ftn Associates Ltd.
water resources / environmental consultants

# LANDFILL POST-CLOSURE PLAN

# ENTERGY ARKANSAS, INC.
# WHITE BLUFF PLANT
# CLASS 3N CCR LANDFILL

# PERMIT NO. 0199-S3N-R3
# AFIN: 35-00110

**OCTOBER 12, 2016**

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ENTERGY ARKANSAS, INC.
WHITE BLUFF PLANT
CLASS 3N CCR LANDFILL

PERMIT NO. 0199-S3N-R3
AFIN: 35-00110

Prepared for

Entergy Arkansas, Inc. White Bluff Plant
1100 White Bluff Road
Redfield, AR 72132

Prepared by

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

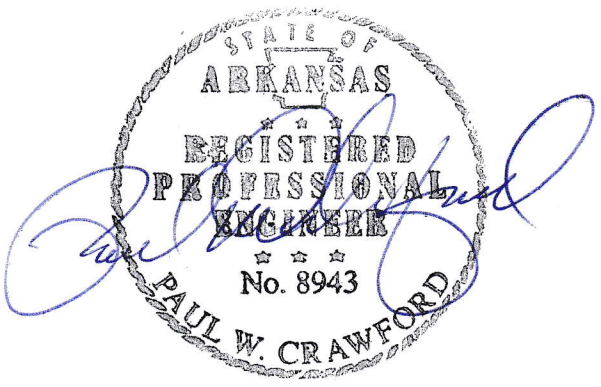
FTN No. R06040-1231-001

October 12, 2016

# PROFESSIONAL ENGINEER'S CERTIFICATION

In accordance with §257.104 , I certify under penalty of law that I have personally examined and am familiar with the information submitted in this demonstration and all attached documents, and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

This Post-Closure Plan for the Entergy Arkansas, Inc. White Bluff Plant Class 3N CCR Landfill was prepared under the direction and supervision of a qualified, State of Arkansas-registered Professional Engineer. Mr. Paul Crawford, PE, PG of FTN Associates, Ltd., was responsible for the overall preparation of the plan.




Paul Crawford, PE #8943

October 12, 2016
Date

# PLAN AMENDMENTS

| Amendment No. | Description of Amendment | Page Number in Plan |
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# 1.0 INTRODUCTION

## 1.1 Purpose of Plan

In accordance with 40 CFR *§257, Subpart D - Disposal of Coal Combustion Residuals From Electric Utilities* (the CCR Rule), the purpose of this plan is to provide information on the procedures required for post-closure care of a CCR unit at the Entergy Arkansas, Inc. White Bluff Plant (the Plant) Class 3N CCR Landfill (the Landfill). This Post-Closure Plan (the Plan) includes:

1. A description of the monitoring and maintenance activities required by the CCR Rule;
2. Contact information for the person or office during post-closure care period;
3. The proposed intended use of the site during post-closure; and
4. Notification procedures upon completion of post-closure care.

Appendix A includes definitions for terms included in this Plan.

## 1.2 White Bluff Power Plant Information

The Plant is located on the west bank of the Arkansas River, near Redfield in Jefferson County, Arkansas, as shown on Figure 1.1. The 3,400-acre site is situated on a bluff overlooking the relatively flat alluvial plain east of the Arkansas River.

The Plant generates electricity through the combustion of coal and has been in operation since 1981. Coal combustion by-products (residues) (CCRs) that are generated during the electrical generation process are disposed in the onsite landfill. The CCR is generally segregated into two categories, “fly” and “bottom.”

Approximately 80% of the CCR produced is classified as fly ash, which is derived from the boiler exhaust gas and is collected in electrostatic precipitators. The fly ash is composed of very fine particles similar to glass and has the consistency of a powder. Collected fly ash is pneumatically transferred to silos for short-term storage. A subcategory of the fly ash is known as economizer ash. This material is the coarsest fraction of the fly ash, which drops out before

