Capital Project Business Case
Asbury Ash Impoundment Closure – PA-038

2022

Project Overview			
Project Name:	Asbury Ash Impoundment Closure	**Date Prepared:**	February 6, 2022
Project ID#:	PA038	**Capital Cost Estimate:**	$22M
Project Sponsor:	Tim Wilson	**Project Start Date:**	February 6, 2022
Project Lead:	Shaen Rooney	**Project End Date:**	December 31, 2022
Prepared By:	Shaen Rooney	**Planned or Unplanned Projects:**	☒ Planned ☐Unplanned
Project Type (click appropriate boxes)**:**	☐ Safety ☒ Mandated ☐ Growth ☐ Regulatory Supported ☐ Discretionary		

Project Scope Statement

The scope of the Asbury Ash Impoundment Closure includes dewatering of the ash impoundment, preparation of the coal combustion residual (CCR) subgrade, installation of a final cover system, construction of stormwater retention ponds, and reclamation of disturbed areas. Preparation of the CCR upgrade will require the contractor to move the CCR within the impoundment to place the CCR in accordance with the engineer's closure design. The purpose of the design is to minimize the amount of cover required while maintaining slope requirements intended to prevent erosion. Because the final cover system recommended has no soil component, stormwater retention ponds are required to manage runoff during heavy precipitation events.

The costs for this project will be recorded in the recently extended accounting authority order for Asbury, and it is the Company's intention to recover these costs through securitization. Completion of this project on the recommended timeline will support this objective.

Background

The Asbury Power Plant was a 200 net MW coal-fired power plant that entered commercial service in 1970. The plant, which is in Jasper County, MO was retired from service in March 2020. During its 50 years of service, the coal combustion byproducts were conveyed to an onsite impoundment for disposal. The U.S. Environmental Protection Agency's (EPA) Coal Combustion Residuals (CCR) Rule requires this impoundment be closed. Closure can be completed by removing all CCR and disposing of it in a landfill or by leaving the CCR in place and installing a final cover system. The purpose of the cover system is to minimize infiltration of surface water and prevent erosion of the stored CCR. The intent to close the Asbury CCR impoundment was made known on April 1, 2021 via posting to our public-facing website, as required by federal regulations. The intent to close was also made known to the Missouri Department of Natural Resources and the EPA.

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Recommendation/Objective
Close the Asbury Power Plant ash impoundment in 2022 by dewatering the impoundment, preparing the CCR subgrade, and installing ClosureTurf as the final cover system. This will require the expenditure of $20 million during 2022. Completion of the project requires the following actions: • Purchase ClosureTurf • Issue RFP • Select contractor and award contract • Prepare CCR subgrade • Install ClosureTurf
Alternatives/Options
As stated previously, the CCR rule does allow for removal of all existing CCR from the impoundment for disposal in a landfill. To implement this alternative, Liberty would either have to identify a landfill to accept the CCR or construct a landfill. In either case, all CCR placed since 1970 would have to be removed from the impoundment and transported. A smaller proportion of the total CCR will need to be handled if it is left in place and closure is achieved by installing an EPA-compliant final cover. Liberty studied all of the alternatives, and ClosureTurf was the lowest cost option. Also, because of the lower vehicle miles traveled, closing the Asbury CCR impoundment with ClosureTurf will result in the least carbon emissions of any of the alternatives.

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Financial Assessment/Cost Estimates			
Next Anticipated Test Year	**12/30/2023**	**Was this Capital Project included in the current year's Board Approved Budget?**	☒ Yes ☐ No
Regulatory Lag (Click appropriate box)	☒Less than 6 Months ☒6-12 Months ☐1 to 3 years ☐Greater than 3 years **MO=PISA, other states longer**		

The total project estimate includes the following estimate plus approximately $2 million in expenses on previously approved work orders related to ash impoundment closure. The following budget is considered a Class 4 Estimate:

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Capital Line Item	%	Cost Code	Cost Code2	Description	Original Budget	Budget
Services		Contract Services	2-CS	**Closure Bid - CCR Grading**	$ -	$ 30,000
Services		**Contract Services**	**2-CS**	**Closure Bid - Geosynthetics**	$ -	$ 12,000
Services		**Contract Services**	**2-CS**	**Kenny Singer**	$ -	$ 40,000
Services					$ -	$ -
Services					$ -	$ -
Contract Work		**Contract Labor**	**1-CW**	**Closure Bid - Geosynthetics**	$ -	$ 2,378,330
Contract Work		**Contract Fees**	**8-FE**	**Closure Bid-CCR Grading**	$ -	$ 2,334,005
Contract Work		**Contract Fees**	**8-FE**	**Closure Bid-Geosynthetics**	$ -	$ 129,600
Contract Work		Contract Fees	**8-FE**	**Closure Bid-Revegetation**	$ -	$ 257,268
Contract Work		**Contract Labor**	**1-CW**	**Groundwater monitoring-CCR Compliance**	$ -	$ 190,000
Contract Work		Contract Fees	**8-FE**	Other Contractor Fees	$ -	$ 30,000
Contract Work		**Contract Labor**	**1-CW**	**Other Contract Labor**	$ -	$ 135,000
Engineering		Consulting Fees	3-CF	**Closure Bid-CQA**	$ -	$ 360,000
Engineering		Consulting Fees	3-CF	**Closure Bid-Project Management**	$ -	$ 120,000
Engineering		**Consulting Fees**	**3-CF**	**Other - PPI**	$ -	$ 44,000
Engineering		**Consulting Fees**	**3-CF**	**MEC Compliance Support and closure design**	$ -	$ 445,000
Engineering		Non-Union Labor	3-PRN	Internal Non-Union Support	$ -	$ 137,000
Labor & Support		**Union Labor**	**4-PRU**	**Internal Union Support**	$ -	$ 125,000
Labor & Support		Support Services	4-SS	Support Services	$ -	$ 3,000
Labor & Support		**Vehicle Usage**	**4-V**	**Vehicle Usage**	$ -	$ -
Labor & Support					$ -	$ -
Labor & Support					$ -	$ -
Owner Materials					$ -	$ -
Owner Materials					$ -	$ -
Owner Materials					$ -	$ -
Owner Materials					$ -	$ -
Owner Materials					$ -	$ -
Contractor Materials		**Materials And Supplies**	**5-MS**	**Closure bid -Contractor Materials-Geosynthetics**	$ -	$ 10,957,628
Contractor Materials		**Materials And Supplies**	5-MS	**Closure bid-Revegetation**	$ -	$ 90,810
Contractor Materials		**Materials And Supplies**	6-MS	Other-Contractor Materials	$ -	$ 80,000
Contractor Materials					$ -	$ -
Contractor Materials					$ -	$ -
Land					$ -	$ -
Land					$ -	$ -
Land					$ -	$ -
Land					$ -	$ -
Land					$ -	$ -
Other		Fee	8-FE	Other Fees	$ -	$ -
Other		Taxes	8-TX	Taxes	$ -	$ -
Other					$ -	$ -
Other					$ -	$ -
Other					$ -	$ -
Overheads	41.00%	Overheads	9-O	Overheads-Contract Work-Services	$ -	$ 149,650.00
Overheads	120.00%	Overheads	9-O	Overheads-Internal Labor	$ -	$ 314,400.00
Overheads	22.00%	Overheads	9-O	Overheads	$ -	$ -
Overheads					$ -	
Overheads					$ -	
Contingency	15.00%	Contingency	10-C	CW Work & Services	$ -	$ 830,430.45
Contingency	10.00%	Contingency	10-C	Engineering	$ -	$ 110,600.00
Contingency	10.00%	Contingency	10-C	Materials	$ -	$ 1,112,843.80
Contingency	10.00%	Contingency	10-C	Internal Labor	$ -	$ 26,200.00
Contingency					$ -	
					$-	$ 20,442,765

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Schedule		
Key Milestone Description	**Forecast Start Date**	**Forecast End Date**
Issue Closure Turf Purchase Order	February 28, 2022	February 28, 2022
Issue RFP	March 1, 2022	April 1, 2022
Select contractor	April 1, 2022	April 15, 2022
Final Award/NTP	April 15, 2022	May 15, 2022
Contractor mobilization	June 1, 2022	June 1, 2022
Closure Turf delivery	June 28, 2022	July 9, 2022
Construction	June 1, 2022	November 30, 2022

Risk Assessment
(Please describe the risk of not completing the project)

The risk of not completing the project is that Liberty will be in violation of federal regulations with a daily maximum civil penalty of more than $70,000 per day per violation. The risk of delaying the project is that future changes to the regulations may require more costly methods of closure, including removal of all CCR from the existing impoundment.

Trade Finance

Not applicable.

Supporting Documentation
(Reference drawings, condition assessment reports, vendor quotations, etc. Attach document or where possible include hyperlink to file located on shared server or SharePoint)

- Notification of Intent to Close CCR Surface Impoundments, by Midwest Environmental Consultants – April 1, 2021
- Asbury CCR Impoundment Final Cover Cost Study, by Midwest Environmental Consultants – February 2022
- Alternative Cover System Demonstration, by Midwest Environmental Consultants – December 2021
- Quotation for ClosureTurf Final Cover System for Asbury CCR Impoundment Closure, by Watershed Geosynthetics, LLC – February 8, 2022

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Approvals and Signatures[1]

Approved By:				
Role	**Approval Authority Limit**	**Name**	**Signature**	**Date**
Manager / Staff (requisitioner/buyer):	Up to $25,000			
Senior Manager:	Up to $50,000	Shaen Rooney	DocuSigned by:	2/16/2022
Senior Director/Director:	Up to $250,000	Drew Landoll	DocuSigned by:	2/16/2022
State President / Senior VP / VP:	Up to $500,000	Tim Wilson	DocuSigned by:	2/17/2022
Regional President:	Up to $3,000,000	Kevin Noblet	DocuSigned by:	3/3/2022
Corporate - Sr VP Operations:	Up to $5,000,000	Gerald Tremblay	DocuSigned by: 4E8A4AC3A02E458...	3/4/2022
Corporate - Exec Team Member (CEO, CFO, COO, Vice Chair):	Over $5,000,000	Johnny Johnston	DocuSigned by: F2C509DAF29448E...	3/9/2022

[1] Approvals for work orders and purchase orders are subject to the limits set forth in the Approval Limits of Authority Policy owned and amended from time to time by the corporate procurement group.

