MWG

Midwest Generation, LLC

Will County Generating Station

Final Written Closure Plan for Pond 1N & Pond 1S

Revision 1

July 28, 2023

Issue Purpose: Use

Project No.: 12661-153

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1.0 PURPOSE

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.720(b)

Pond 1N and Pond 1S at Midwest Generation, LLC's (MWG) Will County Generating Station ("Will County" or the "Station") are former ash ponds that were taken out of service in 2010. The water in both Ponds 1N and 1S was subsequently drained, and the CCR remaining in both ponds was regraded such that the ponds can no longer accumulate water. Accordingly, both former ash ponds are regulated as inactive coal combustion residual (CCR) surface impoundments under the Illinois Pollution Control Board's "Standards for the Disposal of Coal Combustion Residuals in CCR Surface Impoundments," which are codified in Part 845 to Title 35 of the Illinois Administrative Code (35 Ill. Adm. Code 845, Ref. 1) and are also referred to herein as the "Illinois CCR Rule."

Pursuant to 35 Ill. Adm. Code 845.720(b), this document provides the final written closure plan for Ponds 1N and 1S at Will County. MWG intends to close these former ash ponds by leaving the impounded CCR in place and installing final cover systems over the impoundments in accordance with 35 Ill. Adm. Code 845.750. This plan describes the steps necessary to close Ponds 1N and 1S in this manner.

2.0 CLOSURE PLAN NARRATIVE DESCRIPTION

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.720(a)(1)(A) & 845.750(a)

Pursuant to 35 Ill. Adm. Code 845.750(a), Ponds 1N and 1S will be closed by leaving the CCR stored in each pond in place and installing a final cover system over each impoundment. Each final cover system will be designed in accordance with the requirements specified in 35 Ill. Adm. Code 845.750(c) and as described in the following sections of this closure plan.

The anticipated closure in-place of Ponds 1N and 1S will be performed in accordance with the following sequential steps:

1. Removing existing vegetation within each pond;
2. After existing vegetation has been removed, establishing the slopes for the final cover system by:
    a. Grading the ash material to specified lines and grades, and
    b. If enough ash is not available in a pond, placing structural fill material into the subject pond and to reach the specified lines and grades of the final cover system design;
3. Installing an engineered final cover system (ClosureTurf®), which consists of:
    a. Structured geomembrane as the system's low permeability layer, and
    b. Synthetic turf and specialized sand infill as the system's final protective layer; and
4. Initiating post-closure monitoring of groundwater and final cover system integrity.

Because Ponds 1N and 1S were re-graded to prevent the accumulation of water after the ponds were taken out of service in 2010, it is not anticipated that free liquids will need to be removed from the ponds prior to establishing the lines and grades for their respective final cover systems. Indeed, no visible water has been observed in either pond during the weekly inspections MWG conducts in accordance with the Illinois CCR Rule (Refs. 2 and 3). If free water is observed / discovered during closure activities (e.g., water from a recent storm event), the water will be removed prior to re-grading the remaining CCR to support the final cover system. This will be accomplished by excavating sumps and trenches within the CCR and using portable pumps to either pump water to the subject pond's discharge pipe or over the subject pond's weir into the concrete overflow trough.

3.0 FINAL COVER SYSTEM DESCRIPTION

Illinois CCR Rule References: 35 Ill. Adm. Code 845.720(a)(1)(C) & 845.750(a)

Pursuant to the closure performance standards prescribed in 35 Ill. Adm. Code 845.750(a), the final cover system encapsulating the CCR in Ponds 1N and 1S will:

1. Minimize the post-closure infiltration of precipitation into the CCR;
2. Minimize the risk of release of CCR or contaminated run-off to the ground or surface waters, or to the atmosphere;
3. Preclude the probability of future impoundment of water, sediment, or slurry;
4. Provide major slope stability to prevent sloughing of the final cover system during the closure and post-closure care periods;
5. Minimize future maintenance; and
6. Allow closure activities to be completed as quickly as practical consistent with recognized and generally accepted good engineering practices.