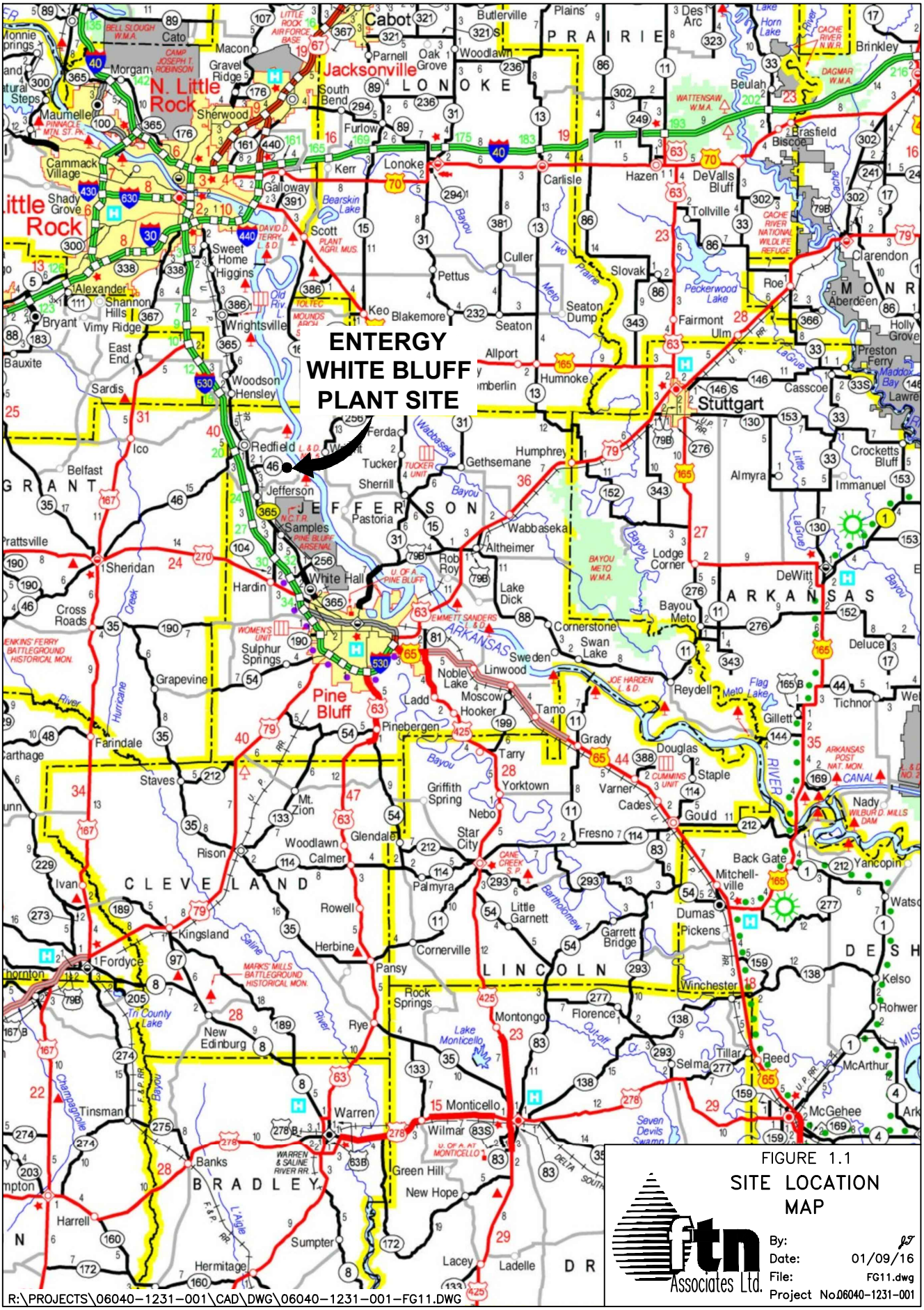


FIGURE 1.1
SITE LOCATION MAP

ftn Associates Ltd.

By: JS
Date: 01/09/16
File: FG11.dwg
Project No. 06040-1231-001

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the electrostatic precipitators, and represents approximately 2% of the total CCR production. The Plant collects this material in a separate silo system.

The remaining 18% of CCR produced from the combustion of coal is comprised of bottom ash, which is composed of angular, glassy particles with a porous surface texture and has the consistency of coarse sand. The bottom ash is sluiced to dewatering hoppers for removal of water and for storage.

Historically, approximately 60 to 70 % of the two types of CCR have been marketed regionally to construction-related industries. The remaining amount of CCR is placed in the onsite landfill for disposal. The amount placed in the Landfill varies from year to year, but the average for the past 5 years is approximately 100,000 cubic yards (cy).

## 1.3 Permit History

The CCR Landfill was initially issued a solid waste permit in 1982 by the Arkansas Department of Pollution Control and Ecology (now the Arkansas Department of Environmental Quality (ADEQ)) and has received three permit modifications to date. The facility permit history is as follows:

1. In October 1982, Chem-Ash, Inc. (Chem-Ash), the onsite landfill contractor which managed coal ash sales and landfill disposal operations for Arkansas Power & Light (AP&L), was granted a permit (No. 199-S) from the Arkansas Department of Environmental Quality ((ADEQ) to construct and operate a solid waste disposal facility at the White Bluff Plant (Entergy Arkansas, Inc. became AP&L's successor in interest as of April 1996).
2. In March 1983, ADEQ granted, among other provisions, a permit modification request to transfer the landfill permit from Chem-Ash to AP&L and revised the permit number to 199-SR-1.
3. In June 1984, AP&L submitted an application for permit modification requesting operational changes and other provisions to include an increase of the permitted landfill area from 110 acres to 177 acres, with 153 acres for waste disposal. ADEQ

granted the permit modification request in September 1985. The permit number was revised to 199-SR-2.

4. Entergy Arkansas, Inc. submitted a permit modification application to the ADEQ-SWMD to upgrade the Landfill to Arkansas Regulation No. 22 (Regulation No. 22) standards in December 1997. The ADEQ issued the revised permit (0199-S3N-R3) November 2000.
5. Entergy Arkansas, Inc. submitted a minor permit modification in April 2011 and the ADEQ approved the request in May 2011 to reconfigure the waste disposal areas into five disposal cells, which is the current landfill configuration.

## 1.4 Existing Conditions of Landfill

The ADEQ-permitted landfill area consists of approximately 177 acres (153 acres for solid waste disposal) and is located in the southwestern portion of the plant site as shown on Figure 1.2.

The current ADEQ-permitted layout of the CCR Landfill includes a total of five disposal cells (Cells 1 through 5) and has a permitted waste capacity of approximately 2,600,000 cubic yards (cy). Waste Cells 1 through 4 have been constructed and comprise the active disposal area of the CCR Landfill that received CCR materials after October 19, 2015 (Figure 1.3).

Construction of the CCR units has followed the numerical sequence of the cell numbers. Cells 1 through 4 are active landfill CCR units and will be operated in accordance with requirements of the CCR Rule.

No final cover system has been installed on the active CCR units, Cells 1 through 4. As shown on Figure 1.3, older portions of the landfill facility that received CCR material prior to the issuance of the 2000 permit have been closed and covered in accordance with the original facility ADEQ-issued permit (1982). These areas did not receive CCR after October 2015.

