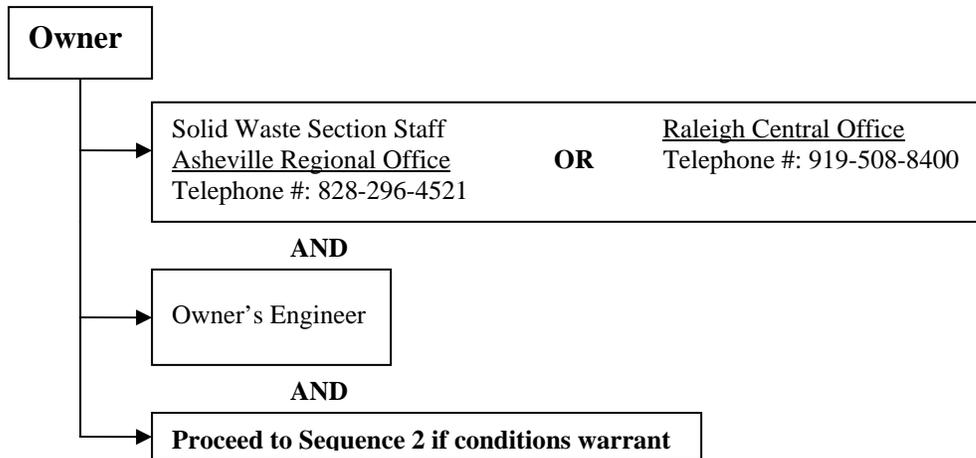
### **3.2 Emergency Status**

The following conditions indicate slope failure is possible. If one or more of these conditions is observed, the owner should initiate Notification Sequence 2 immediately:

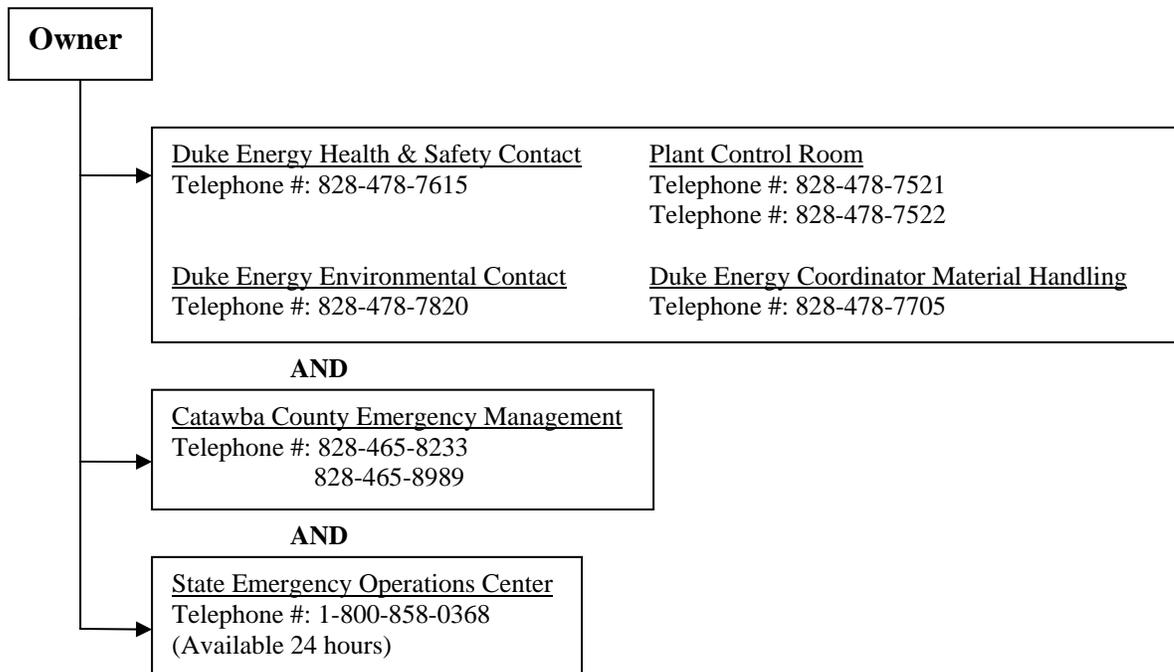
- i. slope faces in the process of cracking, sliding, or sloughing.
- ii. turbid seepage (that is, muddy seepage) and or boils emerging from the landfill slope faces.