Midwest Environmental CONSULTANTS
Sound Environmental Solutions

April 1, 2021

The Empire District Electric Company
A Liberty Utilities Company
602 South Joplin Street
PO Box 127
Joplin, MO 64802-0127

Re: **Notification of Intent to Close CCR Surface Impoundments**
EPA CCR Rule Section 40 CFR 257.102 (g)
Empire District Electric Company – Asbury Power Plant
Asbury, Missouri

2009 E. McCarty St.
Suite 2
Jefferson City, MO 65101
voice: 573.636.9454
fax: 573.761.4200

1350 E. Kingsley St.
Suite E
Springfield, MO 65804
voice: 417.886.9200
fax: 417.886.9876

www.mecpc.com

To Whom it May Concern:

The following provides Notification of Intent to Close the CCR Impoundment located at the Empire District Electric Company's Asbury Power Plant. This letter serves as certification that the facility is in compliance with 40 CFR 257.102(g) of the EPA CCR.

> *257.102(g) No later than the date the owner or operator initiates closure of a CCR unit, the owner or operator must prepare a notification of intent to close a CCR unit. The notification must include the certification by a qualified professional engineer or the approval from the Participating State Director or the approval from EPA where EPA is the permitting authority for the design of the final cover system as required by § 257.102(d)(3)(iii), if applicable. The owner or operator has completed the notification when it has been placed in the facility's operating record as required by § 257.105(i)(7).*

Empire is providing Notification of Intent to Close the CCR Impoundment as of April 11, 2021. This certification has been prepared by a qualified professional engineer and placed in the facility's operating record as required by § 257.105(i)(7).

CERTIFICATION 257.102 (g)

The undersigned Professional Engineer (P.E.) is familiar with the requirements of 40 CFR Part 257. The above serves as Notification of Intent to Close the CCR Impoundment for the Empire District Electric Company's Asbury Power Plant. I hereby certify that the facility is in compliance with 40 CFR 257.102(g) and all information has been placed in the Operating Record. The owner or operator has completed the notification when it has been placed in the facility's operating record as required by § 257.105(i)(7).

Name: Lindsey R. Henry, P.E.

Signature:

Date: April 1, 2021

Registration Number: E-21592

State: Missouri

Seal

Asbury CCR Impoundment
Final Cover Cost Study

Asbury Power Plant
21133 Uphill Road
Asbury, Missouri 64832

February 2022

Prepared For:
The Empire District Electric Company
602 S. Joplin Avenue
Joplin, Missouri 64801

Midwest Environmental CONSULTANTS

2009 E. McCarty St., Ste. 2 Jefferson City, MO 65101 (573) 636-9454 www.mecpc.com

Midwest Environmental CONSULTANTS

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1.0 INTRODUCTION

On April 17, 2015 the United States Environmental Protection Agency (EPA) issued *40 CFR 257 – Criteria of Solid Waste Disposal Facilities and Practices and 40 CFR 261 – Identification and Listing of Hazardous Waste*, known as the EPA CCR Rule. Coal combustion residuals (CCR) means 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.

The EPA CCR Rule allows the closure of a CCR surface impoundment by leaving the CCR in place and requires the installation of a final cover system. If a CCR unit is closed by leaving CCR in place, the owner or operator must install a final cover system that is designed to minimize infiltration and erosion, and at a minimum, meets the requirements of paragraph 40 CFR 257.102(d)(3)(i) or the requirements of the alternative final cover system specified in paragraph 40 CFR 257.102 (d)(3)(ii) of the rule.

This report will provide an analysis of final cover systems that meet the requirements of the EPA CCR Rule to determine which system provides the cost-effective, long-term alternative to meet the requirements of this rule.

2.0 REGULATORY REQUIREMENTS

The final cover system for the CCR impoundment must comply with 40 CFR 257.102(d)(3)(i). This regulation states:

> *The final cover system must be designed and constructed to meet the criteria in paragraphs (d)(3)(i)(A) through (D) of this section. The design of the final cover system must be included in the written closure plan required by paragraph (b) of this section.*
>
> > *(A) The permeability of the final cover system must be less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than 1×10^{-5} cm/sec, whichever is less.*
> >
> > *(B) The infiltration of liquids through the closed CCR unit must be minimized by the use of an infiltration layer that contains a minimum of 18 inches of earthen material.*
> > *(C) The erosion of the final cover system must be minimized by the use of an erosion layer that contains a minimum of six inches of earthen material that is capable of sustaining native plant growth.*
> >
> > *(D) The disruption of the integrity of the final cover system must be minimized through a design that accommodates settling and subsidence.*

40 CFR 257.102(d)(3)(ii) outlines the requirements should the facility chose to utilize an alternative final cover system. This regulation states:

> *The owner or operator may select an alternative final cover system design, provided the alternative final cover system is designed and constructed to meet the criteria in paragraphs (d)(3)(ii)(A) through (C) of this section. The design of the final cover system must be included in the written closure plan required by paragraph (b) of this section.*
>
> > *(A) The design of the final cover system must include an infiltration layer that achieves an equivalent reduction in infiltration as the infiltration layer specified in paragraphs (d)(3)(i)(A) and (B) of this section.*

(B) The design of the final cover system must include an erosion layer that provides equivalent protection from wind or water erosion as the erosion layer specified in paragraph (d)(3)(i)(C) of this section.

(C) The disruption of the integrity of the final cover system must be minimized through a design that accommodates settling and subsidence.

3.0 FINAL COVER SYSTEM ALTERNATIVES

Alternative final cover systems meeting the EPA CCR Rule requirements were reviewed. Three alternatives were chosen and are presented below:

- EPA Soil Cap
- Composite Soil Cap
- ClosureTurf Cap

3.1 EPA Soil Cap

The EPA Soil Cap is defined in 40 CFR 257.102(d)(3)(i). The EPA Soil Cap consists of the following components, top to bottom.

- Vegetation
- Six inches (6") of soil capable of sustaining vegetative growth
- Eighteen inches (18") of compacted soil with a permeability no greater than 1×10^{-5} cm/sec
- Prepared CCR subgrade

3.2 Composite Soil Cap:

A Composite Soil Cap is comparable to a Subtitle D cap. A composite soil cap consists of the following components, top to bottom.

- Vegetation
- Twenty-four inches (24") of soil capable of sustaining vegetative growth
- A drainage layer (geocomposite)
- A flexible geomembrane liner (FML)
- Twelve inches (12") of compacted soil with a coefficient of permeability no greater than 1×10^{-5} cm/sec
- Prepared CCR subgrade

3.3. ClosureTurf Cap:

ClosureTurf is a patented, three component system that is EPA, Subtitle D compliant landfill closure solution that is specifically designed to address and solve soil erosion, slope integrity, installation and maintenance cost control, EPA regulation compliance, and longevity of structure and appearance. The anticipated design life of ClosureTurf is 100 years. ClosureTurf consists of the following components, top to bottom.

- Specialized sand infill
- An engineered artificial turf
- A flexible geomembrane liner (FML)
- Prepared CCR subgrade

There is another artificial closure system on the market that is similar to ClosureTurf. LiteEarth is a monolithic geocomposite capping system with a 40-mil Linear Low-Density Polyethylene (LLDPE) geomembrane, bonded to an advanced UV stabilized synthetic turf. The life of LiteEarth does not meet the anticipated life of ClosureTurf. LiteEarth has an anchoring system that requires penetration of the geomembrane on a 30-foot grid. This would equate to approximately 49 penetrations per acre. Assuming 10% of these penetrations leak the estimated cap infiltration compared to ClosureTurf would be twice as much.

ClosureTurf offers a benefit to easily convert the closed surface of the CCR Impoundment into a solar generation farm. The PowerCap system is a unique geotechnical approach to creating a highly stabilized solar system for landfills and impoundments. PowerCap provides a direct attachment method from the panel to the ClosureTurf surface with no penetration of the cover system.

4.0 FINAL COVER SYSTEMS ANALYSIS

The purpose of the cost study is to select a final cover system that is compliant with the EPA CCR Rule and is the most cost-effective for the facility. This includes initial construction cost, long-term maintenance, and environmental impact cost. The three final cover presented above meet or exceed the requirements of the EPA CCR Rule.

The table below includes a number of items that were reviewed to determine the best final cover systems for the Asbury CCR Impoundment. Further discussion of each of these items is presented below. The factors are presented alphabetically with no impact weight being given to any item. A + represents a positive impact while a – represents a negative impact. A cost analysis is also presented in this report.

Asbury Power Plant CCR Impoundment Closure - Comparison of Cap Options			
	EPA Soil Cap	**Composite Cap**	**ClosureTurf Cap**
Borrow Area Disturbance	-	-	+
Cap Infiltration (GW Impacts)	-	+	+
Carbon Footprint	-	-	+
Construction Time	-	-	+
CQA Oversight	-	-	+
MDNR/EPA Approval	+	+	+
Mowing	-	-	+
Other Utilities	-	-	+
Repair Erosion	-	-	+
Reseed & Fertilizer	-	-	+
Safety	-	-	+
Soil Cost	-	-	+
Solar Capabilities	-	-	+
Stormwater Quality	-	-	+
Truck Traffic	-	-	+

Borrow Area Disturbance: The construction of the EPA Soil Cap and the Composite Cap require large volumes of soil to complete the construction. This will require the development of a borrow area to provide this soil. The areas adjacent to the power plant have been extensively investigated as part of the permitting process for a CCR Landfill. MDNR issued a Construction Permit for an 88.9-acre landfill design in accordance with MDNR Regulations and the EPA CCR Rule. The area of the landfill and the permitted borrow areas must be left untouched or this permit may be rescinded. Should the current CCR regulations change or if there are certain environmental impacts from the CCR Impoundment the landfill may need to be built to be able to dispose of the CCR. Because of these concerns it was determined that these areas would not be disturbed.

During the borrow investigation for the landfill there were two other areas investigated that are owned by The Empire District Electric Company. The first area is located adjacent and north of the Power Plant. This area is an Old Law partially reclaimed strip mine. Test pits indicated the soils in this area would require screening and sorting to provide acceptable material. There was also concern that the soils may contain certain materials that could impact groundwater and may impact the ability to sustain vegetation.

The second potential borrow area is approximately 7.5 miles west of the Power Plant. The soils in this area are undisturbed and should provide the required permeability and also allow for vegetation to be established. A cost of soil should be considered in the analysis due to the detrimental impact to this property.

The third option would be to require the contractor to obtain their own soil for the project. Contractor supplied soil would cause timing issues with the construction of the soil cap because of the need to properly characterize and pre-approve the soils.

The chosen borrow area would require state permitting and final reclamation of the disturbed area. The time to obtain state approval of the borrow reclamation could take a number of years requiring an increased cost and longer environmental impacts to the utility.