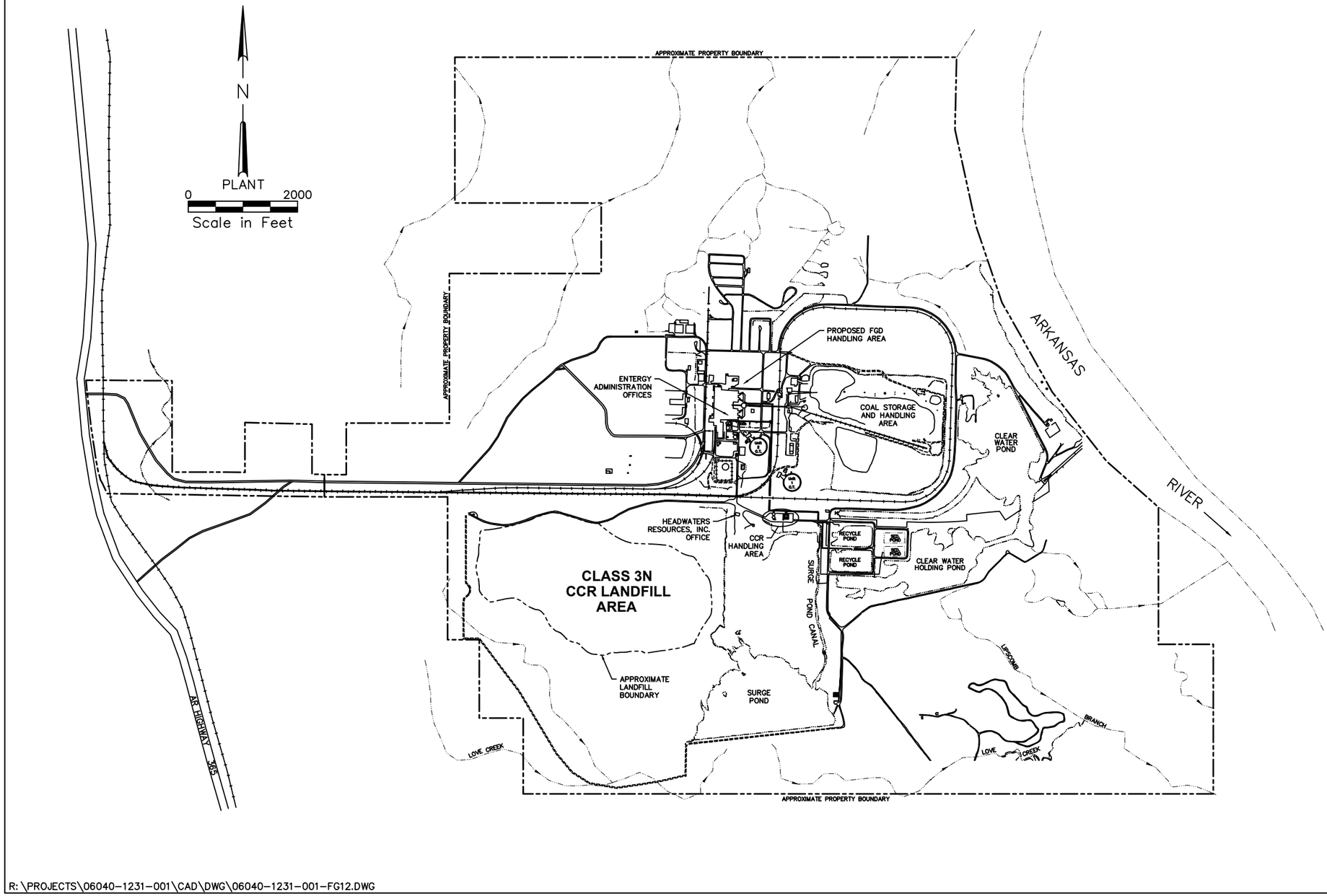



Figure 1.2. Plant site map.