#### 4. NOTIFICATION SEQUENCE

**Sequence 1:** If one of the **Alert Conditions** listed in Section 3.1 of this plan has been observed, but slope failure does not appear imminent then the following notification sequence is followed by the **Owner**:



**Sequence 2:** If one of the **Emergency Conditions** listed in Section 3.2 of this plan is occurring or slope failure appears to be otherwise imminent, the following notification sequence is followed by the Owner:



In the event of an **Emergency Condition**, if directed by the station, assemble at the designated Assembly Area.

# **APPENDIX II – OPERATIONS QUALITY ASSURANCE PLAN**



OPERATIONS QUALITY ASSURANCE PLAN  
INDUSTRIAL LANDFILL NO. 1  
PERMIT NO. 1812  
MARSHALL STEAM STATION  
TERRELL, NORTH CAROLINA  
S&ME Project No. 1356-08-122



Prepared for:  
Duke Energy Carolinas, LLC  
526 South Church Street  
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9751 Southern Pine Boulevard  
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November 24, 2009

Revised February 3, 2010  
Revised February 28, 2011  
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## 1. PROJECT DESCRIPTION

Quality assurance (QA) monitoring and testing of waste placement during operations of the Marshall Steam Station - Industrial Landfill No. 1 shall be performed as presented herein. QA monitoring and testing will be provided by an engineering and testing firm independent of the operator specializing in the observation and testing of soils.

The landfill will accept only fly ash, bottom ash, flue gas desulfurization (FGD) gypsum, FGD clarifier sludge, asbestos material, land clearing and inert debris, coal mill rejects, waste limestone material, boiler slag, construction and demolition waste, sand blast material, ball mill rejects, coal waste, and pyrites generated at the Marshall Steam Station. The waste stream was assumed for design to be comprised predominantly of fly ash. QA monitoring and testing is proposed only for fly ash. Other waste materials shall be placed consistent with Operations Plan requirements.

## 2. QA MONITORING AND TESTING

### 2.1 Waste Placement

Waste shall be placed and compacted using compactors and dozers in approximate 1-foot lifts to achieve a vertical operational lift thickness of 10 feet. The waste filling sequence shall be consistent with the Operations Plan. In general the waste filling sequence shall progress in 10-ft thick operational lifts, with each lift completed across a whole cell before beginning the next lift.

### 2.2 QA Field Monitoring

QA field monitoring shall be performed to verify that operations are being performed in accordance with the general steps outlined in Section 2 of the Operations Plan. The engineering technician responsible for field monitoring shall document the waste type, location of waste placement, and general placement and compaction methods during waste placement. Documentation shall include information, such as the operator's equipment types and number of passes to achieve the minimum compaction requirements. Waste placement monitoring documentation shall be maintained with the on-site operation records.

### 2.3 QA Field Testing

QA field testing shall be performed to monitor the compaction and moisture conditioning during waste placement. Waste shall be compacted to a minimum 95 percent of its Standard Proctor (ASTM D 698) maximum dry density. Compacted moisture content shall be within 5 percent of optimum moisture content.

In-place density and moisture content testing shall be performed at a frequency of one test per 10,000 cubic yards of waste placed. In-place density testing shall be performed using the Sand-Cone Method (ASTM D 1556), Nuclear Methods (ASTM D 6938), or the Drive-Cylinder Method (ASTM D 2937). Moisture content testing shall be performed using the

Direct Heating Method (ASTM D 4959) or Nuclear Methods (ASTM D 6938). Density test locations shall generally be documented on a referenced grid system. Waste placement testing records shall be maintained with the on-site operations records.