In addition to the preceding performance criteria, the final cover systems installed over Ponds 1N and 1S must meet the design criteria promulgated by 35 Ill. Adm. Code 845.750(c), which requires a final cover system to consist of at least two layers: (1) a lower, low-permeability layer for infiltration control and (2) an upper, final protective layer for (a) erosion control and (b) protecting the low permeability layer. MWG plans to install an engineered final cover system developed by Watershed Geosynthetics, LLC (Watershed Geo) called ClosureTurf®, which will provide the performance metrics stipulated by the Illinois CCR Rule for both the low-permeability and final protective layers. ClosureTurf® consists of a structured geomembrane under an engineered synthetic turf with a specialized sand infill. It should be noted that the products used to manufacture these materials are free of per- and polyfluoroalkyl substances (PFAS). Moreover, Watershed Geo has designed its ClosureTurf® product specifically for environmental containment applications, and it

has been tested to ensure long-term compliance with the performance criteria discussed in the following subsections.

3.1 ESTABLISH GRADE & SUPPORT FOR FINAL COVER SYSTEM

Illinois CCR Rule References: 35 Ill. Adm. Code 845.750(a)(2), 845.750(a)(3), & 845.750(c)(3))

To accomplish the performance requirements stipulated by 35 Ill. Adm. Code 845.750, the CCR remaining in Ponds 1N and 1S will be graded to direct non-contact storm water run-off to the concrete overflow trough at the western end of each pond. Additional structural fill material will be placed over the stabilized CCR in each pond to establish the lines and grades for this storm water management scheme if sufficient quantities of CCR are not present in either pond to establish the lines and grades specified for the final cover system design. The slopes of this foundation layer for each pond's final cover system will be steep enough to prevent storm water from ponding over the cap but flat enough to limit erosion caused by the storm water run-off. These slopes will also be designed to accommodate potential settling and subsidence while maintaining a positive drainage strategy. In addition, the foundation layer's slopes (and the final cover system in general) will also include measures that provide slope stability to prevent the sloughing or movement of the final cover system during the closure and post-closure care period. Finally, the foundation layer surface will be prepared such that it is free from large, protruding, or sharp materials that could otherwise cause damage to the overlying low permeability layer.

3.2 LOW PERMEABILITY LAYER

Illinois CCR Rule References: 35 Ill. Adm. Code 845.750(a)(1) & 845.750(c)(1)

The structured geomembrane component of the ClosureTurf® system will be placed on top of the graded CCR (and structural fill if necessary) in Ponds 1N and 1S to minimize the infiltration of precipitation through each pond during their post-closure lives. This low permeability layer will control stormwater run-off from the final cover system and will minimize (1) post-closure infiltration of storm water into the waste and (2) releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere.

Table 1 lists the Illinois CCR Rule's design criteria for the low permeability layer of a final cover system installed over an inactive CCR surface impoundment. The structured geomembrane component of the ClosureTurf® system for Ponds 1N and 1S will be designed in accordance with this design criteria.

Table 1 – Illinois CCR Rule's Design Criteria for Low Permeability Layer in an Inactive CCR Surface Impoundment's Final Cover System

Construction Material	Parameter	Illinois CCR Rule Design Criterion (35 Ill. Adm. Code 845.750(c)(1))
Earthen Material	Thickness	3 feet minimum
	Hydraulic Conductivity	Least of: • Permeability of any bottom liner system or natural subsoils • 1×10^{-7} cm/sec
	Compaction	Minimize void spaces
Geomembrane	Thickness	40 mil
	Hydraulic Flux	Equivalent or superior reduction in infiltration as a low permeability layer constructed with earthen material
	Prepared Subgrade	Free from sharp objects and other materials that may cause damage

Ponds 1N and 1S both have Poz-o-Pac[1] liners along their respective floors and sideslopes. Based on permeability testing performed on a sample taken from the Poz-o-Pac liner in another ash pond at Will County in 2012, the Poz-o-Pac liners in Ponds 1N and 1S are expected to have hydraulic conductivities on the order of 1×10^{-5} cm/sec. Therefore, per 35 Ill. Adm. Code 845.750(c)(1), the low permeability layer in each pond's final cover system must have a permeability that is no more than 1×10^{-7} cm/sec. Pursuant to 35 Ill. Adm. Code 845.750(c)(1)(B), MWG plans to specify a 60-mil HDPE, structured geomembrane for the ClosureTurf® system installed over each pond.