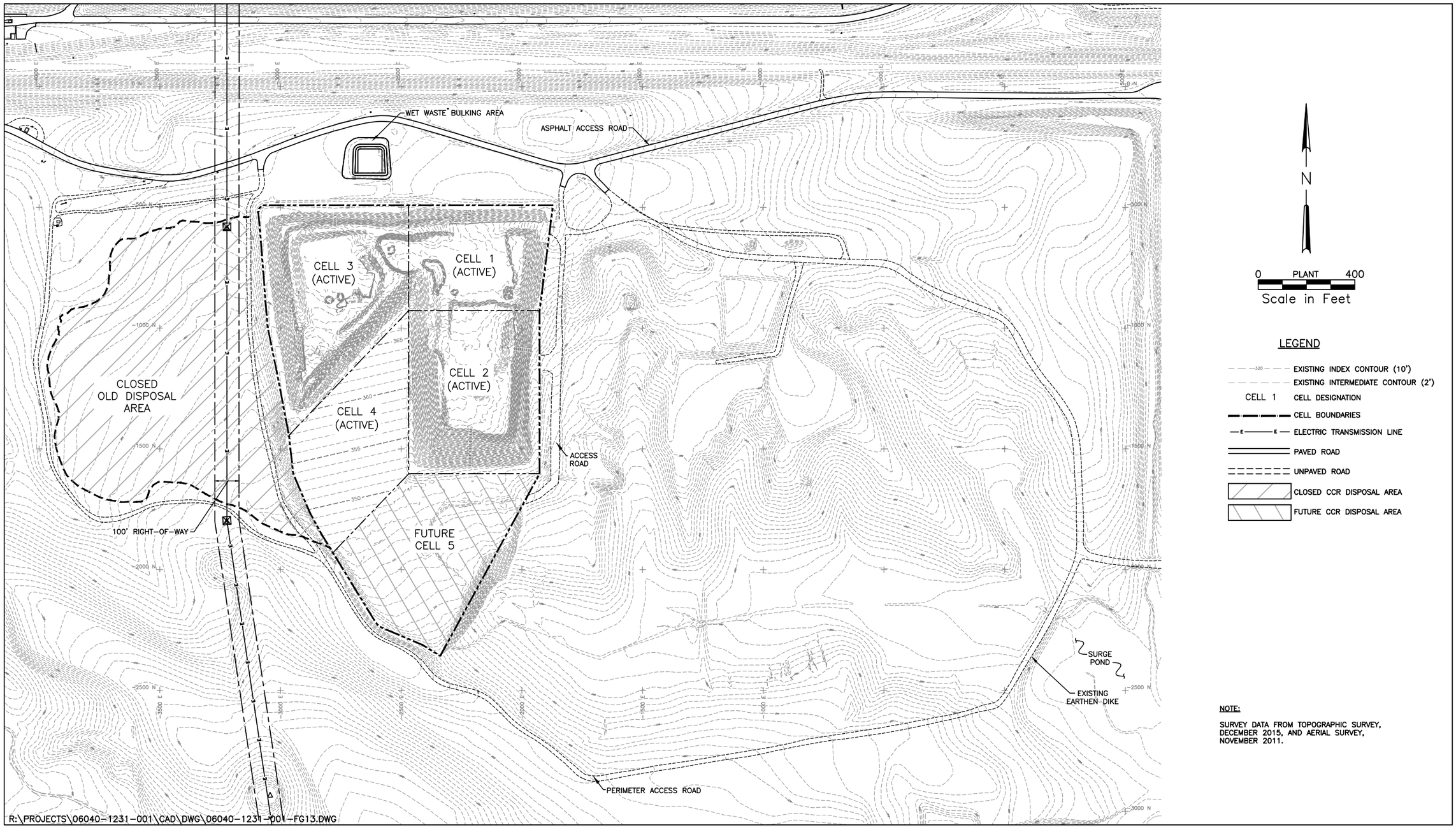



Figure 1.3. Layout of White Bluff Class 3N CCR Landfill.

# 2.0 POST-CLOSURE PLAN

In accordance with §257.104(c)(1), the post-closure period for the CCR Landfill will be 30 years following the date of the certification by an Arkansas-registered professional engineer that the site has been closed. The post-closure period may be extended if the facility is operating under assessment monitoring in accordance with §257.95, and post-closure care activities will continue until the facility returns to detection monitoring in accordance with §257.95.

During the post-closure period, the CCR Landfill will be maintained and monitoring activities will be performed as described in the following subsections.

## 2.1 Post-Closure Maintenance

Post-closure care of the CCR Landfill will be conducted throughout the post-closure period. Post-closure care maintenance activities include monitoring and maintenance of the landfill and the environmental monitoring components. The facility will be inspected semi-annually to determine the condition of the landfill components.

### 2.1.1 Final Cover Maintenance

The integrity of the final cover will be maintained, including the repair of the cover, as necessary to correct the effects of settlement, subsidence, and erosion, and prevent run-off and run-on from damaging the cover. Vegetation shall be mowed at least annually to control the growth of unwanted vegetation that may interfere with the integrity of the landfill cover system. All cracked, eroded and uneven areas will be filled and reseeded.

### 2.1.2 Site Security

Access to the landfill after closure will be controlled through maintenance of existing fencing and signs, and all access gates will be locked to discourage unauthorized entry. Periodic inspections of the security system will be conducted to verify the integrity of the system. Repairs to the system will be scheduled as soon as practicable.

### 2.1.3 Facility Roads

Paved and gravel access roads shall be maintained regularly to provide access to the monitoring and maintenance equipment around the landfill. The facility roads shall be graded and additional asphalt or gravel material will be applied periodically to keep the roads safe and all areas of the landfill facility accessible.

### 2.1.4 Stormwater Facilities

Stormwater facilities such as ditches, letdowns, and culverts shall be inspected, and cleaned or repaired as necessary. Any erosion control devices (if present) will also be inspected and repaired or replaced as necessary. Appendix B includes examples of erosion control devices that could be used at the landfill.

### 2.1.5 Leachate Removal System

The leachate removal and transmission system (all pumping units, control panels, and pipeline) will be inspected to ensure proper operation and quantification of leachate generated. Any repairs or replacement will be done as soon as practicable.

## 2.2 Post-Closure Monitoring

Monitoring activities during the post-closure period includes site inspections, groundwater monitoring and reporting, stormwater monitoring and reporting, and leachate monitoring and reporting. Monitoring reports will be placed in the facility operating record and website.

### 2.2.1 Site Inspections

The facility inspections will be conducted semi-annually to determine the condition of the landfill components. The inspections will be recorded on the inspection form included in Appendix C.

### 2.2.2 Groundwater Monitoring and Reporting

Groundwater monitoring will continue during the post-closure period and will be conducted in accordance with §257.93 and the facility Groundwater Sampling and Analysis Plan (GWSAP).

### 2.2.3 Stormwater Monitoring

Stormwater from the CCR Landfill is routed through the perimeter ditches to the Surge Pond, where is eventually released from the plant facility through the facility's National Pollutant Discharge Elimination System (NPDES) permitted outfall. Monitoring and reporting of stormwater related to the Landfill will be conducted in accordance with the facility NPDES, if required.

### 2.2.4 Leachate Monitoring

The leachate collection system will be monitored by collection and analysis of leachate samples in accordance with the facility GWSAP. In addition, the amounts of leachate generated and removed from the landfill will be recorded.

## 2.3 Contact Persons

The name, address, and telephone number of the person to contact about the facility during the post-closure period will be placed in the facility's operating record and website upon notice of closure of the CCR Landfill. The contact information will be updated in the facility operating record and website any time the role is assigned to a new person.

## 2.4 Planned Use of Site

Upon completion of post-closure care period, Entergy Arkansas, Inc. intends to allow the land to revert back to open grassland. The actual long-term use of the land will be determined upon notice of closure. The integrity of the final landfill cover, liner systems, groundwater monitoring wells, and leachate removal and transmission system will not be disturbed or compromised during the post-closure period.

## 2.5 Certification of Completion

Within 60 days following the completion of the post-closure period for the landfill facility, Entergy Arkansas, Inc. will prepare a notification verifying that the post-closure care has been completed. The notification will include a certification by an independent registered professional engineer verifying that post-closure care has been completed in accordance with the Plan and §257.104(d). Post-closure care will be completed when this notification is placed in the facility operating record and website.

## 2.6 Amendment of the Post-Closure Plan

In accordance with §257.104(d)(3), Entergy Arkansas, Inc. may amend this post-closure plan at any time. Specifically, Entergy Arkansas, Inc. must amend the written post-closure plan whenever:

1. There is a change in the operation of the CCR unit that would substantially affect the written post-closure care plan in effect; or
2. After post-closure activities have commenced, unanticipated events necessitate a revision of the written post-closure plan.

The post-closure plan must be amended at least 60 days prior to a planned change in the operation of the facility or CCR unit, or no later than 60 days after an unanticipated event requires the need to revise the plan. If the plan is revised after post-closure activities have commenced for a CCR unit, the owner or operator must amend the written post-closure plan no later than 30 days following the triggering event.