In the event that an in-place density and moisture content test fails, the area of waste placement shall be reworked, reconditioned, and retested until the minimum compaction requirement is met.

#### **2.4 Laboratory Testing**

Laboratory testing shall be performed at a frequency of one Standard Proctor test (ASTM D 698) per 50,000 cubic yards of waste placed. Laboratory testing records shall be maintained with the on-site operations records.

# APPENDIX III – DUST CONTROL PLAN



DUST CONTROL PLAN  
INDUSTRIAL LANDFILL NO. 1  
PERMIT NO. 1812  
MARSHALL STEAM STATION  
TERRELL, NORTH CAROLINA  
**S&ME Project No. 1356-08-122**  
**S&ME Engineering License No. F-0176**



Prepared for:  
526 South Church Street  
Charlotte, North Carolina 28202



Prepared by:  
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9751 Southern Pine Boulevard  
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August 3, 2011

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| <b>FIGURE</b> | <b>TITLE</b>            |
|---------------|-------------------------|
| 1             | Phase 1 Operations Grid |

## 1. INTRODUCTION AND SITE DESCRIPTION

This Dust Control Plan is for the Industrial Landfill No. 1 at Duke Energy's Marshall Steam Station. This Plan provides dust control methods for managing dust emissions at the landfill, and it provides a monitoring program and corrective action response to contain coal combustion product (CCP's) to prevent dust nuisances to employees and the public. The monitoring program will aid Duke Energy and the landfill operator in evaluating the dust control methods, or combination of dust control methods, that prove effective with site specific conditions.

The landfill has an approximate 36-acre footprint, and is used for CCP management. CCP's primarily consist of fly ash, bottom ash, flue gas desulfurization (FGD) gypsum, FGD clarifier sludge, coal mill rejects, waste limestone material, boiler slag, ball mill rejects, coal waste, and pyrites generated at the Marshall Steam Station. The landfill is permitted to accept non-CCP wastes including asbestos material, land clearing and inert debris, and construction and demolition waste, and sand blast material.

This Plan is Appendix III to the approved landfill Operations Plan.

## 2. DUST CONTROL METHODS

The primary potential source of dust emissions in the landfill is the top deck area and active area of waste placement. These areas are at a higher risk for producing dust due to vehicular and equipment traffic and earthworks-like construction. Exterior landfill slopes are less of a dust control concern as they have intermediate or operational soil covers which are vegetated as required in the Operations Plan. Operational soil cover was previously defined as 6 inches of soil material applied weekly to the active area of waste placement.

Dust emissions from the landfill can be controlled through a variety of dust control methods. Possible dust control methods are identified herein. Dust control methods may be characterized as products and/or applications, structural wind breaks and/or covers, and operational methods.

Dust control methods for the landfill area include:

- Watering;
- Establishing vegetative cover;
- Mulching;
- Structural controls consisting of:
  - Wind breaks (i.e. fencing and/or berms); and
  - Temporary coverings (i.e. tarps);
- Spray applied dust suppressants consisting of, and not limited to:
  - Anionic asphalt emulsion;
  - Latex emulsion;
  - Resin in water;

- Polymer based emulsion; and
- Mineral mortar coatings (i.e. posi-shell);
- Calcium chloride;
- Soil stabilizers (i.e. soil cements);
- Operational soil cover;
- Modifying the active working area; and
- Modifying operations during dry and windy conditions.

The operator may use, and is not limited to, combinations of these dust control methods or any method that is technically sound to control dust for the specific site conditions. If the operator intends to use a dust control method not presented above, the proposed dust control method will be evaluated on a case-by-case basis to assess the effectiveness with specific site conditions. For the purposes of this Plan, operational soil cover will be defined as soil material applied at a suitable thickness to provide dust control. The effectiveness of the dust control methods implemented should be evaluated through a dust monitoring program outlined in Section 3.