The use of ClosureTurf would not require establishing an offsite borrow area.

Cap Infiltration (GW Impacts): The EPA Soil Cap is defined in 40 CFR 257.102(d)(3)(i) and further discussed in Section 3 of this report. The EPA regulation 40 CFR 257.102(d)(3)(ii) outlines what must be considered should an Alternative Cover System be used. One of the major items to address is the requirement to limit infiltration through the cover system. The U.S. EPA Hydrologic Evaluation of Landfill Performance (HELP) Model was utilized to estimate the amount of infiltration that would pass through the three final cover systems.

The HELP Model results showed an average annual percolation reduction of 91.6% for the ClosureTurf final cover system compared to the EPA Soil Cap. The average annual percolation results for the EPA Soil Cover System was 10.83 inches while the ClosureTurf Cover System was 0.91 inches. The percolation rate of the Composite Cap is similar to the ClosureTurf.

Minimizing infiltration into the CCR mass should result in improved groundwater quality in the area of the CCR impoundment limiting future environmental impacts and liability of the facility.

Carbon Footprint: There are published reports that claim the use of exposed geomembrane cover systems have a carbon footprint of approximately 20% of soil caps. The grading and reshaping of the CCR in the CCR Impoundment is not included since it is similar for all alternatives. Below are some factors for each of the final cover systems that would support that claim.

The EPA Soil Cap would have the impacts below:

- Excavation and Loading Soil – 126 crew days
- Soil Hauling - 27,830 trips, approximately 417,450 miles
- Geosynthetic Delivery – 0 trucks
- Soil Placement, Grading and Compaction – 600 crew days
- FML Installation – 0 crew days
- Seeding – 65 crew days
- Mowing (5 times/year) – 76.9 crew days

The Composite Cap would have the impacts below:

- Excavation and Loading Soil – 189 crew days
- Soil Hauling – 41,745 trips, approximately 626,175 miles
- Geosynthetic Delivery – 100 trucks
- Soil Placement, Grading and Compaction – 600 crew days
- FML Installation – 75 crew days
- Seeding – 65 crew days
- Mowing (5 times/year) – 76.9 crew days

The ClosureTurf Cap would have the impacts below:

- Excavation and Loading Soil – 0 crew days
- Soil Hauling – 0 trips, 0 miles
- Geosynthetic Delivery – 100 trucks
- Soil Placement, Grading and Compaction – 0 crew days
- FML Installation – 75 crew days
- Seeding – 0 crew days
- Mowing (5 times/year) – 0 crew days

Review of the information above shows a reduction in carbon footprint for the installation of the ClosureTurf Cap Closure System.

Construction Time: The ClosureTurf Cap would have the shortest time to complete construction while the Composite Cap would have the longest time to complete construction. The soil component of both the EPA Soil Cap and the Composite Cap greatly influence the duration of construction. Review of the crew days presented in the Carbon Footprint section above easily shows the impact of soil on the schedule.

Impacts of wet and cold weather also will greatly influence the construction time for the construction associated with soil. The low permeability layer must be installed in compacted lifts of 6 to 8 inches at the proper moisture-density relationship to meet the permeability requirement of the soil. Also, freezing weather conditions can limit the construction schedule associated with placement of this low permeability layer.

CQA Oversight: Construction Quality Assurance (CQA) services are needed to be able to certify proper closure of the CCR Impoundment to the EPA. The soil portion of the cap discussed above is a large portion of the CQA services. Below is a brief summary the CQA services for each cap system.

- The EPA Cap would involve approximately 59 pre-qualification tests and a minimum of 1,569 moisture density tests along with numerous Atterberg limit tests. There would be no required testing associated with FML installation since no FML would be installed.
- The Composite Cap would have approximately 39 pre-qualification tests and a minimum of 1,044 moisture density tests with fewer Atterberg limit tests. There would also be approximately 440 destructive seam tests for the FML.
- The ClosureTurf would have no soil testing and approximately 440 destructive seam tests for the FML.

The soil portion of the construction of EPA Cap and Composite Cap would also require the presence of a CQA technician at the borrow area to ensure proper soils are being excavated for use at the CCR Impoundment. The construction time and testing associated with CQA oversight would be dramatically less with the ClosureTurf system.

MDNR/EPA Approval: All three of the cover systems would meet the requirements of MDNR and EPA.

Mowing: The EPA CCR Rule requires that vegetation on the closed impoundment cannot exceed 12 inches in height. Both the EPA Cap and the Composite Cap are required to be vegetated. It is estimated that the CCR Impoundment surface will need to be mowed approximately 5 times a year to be in compliance with the EPA CCR Rule. Mowing and other related maintenance of the reclaimed CCR Impoundment area would continue forever. No mowing is required for the ClosureTurf.

Other Utilities: The other regulated utilities in Missouri, Ameren and Evergy, have used ClosureTurf on many of their CCR Impoundment and Landfill closures due to the factors discussed in this report.

Repair Erosion: One of the requirements of the EPA CCR Rule contained in 40 CFR 257.104(b)(1) is to maintain the integrity and effectiveness of the final cover system. This includes repairing any erosion to the final cover system. Both the EPA Cap and the Composite Cap will require to be vegetated and will need to have repairs to the eroded areas of the cap on an annual basis.

The ClosureTurf Cap system will not be impacted by erosion but may require replacement of the sand infill on a periodic basis.

Reseed & Fertilizer: Post-Closure care to maintain the integrity and effectiveness of the final cover system will require periodic reseeding and fertilizing to maintain the vegetation on the cap to limit erosion. Both the EPA Cap and the Composite Cap will require the vegetation to be maintained.

The ClosureTurf Cap system will not be impacted lack of vegetation but may require replacement of the sand infill on a periodic basis.

Safety: The use of the ClosureTurf Cap system will eliminate 417,450 to 626,175 truck miles on the roads in the vicinity of the Asbury Power Plant. This will have a positive impact on safety in the area.

Soil Cost: The Empire District Electric Company owns the property that has been identified as the borrow area. Utilizing this property for borrow will have a detrimental impact on the property. The site is currently a hay field that will be taken out of production. Based upon RSMeans cost data the cost to purchase borrow material is estimated at $18.50 per bank cubic yard of material. A cost of soil should be considered in the analysis due to the detrimental impact to this property to determine the overall cost to close the CCR Impoundment.

There is no soil cost associated with the installation of ClosureTurf.

Solar Capabilities: The Empire District Electric Company has considered the placement of a solar generation farm on the CCR Impoundment Cap. ClosureTurf offers a benefit to easily convert the closed surface of the CCR Impoundment into a solar farm. The PowerCap system is a unique geotechnical approach to creating a highly stabilized solar system for landfills and impoundments. PowerCap provides a direct attachment method from the panel to the ClosureTurf surface with no penetration of the cover system.

The EPA Cap and Composite Cap Systems do not provide this capability. Should this area be converted to a solar farm the cap systems would have to be modified to construct the necessary ballasting, conduits, appurtenances, and other improvements. These additional improvements could result in damage to the cap resulting in more infiltration into the underlying CCR.

Stormwater Quality: Stormwater coming off the ClosureTurf is very clean with little to no suspended solids or settable solids leaving the site. This should allow the facility to be in compliance with their NPDES Permit.

The EPA Cap and Composite Cap Systems will have more suspended solids and settable solids leaving the site both during construction and during the establishment of vegetation on the cap. It could take a number of years for the vegetation to become fully established. Even after the site has established a good stand of vegetation the impact on stormwater leaving the site will be greater than the ClosureTurf.

Truck Traffic: The use of the ClosureTurf Cap system will eliminate 417,450 to 626,175 truck miles on the roads in the vicinity of the Asbury Power Plant. This large amount of truck traffic will have detrimental impacts on the road system between the borrow area and the power plant. There approximately 1.6 miles (3.2 miles roundtrip) of gravel roads as part of the route. These roads will have to a dust suppressant such as magnesium chloride or similar to control dust caused by the haul trucks. There could be longer term maintenance of these roads to return them to their current condition. Safety in the area has been addressed previously in the Section.

5.0 COST ANALYSIS

Appendix 1 includes an estimate of construction costs for each of the three final cover systems. Also included is an estimate of ongoing maintenance costs for each final cover system. The

present worth of the maintenance cost is based upon the Liberty carrying charge over a 60-year period at 9.17%

5.1 EPA Soil Cap

The EPA Soil Cap has the lowest environmental factor score with only 1 positive factor out of a total of 15 of rated items. The estimated construction cost is the second highest at $18,380,818 when a unit cost for soil purchase is included. The annual maintenance cost is tied for the highest annual cost. The present value of the construction cost and annual cost ranks the EPA Soil Cap at second at $20,341,135.06.

The EPA Soil Cap has the second highest construction present value and has the greatest potential for long-term environmental impacts.

5.2 Composite Soil Cap:

The Composite Soil Cap has the second lowest environmental factor score with only 2 positive factors out of a total of 15 of rated items. The extra positive environmental factor is a very strong factor. The HELP Model results show a similar annual percolation reduction as the ClosureTurf final cover system compared to the EPA Soil Cap.

The negative environmental impacts are tied to the hauling of soil and the long-term maintenance of the soil portion of the cap. The Composite Soil Cap provides a high level of groundwater protection for the closure.

The estimated construction cost is the highest at $32,151,496 when a unit cost for soil purchase is included. The annual maintenance cost is tied for highest annual cost. The present value of the construction cost and annual cost ranks the Composite Soil Cap at highest at $34,111,813.06.

Even though the Composite Soil Cap provides a high level of groundwater protection it has the highest construction cost along with higher maintenance costs and high environmental impacts.

5.3 ClosureTurf Cap:

The ClosureTurf Cap System has the highest positive environmental factor score with a score of 15 out of a total of 15 of rated items. The estimated construction cost is the lowest at $16,669,642 when a unit cost for soil purchase is included. The annual maintenance cost is the lowest annual cost of the three alternatives considered. The present value of the construction cost and annual cost ranks the ClosureTurf Cap as the lowest at $16,995,561.54. Through discussions with the ClosureTurf providers a Direct Purchase Discount for the ClosureTurf materials was negotiated. This discount is reflected in the cost estimate.

When all factors are considered the ClosureTurf Cap system is considered to be the best alternative due to cost considerations along with present and long-term environmental impacts.