Entergy Arkansas, Inc. will obtain a written certification from a qualified professional engineer that the initial and any amendment of the written post-closure care plan meets the requirements of §257.104(d)(3).

# APPENDIX A

**Definitions**

# DEFINITIONS

The following definitions are from §257.53 of the CCR Rule and used in this Plan:

***Active Life or In Operation:*** the period of operation beginning with the initial placement of CCR in the CCR unit and ending at completion of closure activities in accordance with §257.102.

***Active portion:*** that part of the CCR unit that has received or is receiving CCR or non-CCR waste and that has not completed closure in accordance with §257.102.

***Coal Combustion Residuals (CCR):*** fly ash, bottom ash, boiler slag, and flue gas desulfurization materials generated from burning coal for the purpose of generating electricity by electric utilities and independent power producers.

***CCR Landfill:*** an area of land or land excavation that receives CCR and which is not a surface impoundment, an underground injection well, a salt dome formation, a salt bed formation, an underground or surface coal mine, or a cave. It also includes sand and gravel pits and quarries that receive CCR, CCR piles, and any practice that does not meet the definition of a beneficial use of CCR.

***CCR Unit:*** any CCR landfill, CCR surface impoundment, or lateral expansion of a CCR unit, or a combination of more than one of these units based on the context of the paragraph(s) in which it is used. This term includes both new and existing units, unless otherwise specified.

***Closed Unit or Landfill:*** placement of CCR in a CCR unit has ceased, and the owner or operator has completed closure of the CCR unit in accordance with § 257.102 and has initiated post-closure care in accordance with § 257.104.

***Existing CCR Landfill:*** a CCR Landfill that receives CCR both before and after October 15, 2015, or for which construction commenced prior to October 14, 2015 and receives CCR on or after October 14, 2015. A CCR landfill has commenced construction if the owner or operator has obtained the federal, state, and local approvals or permits necessary to begin physical construction and a continuous onsite physical construction program had begun prior to October 14, 2015.

***Hydraulic Conductivity:*** the rate at which water can move through a permeable medium (i.e., the coefficient of permeability).

***Lateral Expansion:*** a horizontal expansion of the waste boundaries of an existing CCR landfill or existing CCR surface impoundment made after October 14, 2015.

***New CCR Landfill:*** a CCR landfill or lateral expansion of a CCR landfill that first receives CCR or commences construction after October 14, 2015. A CCR landfill has commenced construction if the owner or operator has obtained the federal, state, and local approvals or

permits necessary to begin physical construction and a continuous onsite physical construction program had begun after to October 14, 2015.

***Operator:*** the person(s) responsible for the overall operation of a CCR unit.

***Qualified Professional Engineer:*** an individual who is licensed by a state as a Professional Engineer to practice one or more disciplines of engineering and who is qualified by education, technical knowledge and experience to make the specific technical certifications required under this subpart. Professional engineers making these certifications must be currently licensed in the state where the CCR unit(s) is located.

***Recognized and Generally Accepted Good Engineering Practices:*** engineering maintenance or operation activities based on established codes, widely accepted standards, published technical reports, or a practice widely recommended throughout the industry. Such practices generally detail approved ways to perform specific engineering, inspection, or mechanical integrity activities.

***Run-Off:*** any rainwater, leachate, or other liquid that drains over land from any part of a CCR landfill or lateral expansion of a CCR landfill.

***Run-On:*** any rainwater, leachate, or other liquid that drains over land onto any part of a CCR landfill or lateral expansion of a CCR landfill.

***Structural Components:*** liners, leachate collection and removal systems, final covers, run-on and run-off systems, inflow design flood control systems, and any other component used in the construction and operation of the CCR unit that is necessary to ensure the integrity of the unit and that the contents of the unit are not released into the environment.