Operational equipment generally consists of dump trucks, vibratory smooth drum roller, bulldozer, water truck, spray trailer, track hoe, and service truck. Operational equipment will be used to construct, install, apply, and/or repair dust control methods. The operator will make provisions to alleviate any on-site issues that arise when primary equipment is being maintained or is inoperable. Marshall Steam Station contains multiple landfill facilities, and the landfill operator will make provisions to have the necessary equipment to control multiple fugitive CCP dusting emission events.

### 3. MONITORING AND CORRECTIVE ACTION RESPONSE

This section describes a dust monitoring program and suggests corrective action responses should fugitive emissions be observed.

#### 3.1 Monitoring

During landfill operations, a dust monitoring program will be implemented to evaluate the dust control measure performance and observe the areas for dust emissions. The dust monitoring program consists of performing visual observations of dust prone areas, dust control measures, and monitoring existing and forecasted weather conditions.

Dust emissions can occur under many conditions. For the purposes of this Plan, dust emissions are characterized as fugitive emissions, where CCP dust is located outside the limit of landfill waste. This is most likely to occur during windy, dry, and hot weather conditions. Therefore, the operator will monitor both existing and forecasted weather conditions and use dust control measures suited to the weather conditions. The dust control measures shall be implemented prior to the forecasted weather conditions.

Equipment operators shall continuously observe the active face and other areas within the landfill limit for dust emissions. In addition, preventative dust control measures should be observed and documented at least twice daily (morning and afternoon) when the

landfill is in operation to evaluate the dust control measure performance. Additional observations may be necessary as site and weather conditions dictate. Observations will be documented on the attached “*Monitoring Worksheet*,” or online database/worksheet, etc. Due to the continual maintenance necessary on moisture conditioned and spray-applied areas, the operator shall pay particular attention to these areas. Structural controls shall be observed to monitor that they are achieving their intended purpose. Observations in the landfill area may be made with reference to the Phase 1 Operations Grid shown in the attached Figure 1.

Monitoring will be conducted during times when the landfill is in operations. The operator shall continue to provide necessary dust control measures during periods when operations are inactive (i.e. outages, weekends, holidays). Operators are to establish appropriate measures so that dust emissions are not reasonably likely to occur during inactive operations periods when monitoring is not being conducted.