6.0 CONCLUSIONS

The use of the ClosureTurf Cap System meets the requirements of an alternative cover system design per the EPA CCR Rule. This final cover system is the least costly for construction and for long-term maintenance costs. It also provides for enhanced groundwater protection while having minimal other environmental impacts. The ClosureTurf Cap System allows for an efficient

transition of the closed CCR impoundment to a solar farm. The ClosureTurf Cap System is the best alternative of the final cover systems for the closure of the Asbury Power Plant CCR Impoundment.

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APPENDIX 1

Cost Estimates

The Empire District Electric Company
Asbury Power Plant
CCR Impoundment Closure
Budgetary Construction Cost Estimate

ITEM	EPA Soil Cap UNIT	QUANTITY	UNIT COST	SUBTOTAL	Composite Cap UNIT	QUANTITY	UNIT COST	SUBTOTAL	ClosureTurf UNIT	QUANTITY	UNIT COST	SUBTOTAL
CCR GRADING												
1. Mobilization/Demobilization	LS	1	$ 30,000.00	$ 30,000.00	LS	1	$ 30,000.00	$ 30,000.00	LS	1	$ 30,000.00	$ 30,000.00
2. Dewatering	DAY	60	$ 1,000.00	$ 60,000.00	LS	60	$ 1,000.00	$ 60,000.00	LS	60	$ 1,000.00	$ 60,000.00
3. Prescribed Burn	LS	1	$ 30,000.00	$ 30,000.00	LS	1	$ 30,000.00	$ 30,000.00	LS	1	$ 30,000.00	$ 30,000.00
4. Clear and Grub	Ac	80	$ 2,000.00	$ 160,000.00	Ac	80	$ 2,000.00	$ 160,000.00	Ac	80	$ 2,000.00	$ 160,000.00
5. Excavate and Haul CCR	CY	63,438	$ 5.44	$ 345,102.72	CY	63,438	$ 5.44	$ 345,102.72	CY	173,651	$ 5.44	$ 944,661.44
6. Dozer Push CCR	CY	343,151	$ 4.00	$ 1,372,604.00	CY	343,151	$ 4.00	$ 1,372,604.00	CY	240,336	$ 4.00	$ 961,344.00
7. Final Grade	Ac	0	$ 700.00	$ -	Ac	0	$ 700.00	$ -	Ac	120	$ 700.00	$ 84,000.00
8. Final Grade and Shape	Ac	120	$ 1,200.00	$ 144,000.00	Ac	120	$ 1,200.00	$ 144,000.00	Ac	0	$ 1,200.00	$ -
9. Compact Subgrade	Ac	120	$ 700.00	$ 84,000.00	Ac	120	$ 700.00	$ 84,000.00	Ac	120	$ 700.00	$ 84,000.00
10. Side Slope Riser	LS	1	$ 10,000.00	$ 10,000.00	LS	1	$ 10,000.00	$ 10,000.00	LS	1	$ 10,000.00	$ 10,000.00
SUBTOTAL				***$ 2,235,706.72***				***$ 2,235,706.72***				***$ 2,364,005.44***
SOIL CAP PLACEMENT												
1. Mobilization/Demobilization	LS	1	$ 40,000.00	$ 40,000.00	LS	1	$ 40,000.00	$ 40,000.00	LS	0	$ 40,000.00	$ -
2. Excavate, Haul and Place Soil (18" Layer)	CY	290,400	$ 9.57	$ 2,779,128.00	CY	0	$ 9.57	$ -	CY	0	$ 9.57	$ -
3. Grading 18" Layer (3 Lifts)	Ac	120	$ 8,739.00	$ 1,048,680.00	Ac	0	$ 8,739.00	$ -	Ac	0	$ 8,739.00	$ -
4. Compact 18" Layer (3 Lifts)	Ac	120	$ 2,058.00	$ 246,960.00	CY	0	$ 2,058.00	$ -	Ac	0	$ 2,058.00	$ -
5. Excavate, Haul and Place Soil (12" Layer)	CY	0	$ 9.57	$ -	CY	193,600	$ 9.57	$ 1,852,752.00	CY	0	$ 9.57	$ -
6. Grading 12" Layer (2 Lifts)	Ac	0	$ 5,826.00	$ -	Ac	120	$ 5,826.00	$ 699,120.00	Ac	0	$ 5,826.00	$ -
7. Compact 12" Layer (2 Lifts)	Ac	120	$ 1,372.00	$ 164,640.00	Ac	120	$ 1,372.00	$ 164,640.00	Ac	0	$ 1,372.00	$ -
8. Final Grading Compacted Soil	Ac	0	$ 700.00	$ -	Ac	120	$ 700.00	$ 84,000.00	Ac	0	$ 700.00	$ -
9. Final Smooth Drum	Ac	0	$ 7,800.00	$ -	Ac	120	$ 7,800.00	$ 936,000.00	Ac	0	$ 7,800.00	$ -
10. Excavate, Haul and Place Vegetative Soil (6" Layer)	CY	96,800	$ 9.57	$ 926,376.00	CY	0	$ 9.57	$ -	CY	0	$ 9.57	$ -
11. Excavate, Haul and Place Vegetative Soil (24" Layer)	CY	0	$ 9.57	$ -	CY	387,200	$ 9.57	$ 3,705,504.00	CY	0	$ 9.57	$ -
12. Final Grading Vegetative Soil	Ac	120	$ 700.00	$ 84,000.00	Ac	120	$ 700.00	$ 84,000.00	Ac	0	$ 700.00	$ -
13. Borrow Area Reclamation	Ac	30	$ 3,027.00	$ 90,810.00	Ac	40	$ 3,027.00	$ 121,080.00	Ac	0	$ 3,027.00	$ -
14. Borrow Area Seed Fertilize & Mulch	Ac	40	$ 3,027.00	$ 121,080.00	Ac	50	$ 3,027.00	$ 151,350.00	Ac	0	$ 3,027.00	$ -
15. Borrow Area Access & Road Maintenance	LS	1	$ 150,000.00	$ 150,000.00	LS	1	$ 150,000.00	$ 150,000.00	LS	0	$ 150,000.00	$ -
16. Borrow Soil Cost	CY	387,500	$ 18.50	$ 7,168,750.00	CY	580,800	$ 18.50	$ 10,744,800.00	CY	0	$ 18.50	$ -
SUBTOTAL				***$ 12,820,424.00***				***$ 18,733,246.00***				***$ -***

ITEM	EPA Soil Cap UNIT	QUANTITY	UNIT COST	SUBTOTAL	Composite Cap UNIT	QUANTITY	UNIT COST	SUBTOTAL	ClosureTurf UNIT	QUANTITY	UNIT COST	SUBTOTAL
GEOSYNTHETICS												
1. Mobilization/Demobilization	LS	0	$ 12,000.00	$ -	LS	1	$ 12,000.00	$ 12,000.00	LS	1	$ 12,000.00	$ 12,000.00
2. Geocomposite Drainage Layer (materials & install)	SF	0	$ 0.88	$ -	SF	5,227,200	$ 0.88	$ 4,599,936.00	SF	0	$ 0.88	$ -
3. 40 mil LLDPE (materials & install)	SF	0	$ 0.60	$ -	SF	5,227,200	$ 0.60	$ 3,136,320.00	SF	0	$ 0.60	$ -
4. ClosureTurf 40 mil for slopes < 4:1 (materials)	SF	0	$ 2.26	$ -	SF	0	$ 2.26	$ -	SF	4,356,000	$ 2.26	$ 9,844,560.00
5. ClosureTurf 50 mil for slopes > 4:1 (materials)	SF	0	$ 2.72	$ -	SF	0	$ 2.72	$ -	SF	871,000	$ 2.72	$ 2,369,120.00
6. ClosureTurf 40 mil for slopes < 4:1 (install)	SF	0	$ 0.20	$ -	SF	0	$ 0.20	$ -	SF	4,356,000	$ 0.20	$ 871,200.00
7. ClosureTurf 50 mil for slopes > 4:1 (install)	SF	0	$ 0.23	$ -	SF	0	$ 0.23	$ -	SF	871,000	$ 0.23	$ 200,330.00
8. Sand Infill ClosureTurf (120 T/acre) (material)	Ton	0	$ 40.00	$ -	Ton	0	$ 40.00	$ -	Ton	14,400	$ 40.00	$ 576,000.00
9. Sand Infill ClosureTurf (120 T/acre) (install)	SF	0	$ 0.25	$ -	SF	0	$ 0.25	$ -	SF	5,227,200	$ 0.25	$ 1,306,800.00
10. Anchor Trenches	LF	0	$ 12.00	$ -	LF	10,800	$ 12.00	$ 129,600.00	LF	10,800	$ 12.00	$ 129,600.00
11. Direct Purchase Discount for Closure Turf	%		0%	$ -	%		0%	$ -	%		15%	$ (1,832,052.00)
SUBTOTAL				***$ -***				***$ 7,877,856.00***				***$ 13,477,558.00***
REVEGATATION AND STORM WATER												
1. Seed Fertilize & Mulch	Ac	150	$ 3,027.00	$ 454,050.00	Ac	150	$ 3,027.00	$ 454,050.00	Ac	30	$ 3,027.00	$ 90,810.00
2. Erosion & Sediment Control (Silt Fence)	LF	49,680	$ 3.43	$ 170,402.40	LF	49,680	$ 3.43	$ 170,402.40	LF	7,670	$ 3.43	$ 26,308.10
3. Temporary Seeding	Ac	120	$ 1,720.62	$ 206,474.40	Ac	120	$ 1,720.62	$ 206,474.40	Ac	0	$ 1,720.62	$ -
4. Rip Rap 18"	SY	10,480	$ 110.00	$ 1,152,800.00	SY	10,480	$ 110.00	$ 1,152,800.00	Ac	0	$ 110.00	$ -
5. Perimeter Ditches	LF	8,000	$ 13.87	$ 110,960.00	LF	8,000	$ 13.87	$ 110,960.00	LF	8,000	$ 13.87	$ 110,960.00
6. Stormwater Detention Pond	LS	2	$ 60,000.00	$ 120,000.00	LS	2	$ 60,000.00	$ 120,000.00	LS	2	$ 60,000.00	$ 120,000.00
7. Pond Improvements for E&S Control	LS	2	$ 15,000.00	$ 30,000.00	LS	2	$ 15,000.00	$ 30,000.00	LS	0	$ 15,000.00	$ -
SUBTOTAL				***$ 2,244,686.80***				***$ 2,244,686.80***				***$ 348,078.10***
PROJECT MANAGEMENT												
1. CQA - Pond	Mo	24	$ 30,000.00	$ 720,000.00	Mo	24	$ 30,000.00	$ 720,000.00	Mo	12	$ 30,000.00	$ 360,000.00
2. CQA - Borrow Area	Mo	6	$ 20,000.00	$ 120,000.00	Mo	5	$ 20,000.00	$ 100,000.00	Mo	12	$ -	$ -
3. Project Management	Mo	24	$ 10,000.00	$ 240,000.00	Mo	24	$ 10,000.00	$ 240,000.00	Mo	12	$ 10,000.00	$ 120,000.00
SUBTOTAL				***$ 1,080,000.00***				***$ 1,060,000.00***				***$ 480,000.00***
			TOTAL	**$ 18,380,817.52**			**TOTAL**	**$ 32,151,495.52**			**TOTAL**	**$ 16,669,641.54**