# APPENDIX B

**Erosion Control Devices**

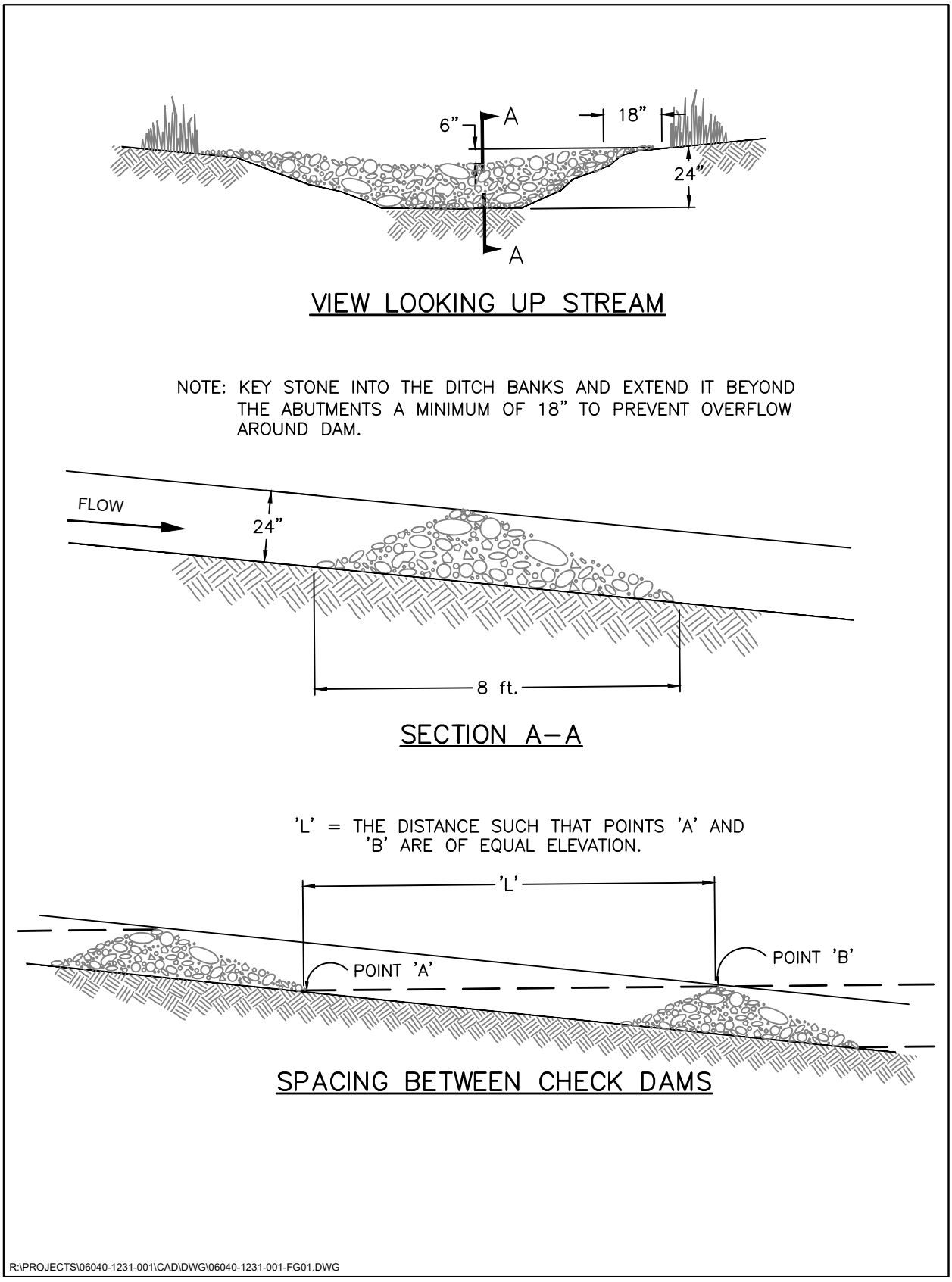
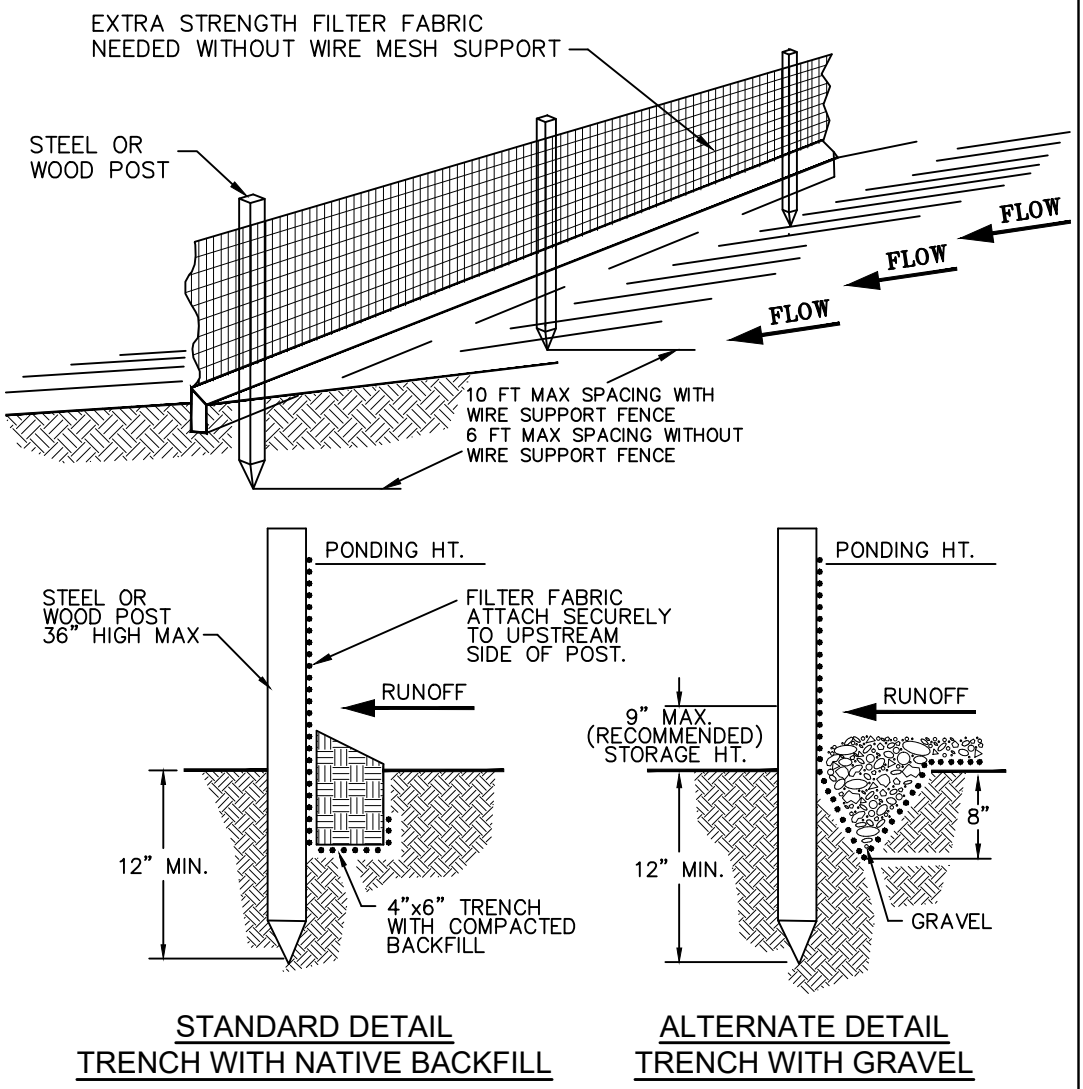



Figure 1. Rock check dam detail.




NOTES:

1. INSPECT AND REPAIR FENCE AFTER EACH STORM EVENT AND REMOVE SEDIMENT WHEN NECESSARY.
2. REMOVED SEDIMENT SHALL BE DEPOSITED TO AN AREA THAT WILL NOT CONTRIBUTE SEDIMENT OFF-SITE AND CAN BE PERMANENTLY STABILIZED.
3. SILT FENCE SHALL BE PLACED ON SLOPE CONTOURS TO MAXIMIZE PONDING EFFICIENCY.