As required by 35 Ill. Adm. Code 845.750(c)(1)(B)(i), Table 2 demonstrates that a 60-mil HDPE geomembrane will provide a superior reduction in infiltration when compared to a 3-foot-thick layer of earthen material with a hydraulic conductivity of 1×10^{-7} cm/sec. The liquid flow rate through a 3-foot-thick layer of earthen material is calculated using the equation derived from Darcy's Law for gravity flow through porous media that is specified by the Illinois CCR Rule as the basis for demonstrating compliance with the Rule's alternative composite liner design criteria (Ref. 1, §845.400(c)(3)). Meanwhile, the liquid flow rate through a

[1] Per the Federal Highway Administration's (FHWA) "User Guidelines for Waste and Byproduct Materials in Pavement Construction" (Ref. 2), "Poz-o-Pac" was a patented base course product consisting of a blend of lime, fly ash, and aggregate. Per the FHWA guideline, Poz-o-Pac and similar formulations may be described as pozzolan-stabilized base (PSB) mixtures.

geomembrane liner is calculated using Bernoulli's equation for free flow through an orifice based on the assumption that one 2-mm-diameter hole is present in the geomembrane for every acre (4,000 m^2) of liner (Ref. 5). Both liquid flow rates calculated in Table 2 are based on the assumption that 5.96 inches (0.15 meter) of hydraulic head is present on the low permeability layer, which is the estimated 25-year, 24-hour precipitation depth at the Station (Ref. 6). This is a conservative assumption because the final cover system will be sloped to preclude the build-up of storm water on the low permeability layer.

Table 2 – Liquid Flow Rate Comparison Between Low Permeability Layers Constructed Using Geomembrane & Earthen Material

Parameter	Symbol	Value
Liquid Flow Rate Through Earthen Material		
Hydraulic Conductivity	k	1×10^{-9} m/sec
Hydraulic Head Above Layer	h	0.15 m
Layer Thickness	t	3 ft = 0.91 m
Hydraulic Gradient Through Earthen Material	$i = h / t$	0.16
Liquid Flow Rate Through Layer per Acre of Final Cover System (Ref. 1, §845.400(c)(3)).	$q = k \times (i + 1)$	1.16×10^{-9} $m^3/sec/m^2$
Liquid Flow Rate Through Geomembrane		
Hole Area in Geomembrane	a	3.1 mm^2 / 4000 m^2
Acceleration Due to Gravity	g	9.81 m/sec^2
Hydraulic Head Above Layer	h	0.15 m
Liquid Flow Rate Through Layer per Unit Area (Ref. 5)	$q = 0.6a(2gh)^{0.5}$	7.98×10^{-10} $m^3/sec/m^2$

3.3 FINAL PROTECTIVE LAYER

Illinois CCR Rule References: 35 Ill. Adm. Code 845.750(c)(2)

To minimize wind and water erosion, the ClosureTurf® system features an engineered synthetic turf with a thin (0.5- to 0.75-in. thick) layer of specialized sand infill that is installed over the structured geomembrane. The artificial turf component consists of a double-layer, woven geotextile base through which tufts of polyethylene fibers are inserted. This engineered synthetic turf and specialized sand infill will cover the entire structured geomembrane component and will be installed as soon as possible after deployment and welding of the geomembrane.

Research and testing performed by Watershed Geo has demonstrated that ClosureTurf® provides superior protection against wind and water erosion than a traditional final protective layer consisting of vegetated topsoil or other earthen materials (Ref. 7). Specifically, the engineered synthetic turf component has been tested at hurricane-level wind speeds (using a wind tunnel) and at storm rainfall intensities of more than 6 inches per hour. By comparison, the 100-year, 1-hour rainfall depth for Will County, Illinois, where the Station is located, is approximately 3.92 inches (Ref. 6). The most significant rainfall event to date at a site with a ClosureTurf® cap occurred in 2014 in Pensacola, Florida, where 22 inches of rain fell over 24 hours, and no damage to the final cover system was observed during the inspections that immediately followed the storm event. By comparison, the 100-year, 24-hour rainfall depth for Will County, Illinois is 11.14 inches (Ref. 6), or approximately 51% of the aforementioned 2014 storm event in Pensacola, Florida.

The aforementioned wind tunnel testing conducted on ClosureTurf® at hurricane-level wind speeds by Watershed Geo has also demonstrated that the 0.5- to 0.75-in.-thick, specialized sand infill layer provides enough weight to prevent wind from lifting the ClosureTurf® cap and subsequently exposing the underlying CCR to the atmosphere. The hydraulic performance of ClosureTurf® also is not affected by freezing temperatures and freeze-thaw conditions (Ref. 8). Because the final protective layer will consist of synthetic turf, there is no risk of roots penetrating the underlying geomembrane cap. Therefore, the engineered synthetic turf and specialized sand infill components of the proposed ClosureTurf® final cover system for Ponds 1N and 1S will provide equivalent or superior performance to the 3-foot-thick final protective layer specified in 35 Ill. Adm. Code 845.750(c)(2).