The Empire District Electric Company
Asbury Power Plant
CCR Impoundment Closure
Annual Maintenance Cost Estimate

ITEM	EPA Soil Cap UNIT	QUANTITY	UNIT COST	SUBTOTAL	Composite Cap UNIT	QUANTITY	UNIT COST	SUBTOTAL	ClosureTurf UNIT	QUANTITY	UNIT COST	SUBTOTAL
Annual Maintenance												
1. Vegetation (mowing, reseed, fertilizer)	Ac	120	$ 779.99	$ 93,598.80	Ac	120	$ 779.99	$ 93,598.80	Ac	0	$ 779.99	$ -
2. Erosion & sediment repairs	Ac	120	$ 723.69	$ 86,842.80	Ac	120	$ 723.69	$ 86,842.80	Ac	0	$ 723.69	$ -
3. ClosureTurf Sand Replacement Top	Ac	0	$ 200.00	$ -	Ac	0	$ 200.00	$ -	Ac	100	$ 200.00	$ 20,000.00
4. ClosureTurf Sand Replacement Slopes	Ac	0	$ 500.00	$ -	Ac	0	$ 500.00	$ -	Ac	20	$ 500.00	$ 10,000.00
SUBTOTAL				***$ 180,441.60***				***$ 180,441.60***				***$ 30,000.00***
Present Worth Annual Maintenance												
60 years at 9.15%				**$ 1,960,317.54**				**$ 1,960,317.54**				**$ 325,920.00**
			TOTAL OVER 60 YEARS	**$ 20,341,135.06**			**TOTAL OVER 60 YEARS**	**$ 34,111,813.06**			**TOTAL OVER 60 YEARS**	**$ 16,995,561.54**

Alternative Cover System Demonstration
40 CFR § 257.102(d)(3)(ii)

Asbury Power Plant
2133 Uphill Road
Asbury, Missouri 64832

December 2021

Prepared For:
The Empire District Electric Company
602 S. Joplin Avenue
Joplin, Missouri 64801

Midwest Environmental CONSULTANTS

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1.0 INTRODUCTION

The EPA CCR Rule allows the closure of a CCR surface impoundment by leaving the CCR in place and requires the installation of a final cover system. If a CCR unit is closed by leaving CCR in place, the owner or operator must install a final cover system that is designed to minimize infiltration and erosion, and at a minimum, meets the requirements of paragraph 40 CFR 257.102(d)(3)(i) or the requirements of the alternative final cover system specified in paragraph 40 CFR 257.102 (d)(3)(ii) of the rule. The owner or operator of the CCR unit must obtain a written certification from a qualified professional engineer that the design of the final cover system meets the requirements of this section (40 CFR 257.102(d)(3)(iii)).

2.0 CERTIFICATE OF COMPLIANCE

Alternative Final Cover System Demonstration
EPA CCR Rule Section 40 CFR 257.102(d)(3)
Empire District Electric Company – Asbury Power Plant
Asbury, Missouri

CERTIFICATION 40 CFR 257.102(d)(3)(iii)
The undersigned Professional Engineer (P.E.) is familiar with the requirements of 40 CFR Part 257. The above summarizes the status of the Alternative Final Cover System Demonstration for the closure of the Empire District Electric Company's CCR Impoundment at the Asbury Power Plant. I hereby certify that the facility is in compliance with 40 CFR 257.102(d)(3)(iii)and all information has been placed in the Operating Record. Notification of availability of this document should be provided to the State Director as required in section 257.107(h).

Name: Anika Careaga, P.E. Seal:

Signature: Anika Careaga

Date: 12/21/2021

Registration Number: 2005022085

State: Missouri

Anika Careaga
12/21/21

3.0 REGULATORY REQUIREMENTS

The following Alternative Final Cover System Demonstration is being presented for the Empire District Electric Company's CCR Impoundment at the Asbury Power Plant. This serves as certification that the facility has completed an Alternative Final Cover System Demonstration in compliance with 40 CFR 257.102(d)(3)(ii)) of the EPA CCR Rule.

The final cover system for the CCR impoundment must comply with 40 CFR 257.102(d)(3)(i). This regulation states:

> *The final cover system must be designed and constructed to meet the criteria in paragraphs (d)(3)(i)(A) through (D) of this section. The design of the final cover system must be included in the written closure plan required by paragraph (b) of this section.*
>
> > *(A) The permeability of the final cover system must be less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than 1×10^{-5} cm/sec, whichever is less.*
> >
> > *(B) The infiltration of liquids through the closed CCR unit must be minimized by the use of an infiltration layer that contains a minimum of 18 inches of earthen material.*
> >
> > *(C) The erosion of the final cover system must be minimized by the use of an erosion layer that contains a minimum of six inches of earthen material that is capable of sustaining native plant growth.*
> >
> > *(D) The disruption of the integrity of the final cover system must be minimized through a design that accommodates settling and subsidence.*

40 CFR 257.102(d)(3)(ii) outlines the requirements should the facility chose to utilize an alternative final cover system. This regulation states:

> *The owner or operator may select an alternative final cover system design, provided the alternative final cover system is designed and constructed to meet the criteria in paragraphs (d)(3)(ii)(A) through (C) of this section. The design of the final cover system must be included in the written closure plan required by paragraph (b) of this section.*
>
> > *(A) The design of the final cover system must include an infiltration layer that achieves an equivalent reduction in infiltration as the infiltration layer specified in paragraphs (d)(3)(i)(A) and (B) of this section.*
> >
> > *(B) The design of the final cover system must include an erosion layer that provides equivalent protection from wind or water erosion as the erosion layer specified in paragraph (d)(3)(i)(C) of this section.*
> >
> > *(C) The disruption of the integrity of the final cover system must be minimized through a design that accommodates settling and subsidence.*

40 CFR 257.102(d)(3)(iii) requires an alternative cover system design to be certified by a professional engineer. This regulation states:

> *The owner or operator of the CCR unit must obtain a written certification from a qualified professional engineer that the design of the final cover system meets the requirements of this sect*ion.

4.0 ALTERNATIVE FINAL COVER SYSTEM

The chosen final cover system to be evaluated is the ClosureTurf system. ClosureTurf is a patented, three component system that is EPA Subtitle D compliant landfill that is specifically designed to address and solve soil erosion, slope integrity, installation and maintenance cost control, EPA regulation compliance, and longevity of structure and appearance. The anticipated design life of ClosureTurf is 100 years. ClosureTurf consists of the following components, top to bottom.

- Specialized sand infill
- Engineered artificial turf
- Flexible geomembrane liner (FML)
- Prepared CCR subgrade

The owner or operator may select an alternative final cover system provided the system is designed and constructed to meet the criteria discussed later in this report. These criteria include:

- Infiltration
- Erosion
- Integrity

5.0 INFILTRATION

The U.S. EPA Hydrologic Evaluation of Landfill Performance (HELP) Model was utilized to complete a comparison of the reduction of infiltration through the final cover system. The assumptions listed below were used as input parameters used for running the HELP model:

- The HELP model was run for a one acre (43,560 square feet) area over a twenty year period.
- The monthly precipitation and temperature data for Asbury, Missouri as tabulated per EPA guidance in the HELP Model.
- In order to determine membrane leakage for the proposed ClosureTurf flexible membrane liner (FML) cap, the following parameters were specified: a pinhole density of 2 holes per acre, an installation defect of 2 holes per acre, and a placement quality of "good." This is believed to be representative of a 40-mil linear low-density polyethylene (LLDPE) liner installed with typical quality assurance/quality control (QA/QC) methods.

The HELP Model runs were performed for the following two conditions: (1) EPA Soil Cover and (2) ClosureTurf Cover. The HELP Model results are included in **Appendix A** for the EPA Soil Cover, **Appendix B** for the ClosureTurf Cover**.**

Operating Condition	Average Annual Percolation Through Cap
EPA Soil Cover	10.83"
ClosureTurf Cover	0.91"

The ClosureTurf final cover system reduces the average annual percolation through the final cover by 91.6% when compared to the EPA Soil Cover.

6.0 EROSION

The alternative cover system must provide protection from wind and water erosion. Since there is not a soil component of this system the ClosureTurf Cap system will have minimal impacts from wind and water erosion. The system may require replacement of the sand infill on a periodic basis.

7.0 INTEGRITY

The alternative cover system must accommodate settling and subsidence. The ClosureTurf final cover system will have minimal disruption of the integrity of the system due to settling and subsidence.

8.0 CONCLUSIONS

The use of the ClosureTurf final cover system meets or exceeds the performance of the EPA Soil Cap when factors associated with infiltration, erosion and integrity are considered.