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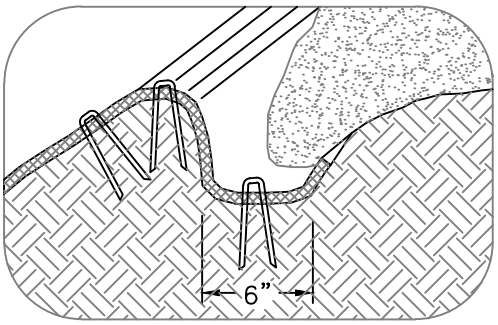
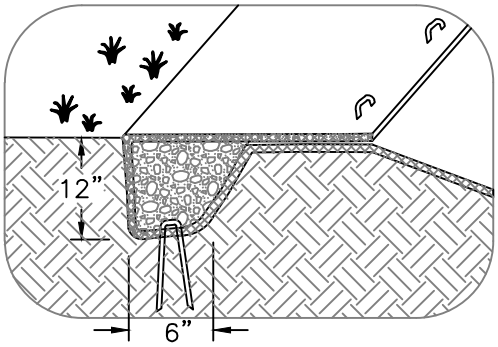
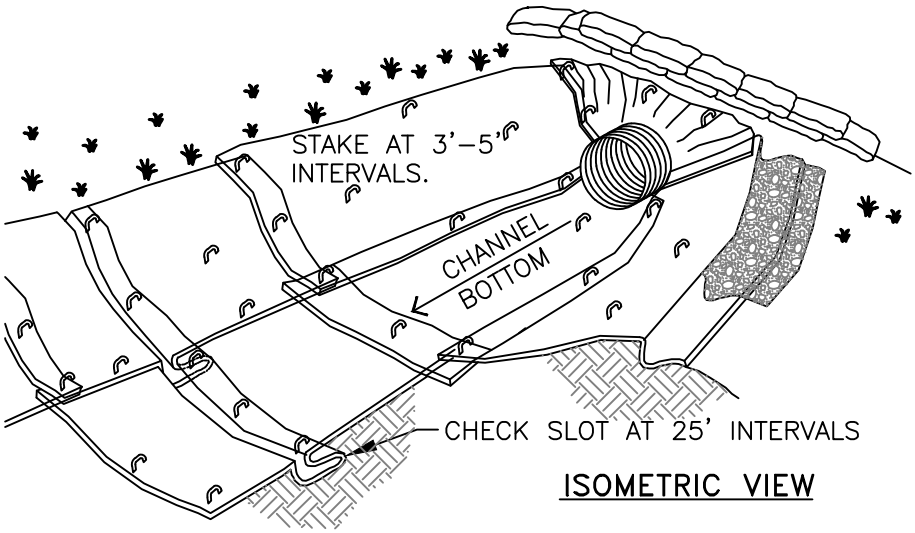
Figure 2. Silt fence detail.



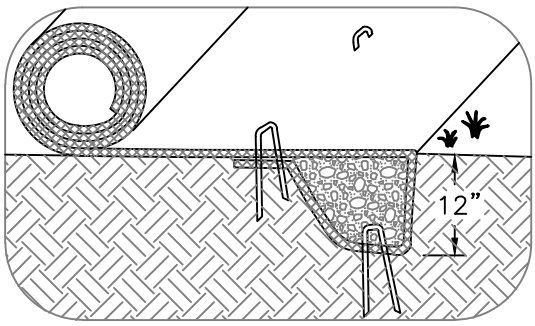

LONGITUDINAL ANCHOR TRENCH



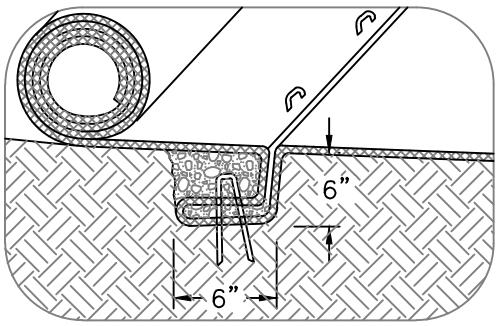

TERMINAL SLOPE AND CHANNEL ANCHOR TRENCH




ISOMETRIC VIEW




INITIAL CHANNEL ANCHOR TRENCH




INTERMITTENT CHECK SLOT

NOTES:

1. CHECK SLOTS TO BE CONSTRUCTED PER MANUFACTURERS SPECIFICATIONS.
2. STAKING OR STAPLING LAYOUT PER MANUFACTURERS SPECIFICATIONS.

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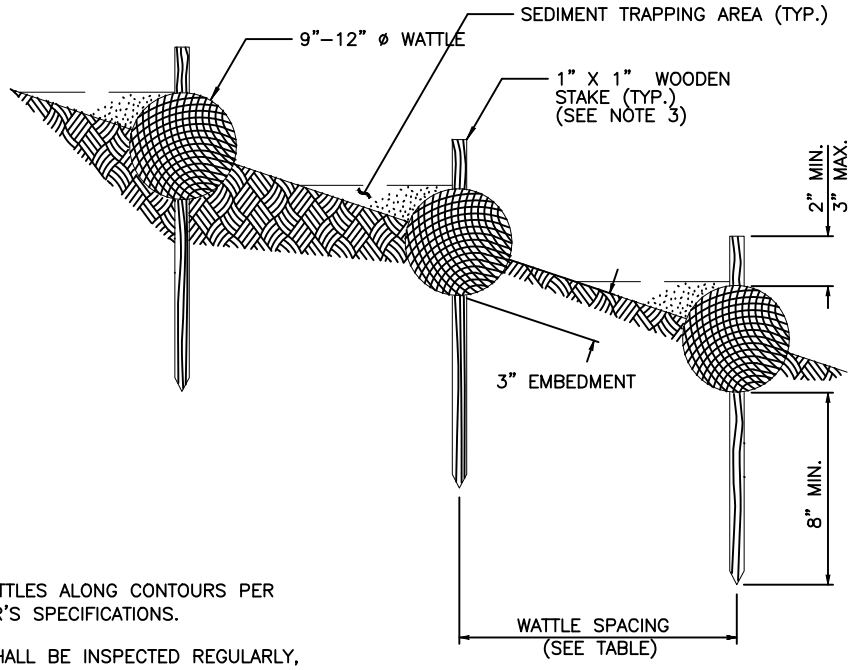
Figure 3. Erosion control mattting detail.