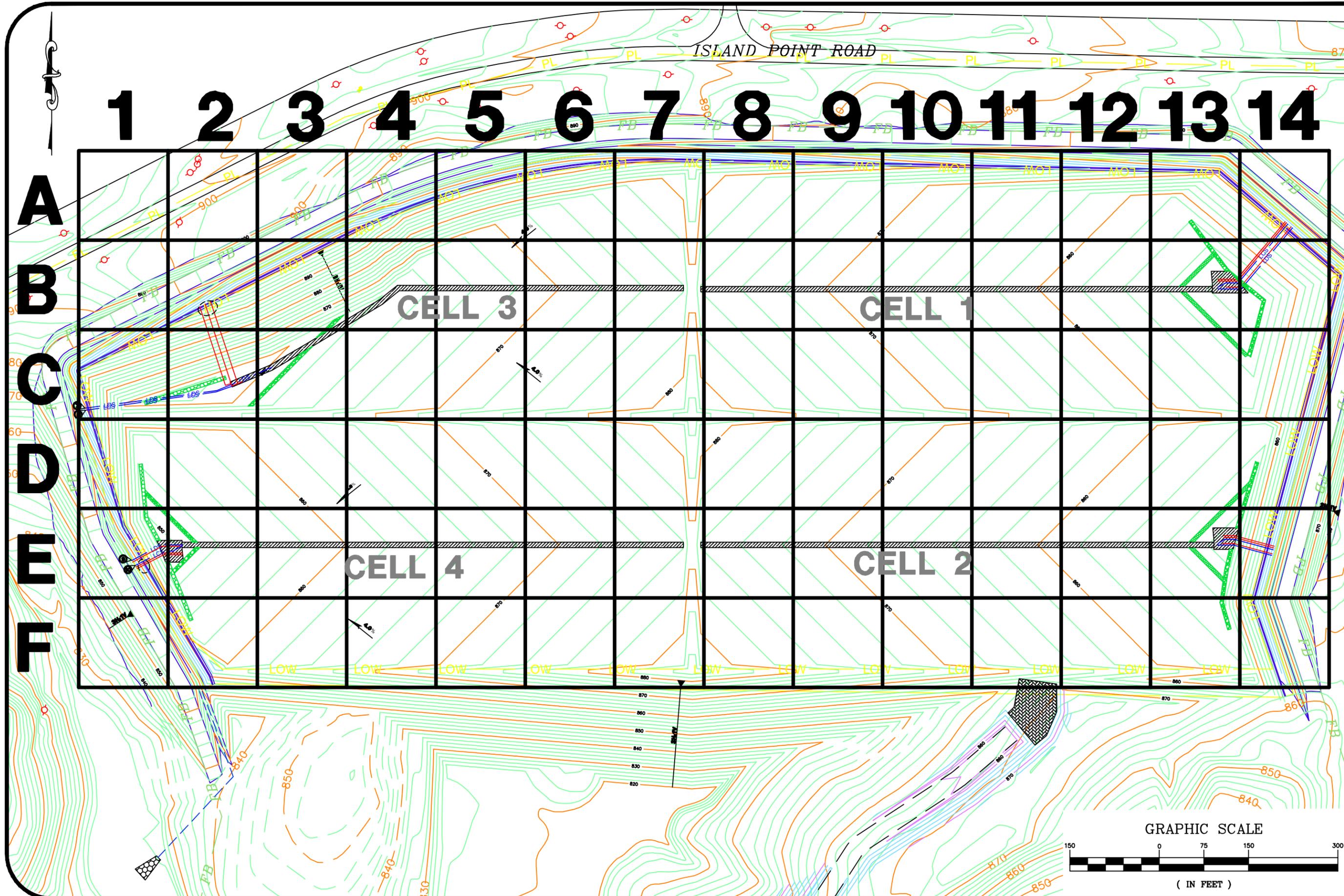
### **3.2 Corrective Action**

If fugitive dust emissions are observed and observations indicate dust control measures are not achieving their intended purpose, then appropriate corrective actions will be taken. Dust control measures should be reapplied, repaired, or added, as necessary, to control dust emissions. The operator will construct, install, apply, and/or repair dust control measures prior to the end of the work day to control dust emissions during non-operating hours. The operator will implement dust control measures as preventative controls rather than in response to fugitive dust emissions.

## **4. REGULATED COVER REQUIREMENTS**

As previously stated, the landfill is permitted to accept non-CCP wastes including asbestos material and construction and demolition waste. Asbestos material and construction and demolition waste shall be placed in accordance with the approved Operations Plan and regulated cover requirements. In accordance with 40 CFR 61, asbestos material shall be covered with 6 inches of nonasbestos-containing material (i.e. soil, ash, gypsum) within a 24-hour period. In accordance with Solid Waste Rules Section 15A NCAC 13B.0542, construction and demolition waste shall be covered with 6 inches of earthen material (i.e. soil, ash, gypsum) when the disposal area exceeds one-half acre and at least once weekly.





|   |                         |             |
|---|-------------------------|-------------|
| DATE: 06/13/11  | DRAWN BY: KB            | CHECKED BY: |
| SCALE: 1" = 150'  | PROJECT NO. 1356-08-122 |             |
| <br><b>S&amp;ME</b><br>WWW.SMEINC.COM   |                         |             |
| <b>PHASE 1 OPERATIONS GRID</b><br><b>DUST CONTROL PLAN</b><br>MARSHALL INDUSTRIAL LANDFILL NO. 1<br>TERRELL, NORTH CAROLINA |                         |             |
| FIGURE NO.  |                         | <b>1</b>    |