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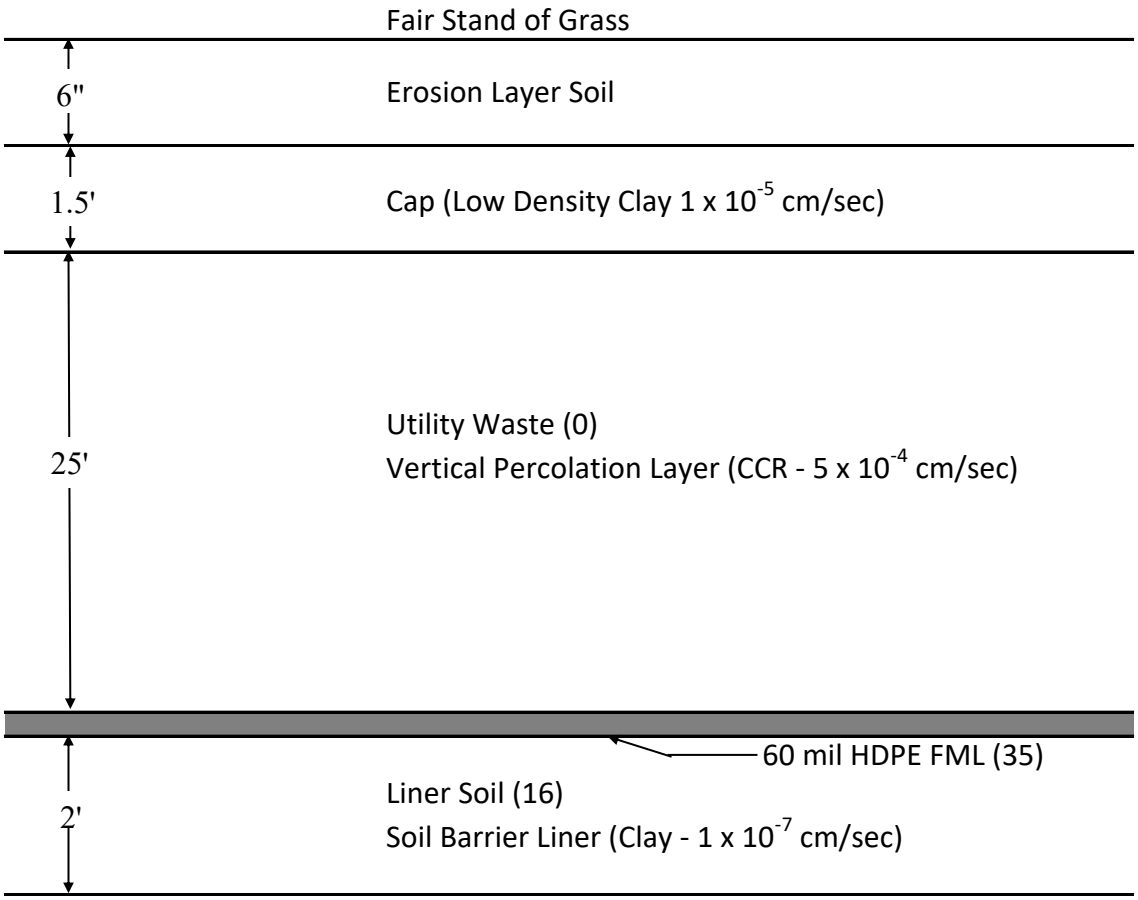
APPENDIX A

HELP Model (EPA Soil Cover)

Asbury Impoundments
EPA Soil Cover HELP Model
(Not to Scale)



EPA | **HELP Model**
Hydrologic Evaluation of Landfill Performance Model

General Information

Title	ASBURY IMPOUNDMENT CLOSURE		
Address	21133 UPHILL LANE		
	ASBURY	MO	64832
Coordinates (degrees)	Lat 37.34	Long	-94.57

Years of Simulation	20	Units	U.S. Standard
LF Area (acres)	1.00	Specify Initial Moisture?	No
% Subject to Runoff	100	Water/snow storage (in)	

Weather

Data Method	Parameter	Years of Data
	Precipitation	20
	Temperature	20
	Solar Radiation	20
	Wind Speed/Rel Humidity	
	Other Parameters (growing season, LAI & evap zone)	

Runoff Curve Number

User-specified curve number (1)

HELP will use the curve number: 91

Soil & Design

☐ Temporarily suspend layer rule checking

1	SiL - Silty Loam
2	Soil Cap
3	CCR Waste
4	HDPE Membrane
5	Liner Soil (High)

HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
HELP MODEL VERSION 4.0 BETA (2018)
DEVELOPED BY USEPA NATIONAL RISK MANAGEMENT RESEARCH LABORATORY

Title: ASBURY IMPOUNDMENT CLOSURE **Simulated On:** 10/26/2021 17:36

Layer 1

Type 2 - Lateral Drainage Layer
SiL - Silty Loam
Material Texture Number 9

Thickness	=	6	inches
Porosity	=	0.501	vol/vol
Field Capacity	=	0.284	vol/vol
Wilting Point	=	0.135	vol/vol
Initial Soil Water Content	=	0.1967	vol/vol
Effective Sat. Hyd. Conductivity	=	1.90E-04	cm/sec
Slope	=	2.25	%
Drainage Length	=	200	ft

Layer 2

Type 3 - Barrier Soil Liner
Soil Cap
Material Texture Number 43

Thickness	=	18	inches
Porosity	=	0.475	vol/vol
Field Capacity	=	0.378	vol/vol
Wilting Point	=	0.265	vol/vol
Initial Soil Water Content	=	0.475	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E-05	cm/sec

Layer 3

Type 1 - Vertical Percolation Layer (Waste)
CCR Waste
Material Texture Number 83

Thickness	=	300	inches
Porosity	=	0.541	vol/vol
Field Capacity	=	0.187	vol/vol
Wilting Point	=	0.047	vol/vol
Initial Soil Water Content	=	0.2294	vol/vol
Effective Sat. Hyd. Conductivity	=	5.00E-04	cm/sec

Layer 4

Type 4 - Flexible Membrane Liner
HDPE Membrane
Material Texture Number 35

Thickness	=	0.06	inches
Effective Sat. Hyd. Conductivity	=	2.00E-13	cm/sec
FML Pinhole Density	=	1	Holes/Acre
FML Installation Defects	=	2	Holes/Acre
FML Placement Quality	=	3	Good

Layer 5
Type 3 - Barrier Soil Liner
Liner Soil (High)
Material Texture Number 16

Thickness	=	24	inches
Porosity	=	0.427	vol/vol
Field Capacity	=	0.418	vol/vol
Wilting Point	=	0.367	vol/vol
Initial Soil Water Content	=	0.427	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E-07	cm/sec

Note: Initial moisture content of the layers and snow water were computed as nearly steady-state values by HELP.

General Design and Evaporative Zone Data

SCS Runoff Curve Number	=	91	
Fraction of Area Allowing Runoff	=	100	%
Area projected on a horizontal plane	=	1	acres
Evaporative Zone Depth	=	6	inches
Initial Water in Evaporative Zone	=	1.18	inches
Upper Limit of Evaporative Storage	=	3.006	inches
Lower Limit of Evaporative Storage	=	0.81	inches
Initial Snow Water	=	0	inches
Initial Water in Layer Materials	=	88.792	inches
Total Initial Water	=	88.792	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was User-Specified.

Evapotranspiration and Weather Data

Station Latitude	=	37.34	Degrees
Maximum Leaf Area Index	=	2	
Start of Growing Season (Julian Date)	=	101	days

End of Growing Season (Julian Date)	=	298	days
Average Wind Speed	=	10	mph
Average 1st Quarter Relative Humidity	=	70	%
Average 2nd Quarter Relative Humidity	=	73	%
Average 3rd Quarter Relative Humidity	=	65	%
Average 4th Quarter Relative Humidity	=	67	%

Note: Evapotranspiration data was obtained for ASBURY, MISSOURI

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
1.889852	2.02005	3.921549	4.211902	6.485159	5.735078
3.560809	3.345081	5.309204	3.827304	4.61823	3.094609

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 37.34/-94.57

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
40.4	42	50.8	61.5	73.2	81.6
88.6	84.9	77.4	64.1	53.5	47.3

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 37.34/-94.57
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 37.34/-94.57

Average Annual Totals Summary

Title: ASBURY IMPOUNDMENT CLOSURE
Simulated on: 10/26/2021 17:37

	Average Annual Totals for Years 1 - 20*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	48.02	[6.86]	174,308.3	100.00
Runoff	6.727	[2.246]	24,417.2	14.01
Evapotranspiration	30.444	[3.661]	110,512.7	63.40
Subprofile1				
Lateral drainage collected from Layer 1	0.0054	[0.0026]	19.7	0.01
Percolation/leakage through Layer 2	10.832031	[2.650459]	39,320.3	22.56
Average Head on Top of Layer 2	0.1068	[0.0433]	---	---
Subprofile2				
Percolation/leakage through Layer 5	0.144342	[0.057306]	524.0	0.30
Average Head on Top of Layer 4	243.1687	[86.4836]	---	---
Water storage				
Change in water storage	10.6983	[2.9634]	38,834.8	22.28

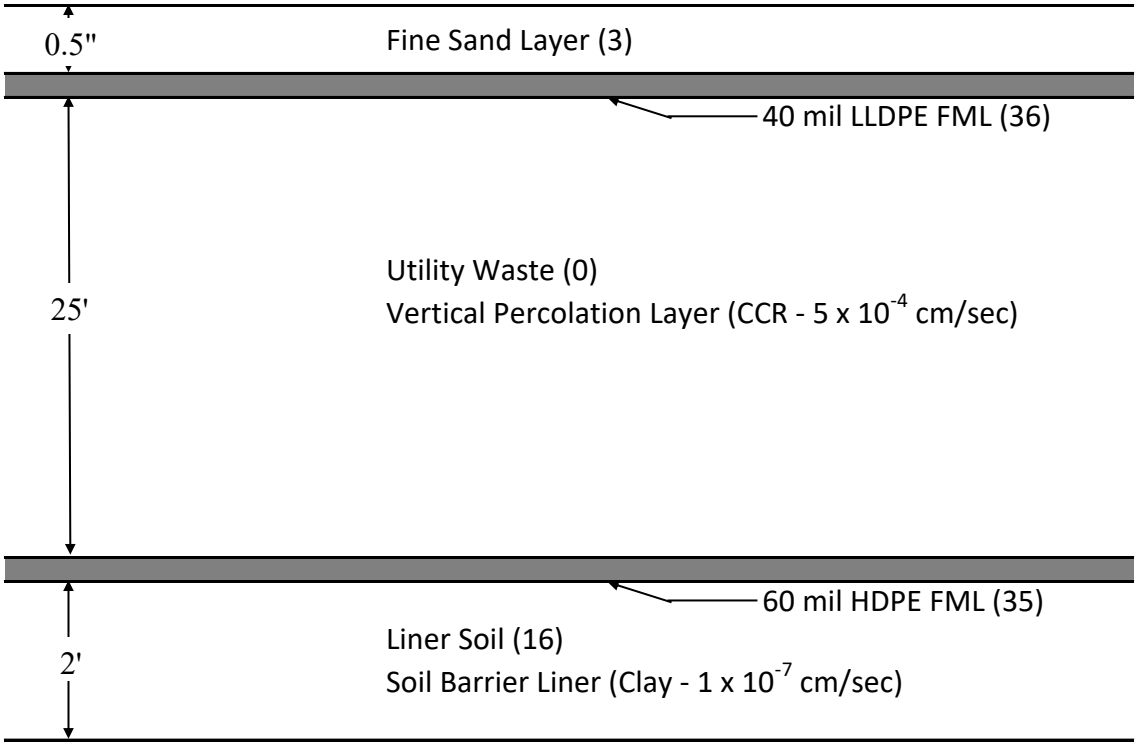
* Note: Average inches are converted to volume based on the user-specified area.