Finally, in addition to providing superior protection against wind and water erosion than a traditional cover system, ClosureTurf® also does not require as much maintenance as a vegetated final protective layer, which needs to be mowed regularly and may need to be reseeded, refertilized, and/or regraded throughout the former ash ponds' post-closure lives.

4.0 ESTIMATED MAXIMUM INVENTORY OF CCR

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.720(a)(1)(D)

Detailed records of the maximum inventories of CCR ever stored in Ponds 1N and 1S are not available. For the purposes of this closure plan, the maximum CCR inventories for Ponds 1N and 1S are conservatively based on their estimated maximum capacities, which are 19,259 and 17,037 cubic yards, respectively.

5.0 ESTIMATED COVER SURFACE AREA

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.720(a)(1)(E)

The estimated final cover surface areas for Ponds 1N and 1S are 2.13 and 1.94 acres, respectively. It is estimated that these areas represent the largest surface areas that will ever require final covers at any point over the ponds' active lives.

6.0 CLOSURE SCHEDULE

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.720(a)(1)(F)

Closure activities are anticipated to be performed concurrently for both Ponds 1N and 1S and are estimated to be completed in 2026. Table 3 lists the major milestones necessary for closing both ponds and the expected duration for completing each milestone.

Table 3 – Planning Level Schedule for Closing Ponds 1N & 1S

Activity	Estimated Duration
Prepare Closure Construction Design Documents	Complete
Obtain Closure Construction Permit from Illinois EPA	18 Months
Hire Contractor to Complete Closure Activities in Accordance with Illinois EPA Permit	4 Months
Remove Existing Vegetation	1 Month
Grade Existing Ash and Place and Grade Structural Fill as Needed	1 Month
Install Final Cover System	1 Month
Submit Closure Report and Certification to Illinois EPA	2 Weeks
Obtain Approval of Closure Report and Certification from Illinois EPA	3 Months
Complete and Certify Closure of Ponds 1N & 1S	--

7.0 AMENDMENTS TO CLOSURE PLAN

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.720(a)(3)

This closure plan will be amended in accordance with 35 Ill. Adm. Code 845.720(a)(3) if a change in the operation of either Pond 1N or Pond 1S would substantially affect this closure plan or if an unanticipated event necessitates a revision to this closure plan. Any and all amendments to this closure plan will be certified by a qualified professional engineer registered in the State of Illinois in accordance with 35 Ill. Adm. Code 845.720(a)(4).

8.0 COMPLETION OF CLOSURE ACTIVITIES

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.760

Upon completion of all closure activities required by 35 Ill. Adm. Code Part 845 and approved by the Illinois EPA in a construction permit, a closure report and a closure certification for Ponds 1N and 1S will be submitted to the Illinois EPA in accordance with 35 Ill. Adm. Code 845.760(e). The closure report will include (1) the engineering and hydrogeology reports containing any monitoring well completion reports, boring logs, all construction quality assurance (CQA) reports, certifications, designations of CQA officers-in-absentia required by 35 Ill. Adm. Code 845.290; (2) photographs with time, date, and location information relied upon for documentation of construction activities; (3) a written summary of the closure requirements and completed activities as stated in the closure plan in effect and 35 Ill. Adm. Code Part 845; and (4) any other information relied upon by the qualified professional engineer for certification. Pursuant to 35 Ill. Adm. Code 845.760(e)(2), the certification will be prepared by an independent, qualified professional engineer licensed in the State of Illinois and will verify that Ponds 1N and 1S have been closed in accordance with the closure plan in effect at the time of the closure work, the requirements of 35 Ill. Adm. Code Part 845. Finally, within 30 days of the Illinois EPA approving the closure report and closure certification, a notification of completion of closure will be prepared in accordance with 35 Ill. Adm. Code 845.760(f).

9.0 CERTIFICATION

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.720(a)(4)

I certify that:

- This final written closure plan for Pond 1N and Pond 1S was prepared by me or under my direct supervision.
- The work was conducted in accordance with the requirements of 35 Ill. Adm. Code Part 845.
- I am a registered professional engineer under the laws of the State of Illinois.

Certified By: Thomas J. Dehlin Date: July 28, 2023

Seal:

Thomas Dehlin
2023.07.28
10:39:06-05'00'

10.0 REFERENCES

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7. Watershed Geosynthetics, LLC. “ClosureTurf® Overview: Superior Performance When Compared to EPA Subtitle D Landfill Final Covers.” https://watershedgeo.com/products/closureturf/. Accessed April 12, 2023.
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