ELEVATION VIEW

NOTES

1. INSTALL WATTLES ALONG CONTOURS PER MANUFACTURER'S SPECIFICATIONS.

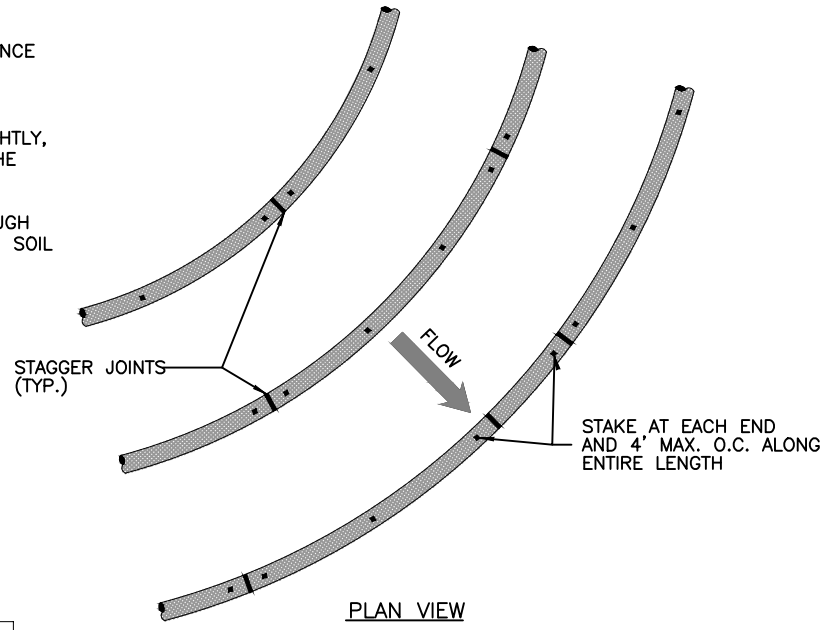
2. WATTLES SHALL BE INSPECTED REGULARLY, AND IMMEDIATELY AFTER A RUNOFF PRODUCING RAINFALL, TO ENSURE THEY REMAIN THOROUGHLY ENTRENCHED AND IN CONTACT WITH THE SOIL.

3. LIVE STAKES MAY BE USED FOR PERMANENT INSTALLATIONS.

4. PERFORM MAINTENANCE IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.

5. INSTALL WATTLES SNUGLY INTO THE TRENCH. ABUT ADJACENT WATTLES TIGHTLY, END TO END, WITHOUT OVERLAPPING THE ENDS.

6. PILOT HOLES MAY BE DRIVEN THROUGH THE WATTLE AND INTO THE SOIL, WHEN SOIL CONDITIONS REQUIRE.




PLAN VIEW

| WATTLE SPACING TABLE | |
|---|---|
| SLOPE | MAXIMUM SPACING |
| 1:1 | 20 FEET |
| 2:1 | 30 FEET |
| 3:1 | 40 FEET |
| 4:1 | 50 FEET |

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Figure 4. Wattle.

# APPENDIX C

**Post-Closure Care Inspection Form**

# WHITE BLUFF PLANT LANDFILL
# POST-CLOSURE INSPECTION FORM

| | | |
|---|---|---|
| Facility Name: Entergy White Bluff Plant Landfill | | |
| Facility Address: 1100 White Bluff Road, Redfield, AR 72132 | | |
| Date: | Time: | Weather: |
| **Inspection Representatives** | | |
| Entergy: | | |
| Others: | | |

| **Inspection Observations** | | | |
|---|---|---|---|
| | Acceptable | Needs Improvement | Comments (See Page 2 for Additional Comments) |
| 1. Final Cover System | | | |
| 1a. General condition of final cover | | | |
| 1b. Condition of vegetation | | | |
| 1c. Condition of erosion control devices (if used) | | | |
| 1d. Settlement areas | | | |
| 1e. Stability of waste mass | | | |
| 2. Site Security | | | |
| 2a. Perimeter fencing | | | |
| 2b. Gates | | | |
| 2c. Signage | | | |
| 3. Landfill Access Roads | | | |
| 3a. Condition of paved roads | | | |
| 3b. Condition of unpaved roads | | | |
| 4. Stormwater Control Facilities | | | |
| 4a. Condition of culverts | | | |
| 4b. Condition of ditches | | | |
| 4c. Condition of diversion berms | | | |
| 4d. Condition of letdowns | | | |
| 4e. Condition of stormwater pond | | | |
| 5. Leachate Collection and Transmission System | | | |
| 5a. Condition of leachate pumps | | | |
| 5b. Condition of leachate control panels | | | |
| 5c. Status of leachate levels in disposal cells | | | |
| 5d. Condition of leachate collection piping | | | |
| 5e. Condition of cleanouts and headwalls | | | |
| 5f. Condition of leachate transmission piping | | | |
| 6. Groundwater Monitoring Wells | | | |
| 6a. Condition of well casings and locks | | | |
| 6b. Condition of well pads and pipe bollards | | | |
| 6c. Access to wells | | | |
| 7. Other Items | | | |
| 7a. | | | |
| 7b. | | | |
| 7c. | | | |
| 7d. | | | |
| 7e. | | | |

| Print Name of Inspector Completing Form | Signature | Date |
|---|---|---|
| | | |

# WHITE BLUFF PLANT LANDFILL
# POST-CLOSURE INSPECTION FORM

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|---|
| Facility Name: Entergy White Bluff Plant Landfill |
| Facility Address: 1100 White Bluff Road, Redfield, AR 72132 |
| Additional Comments: |
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| Print Name of Inspector Completing Form | Signature | Date |
|---|---|---|
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