Midwest Environmental CONSULTANTS

APPENDIX B

HELP Model (ClosureTurf Cover)

Asbury Impoundments
ClosureTurf HELP Model
(Not to Scale)



EPA | **HELP Model**
Hydrologic Evaluation of Landfill Performance Model

General Information

Title	ASBURY IMPOUNDMENT CLOSURE		
Address	21133 UPHILL LANE		
	ASBURY	MO	64832
Coordinates (degrees)	Lat 37.34	Long	-94.57

Years of Simulation	20	Units	U.S. Standard
LF Area (acres)	1.00	Specify Initial Moisture?	No
% Subject to Runoff	100	Water/snow storage (in)	

Weather

Data Method	Parameter	Years of Data
	Precipitation	20
	Temperature	20
	Solar Radiation	20
	Wind Speed/Rel Humidity	
	Other Parameters (growing season, LAI & evap zone)	

Runoff Curve Number

User-specified curve number (1)

HELP will use the curve number: 91

Soil & Design

☐ Temporarily suspend layer rule checking

1	FS - Fine Sand
2	LDPE Membrane
3	CCR Waste
4	HDPE Membrane
5	Liner Soil (High)

HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
HELP MODEL VERSION 4.0 BETA (2018)
DEVELOPED BY USEPA NATIONAL RISK MANAGEMENT RESEARCH LABORATORY

Title: ASBURY IMPOUNDMENT CLOSURE **Simulated On:** 10/26/2021 18:02

Layer 1

Type 2 - Lateral Drainage Layer
FS - Fine Sand
Material Texture Number 3

Thickness	=	6	inches
Porosity	=	0.457	vol/vol
Field Capacity	=	0.083	vol/vol
Wilting Point	=	0.033	vol/vol
Initial Soil Water Content	=	0.4199	vol/vol
Effective Sat. Hyd. Conductivity	=	3.10E-03	cm/sec
Slope	=	1	%
Drainage Length	=	200	ft

Layer 2

Type 4 - Flexible Membrane Liner
LDPE Membrane
Material Texture Number 36

Thickness	=	0.04	inches
Effective Sat. Hyd. Conductivity	=	4.00E-13	cm/sec
FML Pinhole Density	=	2	Holes/Acre
FML Installation Defects	=	2	Holes/Acre
FML Placement Quality	=	3	Good

Layer 3

Type 1 - Vertical Percolation Layer (Waste)
CCR Waste
Material Texture Number 83

Thickness	=	300	inches
Porosity	=	0.541	vol/vol
Field Capacity	=	0.187	vol/vol
Wilting Point	=	0.047	vol/vol
Initial Soil Water Content	=	0.1898	vol/vol
Effective Sat. Hyd. Conductivity	=	5.00E-04	cm/sec

Layer 4

Type 4 - Flexible Membrane Liner

HDPE Membrane
Material Texture Number 35

Thickness	=	0.06	inches
Effective Sat. Hyd. Conductivity	=	2.00E-13	cm/sec
FML Pinhole Density	=	2	Holes/Acre
FML Installation Defects	=	2	Holes/Acre
FML Placement Quality	=	3	Good

Layer 5
Type 3 - Barrier Soil Liner
Liner Soil (High)
Material Texture Number 16

Thickness	=	24	inches
Porosity	=	0.427	vol/vol
Field Capacity	=	0.418	vol/vol
Wilting Point	=	0.367	vol/vol
Initial Soil Water Content	=	0.427	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E-07	cm/sec

Note: Initial moisture content of the layers and snow water were computed as nearly steady-state values by HELP.

General Design and Evaporative Zone Data

SCS Runoff Curve Number	=	91	
Fraction of Area Allowing Runoff	=	100	%
Area projected on a horizontal plane	=	1	acres
Evaporative Zone Depth	=	0.5	inches
Initial Water in Evaporative Zone	=	0.018	inches
Upper Limit of Evaporative Storage	=	0.228	inches
Lower Limit of Evaporative Storage	=	0.016	inches
Initial Snow Water	=	0	inches
Initial Water in Layer Materials	=	69.706	inches
Total Initial Water	=	69.706	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was User-Specified.

Evapotranspiration and Weather Data

Station Latitude	=	37.34	Degrees
Maximum Leaf Area Index	=	2	
Start of Growing Season (Julian Date)	=	101	days
End of Growing Season (Julian Date)	=	298	days

Average Wind Speed	=	10 mph
Average 1st Quarter Relative Humidity	=	70 %
Average 2nd Quarter Relative Humidity	=	73 %
Average 3rd Quarter Relative Humidity	=	65 %
Average 4th Quarter Relative Humidity	=	67 %

Note: Evapotranspiration data was obtained for ASBURY, MISSOURI

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
1.889852	2.02005	3.921549	4.211902	6.485159	5.735078
3.560809	3.345081	5.309204	3.827304	4.61823	3.094609

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40.4	42	50.8	61.5	73.2	81.6
88.6	84.9	77.4	64.1	53.5	47.3

Note: Temperature was simulated based on HELP V4 weather simulation for:
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Average Annual Totals Summary

Title: ASBURY IMPOUNDMENT CLOSURE
Simulated on: 10/26/2021 18:02

	Average Annual Totals for Years 1 - 20*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	48.02	[6.86]	174,308.3	100.00
Runoff	30.783	[5.429]	111,740.5	64.11
Evapotranspiration	14.505	[1.908]	52,651.6	30.21
Subprofile1				
Lateral drainage collected from Layer 1	1.8262	[0.0137]	6,629.1	3.80
Percolation/leakage through Layer 2	0.907643	[0.004009]	3,294.7	1.89
Average Head on Top of Layer 2	5.5846	[0.0302]	---	---
Subprofile2				
Percolation/leakage through Layer 5	0.015768	[0.008321]	57.2	0.03
Average Head on Top of Layer 4	27.6952	[14.9027]	---	---
Water storage				
Change in water storage	0.8898	[0.1835]	3,229.9	1.85

* Note: Average inches are converted to volume based on the user-specified area.

WG WatershedGeo® Unearthing Solutions

Quotation

Customer:	Liberty Utilities Shaen Rooney shaen.rooney@libertyutilities.com (855) 216-6305 602 S Joplin Ave., Joplin, MO 64802	**Date:** **Quotation No:** **Revision No:** **Quote Prepared By:** **Email Address:**	February 8, 2022 2022-Q-00267 1 Steve Mayes smayes@watershedgeo.com
Project:	Asbury CCR Impoundment Closure	**Payment Terms:** **Quote Good For:**	Net 30 31 Days
Location:	21133 Uphill Rd, Asbury, Missouri 64832	**Tariffs and Fees:**	Not Included

Quotation Material Schedule

Description	Quantity	Unit	Unit Price (USD$)	Total Price (USD$)
ClosureTurf Final Cover System Engineered Synthetic Turf (ClosureTurf CT) - MC270-306 Color: 100% Green (Olive 06) Square Feet: 5,229,000 Roll Size: 15' x 300' Number of Rolls: 1162 Waste and Overlap: 0.00 % MicroSpike DS - MS-LL-40 mil - 750' Thickness: 40-mil Polyethylene Type: LLDPE Square Feet: 5,226,750 Roll Size: 23' x 750' Number of Rolls: 303 Waste and Overlap: 0.00 % Welding Rod # of Units: 120 Pressure Relief Vents # of Units: 60	5,226,750	Sq. Ft.	$1.84	$9,617,220.00
			MATERIAL SUBTOTAL	**$9,617,220.00**
Engineered Turf Freight Type of Truck: Enclosed Box Truck Rolls per Truck: 27	44	Truck	$5,500.00	$242,000.00
Geomembrane Freight Type of Truck: Flatbed Rolls per Truck: 12	26	Truck	$4,000.00	$104,000.00
			FREIGHT SUBTOTAL	**$346,000.00**
Sales Tax (Estimate) Sales Tax will not be Charged if Provided a Tax Exemption Form (Please Provide Tax Exemption Form with Purchase Order)	Percent		5.45 %	$524,138.49
			TOTAL w/ SALES TAX	**$10,487,358.49**

SEE NOTES ON FOLLOWING PAGE

Notes:

NOTICE TO CUSTOMERS: IN RECENT MONTHS, THE VOLATILITY OF THE RESIN MARKET HAS INCREASED AS SUPPLIERS ARE EXPERIENCING A HIGHER DEMAND THAN THEIR SUPPLY CAN ACCOMMODATE. THIS VOLATILITY, COUPLED WITH THE RECENT EXTREME WINTER WEATHER ALONG THE GULF COAST, HAS CREATED A FORCE MAJEURE EVENT THAT IMPACTS THE PRICING AND AVAILABILITY OF RESIN. IN THE EVENT OF VERIFIABLE RESIN PRICE INCREASES PRIOR TO THE EXPIRATION OF THIS QUOTATION, WATERSHED GEO SHALL REVISE AND REISSUE THIS QUOTATION. CUSTOMER SHALL ACKNOWLEDGE ACCEPTANCE OF THE PRICE ADJUSTMENT BEFORE WATERSHED GEO WILL COMPLETE THE ORDER PROCESSING.

1. Quantities provided by Customer. Customer shall confirm material quantities prior to ordering.
2. This quote shall be revised if the material quantities are changed.
3. Sales Tax will not be charge if Customer provides a Tax Exemption Form.
4. Freight pricing includes a one-hour off-loading window. Beyond this grace period a fee of $100.00 per hour will be charged to the customer.
5. Watershed Geo standard Terms and Conditions of Sale will apply.
6. Watershed Geo reserves the right to pass along any verifiable raw material (i.e., resin) increases from our supplier's supplier up to the time of purchase order receipt assuming material delivery occurs on or before June 30, 2022.
7. Any costs associated with third party testing will be the responsibility of the customer.
8. Ten (10) year manufacturer's material warranty on the geomembrane component and a five (5) year manufacturer's material warranty on the turf component for material defects upon the completion of project. Manufacturer's warranty starts on the day that the materials are delivered to the site.
9. Current product lead time for the ClosureTurf® system components of geomembrane and engineered turf are 10 to 12 weeks from receipt of Purchase Order excluding time for MQC approval and conformance testing. Lead times are subject to change.

Technical Clarifications and Exceptions:

1. Watershed Geo will provide ClosureTurf Final Cover System geomembrane and turf components meeting the property values listed in the attached product data sheet.

Acceptance of Quotation and the attached Terms and Conditions:

Print Name: _____

Title: _____ Signature: _____

Purchase Order Number: _____ Date: _____

TERMS AND CONDITIONS OF SALE

1. **GENERAL:** These standard terms and conditions ("Terms and Conditions") will apply to the sale of all product ("Product") by Watershed Geosynthetics LLC, or any of its partners, distributors, affiliates, agents, and/or joint ventures (collectively and individually, "Seller"). These Terms and Conditions cannot be modified, amended or changed without Seller's prior written consent. Seller hereby specifically and expressly objects to and rejects any terms and conditions or other provisions in customer's purchase orders, printed forms, correspondence or any other writings which are different from, inconsistent with or in addition to these Terms and Conditions and the terms contained in the quotation to which these Terms and Conditions are attached (the "Quotation").

2. **PRICE:** The Product will be sold and invoiced at the price stated in the Quotation. Unless otherwise expressly specified in the Quotation, the prices set forth therein will expire fifteen (15) days after the date thereof. If customer has not accepted the Quotation at the stated prices within such fifteen (15) day period, Seller reserves the right to thereafter adjust the prices for such Product. Unless otherwise expressly specified in the Quotation, prices do not include federal, state or local sales, excise, use or other taxes now in effect or hereafter levied by reason of this contract. All such taxes shall be paid by customer.

3. **DELIVERY, TRANSPORTATION AND RISK OF LOSS:** Unless otherwise agreed in writing by the parties, all Product sold will be transported and delivered "FOB Destination." Seller will select the method, routing and agency of transportation but the cost therefor will be the responsibility of the customer. Seller will bear the risk of loss, damage or other incidents of ownership until delivery is made to customer's destination.

Upon request, the customer will be given the right to select the method, routing and agency of transportation. If the Product is to be shipped pursuant to the customer's shipping instructions and the customer fails to provide Seller with such instructions by the fourteenth (14^{th}) day after Seller is ready to ship the Product, Seller will ship the Product as Seller deems appropriate and reasonable. The delivery date set forth the Quotation is an approximate date of delivery only unless the parties have mutually agreed in writing to a definitive date for delivery. Seller may deliver the Product within a reasonable time prior to or after the delivery date set forth in the Quotation. If the customer fails or refuses for any reason whatsoever to take delivery of Product at the designated time of delivery, then the customer shall be responsible for all reasonable storage fees resulting from such failure or refusal to accept timely delivery. Such storage fees shall be in addition to the price of the Product set forth in the Quotation. Unless otherwise agreed to in writing, any Product held by Seller in storage for more than thirty (30) days after the agreed date of delivery may be sold, scrapped or destroyed by Seller without relieving the customer of the obligation to pay for the Product and storage.

4. **INSPECTION:** The customer shall inspect the Product at the place of destination promptly upon delivery but in no event more than fifteen (15) days after the date thereof (the "Inspection Period"). The customer must accept any tender by Seller of the Product substantially in conformity with the terms set forth in the Quotation, subject to the customer's remedies set forth in paragraph 8 below. The customer will be deemed to have accepted tender of the Product if the customer fails to submit a claim pursuant to paragraph 6(b) below before the expiration of the Inspection Period.

5. **PAYMENT:** Unless terms to the contrary are set forth in the Quotation, payment terms are net 15 days from the date of delivery. All payments shall be made in United States currency, and any payments not made within said payment terms may, at Seller's election, accrue interest at the rate of one and one-half percent (1.5%) per month until paid in full. Whenever reasonable grounds for insecurity arise with respect to due performance by the customer, Seller may demand terms of payment different from those specified herein and may demand assurance of the customer's due performance. Seller may, upon making such demand, suspend production, shipment and/or deliveries of the Product. If within the period stated in any such demand, the customer fails or refuses to agree to any such different terms of payment and/or fails or refuses to give adequate assurance of due performance, Seller may either:

(a) by notice to the customer, treat such failure or refusal as a repudiation by the customer of the portion of the contemplated transaction not then fully performed, whereupon Seller may cancel all further deliveries of the Product and all amounts unpaid for Product previously delivered will immediately become due and payable, or

(b) make shipments under reservation of a security interest and demand payment against tender of documents of title. If Seller retains a collection agency and/or attorney to collect overdue amounts, all collection costs, including attorney's fees, incurred by Seller shall be paid by the customer.

6. **WARRANTY TERMS:**

(a) Warranty. Seller hereby warrants to customer only that, subject to the terms, conditions and limitations set forth herein, for a period of one (1) year from and after the date of delivery and acceptance thereof, the Product will be free of manufacturing defects, as of said date, and will materially comply with the specifications set forth in its Product Data Sheet in effect on the date of this quotation for the specific project for which customer will install or use the Product (the "Warranty").

(b) Notification of Claims. Claims under the Warranty must be submitted to Seller in writing within thirty (30) days after discovery of any alleged breach of the Warranty via a nationally recognized overnight delivery service and addressed to:

Watershed Geosynthetics LLC
11400 Atlantis Place
Suite 200
Alpharetta, Georgia 30022
Attn: Michael R. Ayers, President

(c) Limitations on Coverage. The Warranty does not apply if the Product is (i) used for any application other than for which it was designed, (ii) Product is installed or repaired by anyone who has not been certified by Seller, or (iii) damaged by or as a result of:

i. burns, cuts, accidents, vandalism, abuse, negligence or neglect;
ii. improper design (i.e., noncompliance with the engineering standards of practice and/or Company's design guidance);
iii. displacement of Product components due to gas uplift;
iv. failure of adjacent structures such as storm water conveyance systems, roads, etc.;
v. failure of the sub-base or subgrade;
vi. the operation of non-rubber-tire or rubber-track equipment on the Product;
vii. wind recorded on the site of the Product in excess of 120 mph;
viii. storm events and/or seismic events exceeding the project's design parameters;
ix. the surface being used for purposes other than for which it was designed and installed;
x. exposure to chemicals or conditions which are not suitable for polyethylene, and polypropylene polymers;
xi. post-fibrillation during or after installation of the Product for any purpose other than getting infill materials in place;
xii. the operation of non-rubber-tire and/or non-rubber-track equipment on the Product;
xiii. failure to properly limit vehicle traffic trips over the Product other than for maintenance and inspection;
xiv. failure to limit the ground pressure of vehicle tires operating over the Product to less than 15 psi;
xv. damages due to the misapplication, incorrect installation, installation defects and/or damages resulting from any kind of inadequate handling;
xvi. settlement that causes loss of intimate contact with the subgrade or inverse grades causing non-positive drainage (i.e., ponding); and,
xvii. global instability, waste mass instability and/or subgrade instability.

(d) Disclaimer of Warranties. Notwithstanding anything set forth herein to the contrary, SELLER MAKES NO WARRANTY THAT THE PRODUCT SHALL BE MERCHANTABLE OR FIT FOR ANY PARTICULAR PURPOSE, NOR DOES SELLER MAKE ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, BY OPERATION OF LAW OR OTHERWISE, EXCEPT SUCH WARRANTIES AS ARE EXPRESSLY SET FORTH HEREIN.

(e) Limitation of Liability. In the event of a breach of the Warranty, under no circumstances shall Seller be liable to customer for any consequential, incidental, indirect, special, exemplary, punitive or any other damages regardless of whether the customer had notified Seller of the possibility thereof. The restrictions set forth in this provision include, but are not limited to, the recovery of lost profits, lost opportunity, loss of use, and downtime expenses.

7. **DEFAULT:** A party shall be in default hereunder if (a) it breaches any of its obligations set forth herein, or (b) a voluntary or involuntary petition in bankruptcy is filed by or against it, or (c) it is unable to pay its debts as they become due.

8. **CUSTOMER REMEDIES:** All claims for alleged defects in quality shall be deemed waived unless made in writing in accordance with paragraph 6(b) above. Seller's liability and customer's exclusive remedies hereunder are hereby limited to the repair or replacement of that portion of the Product that fails to comply with the Warranty, and customer shall not be entitled to any other remedies, whether in contract or tort, at law or in equity. Replacement of defective Product will be made only upon return of the defective Product after Seller has consented thereto and has delivered to the customer written shipping instructions. Seller shall be given a reasonable opportunity to investigate all claims and to inspect all Product that allegedly does not comply with the Warranty. Under no circumstances shall the customer be permitted to set off or credit any amounts due and owing to Seller unless Seller has agreed thereto in writing.

9. FORCE MAJEURE DELAYS: Seller's delay or failure in the performance of any of its obligations hereunder shall be excused if and to the extent such delay or failure is a result of Force Majeure. The term "Force Majeure" means any act or event that (i) delays the Seller's performance of its obligations in accordance with the terms of the Purchase Order, (ii) is beyond the reasonable

control of the Seller and is not due to its fault or negligence, (iii) is not reasonably foreseeable, and (iv) could not have been prevented or avoided by the Seller through the exercise of due diligence. Force Majeure includes, without limitation:

(a) strikes or work stoppages;

(b) fires, floods, inclement weather, or other acts of God;

(c) riots, war, sabotage or other disturbances of the peace;

(d) breakdowns, destruction, or failure of any kind of Seller's equipment or facilities necessary for performance hereunder or accidents at Seller's plants;

(e) transportation delays, reductions, shortages, curtailment or cessation of supplies, materials, equipment, facilities, power, labor, transportation or other factors of production;

(f) governmental legislation, regulations, rules or orders, or Seller's voluntary or involuntary participation in any plan of general public interest, either of which adversely affect manufacture or delivery hereunder;

(g) delays of suppliers; or

(h) any other cause beyond the reasonable control of Seller, whether or not similar to the causes or occurrences enumerated above.

In no event shall Seller, in the event of any of the aforesaid conditions, be liable to the customer or any third parties for any incidental, consequential, special, direct, indirect, punitive, contingent or reliance damages. In the event of any such delay or failure in performance, Seller shall have such additional time within which to perform its obligations hereunder as may reasonably be necessary under the circumstances. Further, Seller shall also have the right, to the extent necessary in Seller's reasonable judgment, to apportion fairly among its customers in such manner as Seller may consider equitable, the Product then available for delivery.

10. **TECHNICAL INFORMATION:** Unless otherwise agreed to by the parties in writing, all (i) drawings, data, specifications, designs, patterns, molds, tools, samples and other items prepared by Seller, and (ii) inventions made by Seller, including inventions based on information supplied by the customer, pursuant to a purchase of Product, shall be the sole and exclusive property of Seller.

11. **CANCELLATION:** The customer may not cancel this contract for the purchase of Product hereunder without prior written notice to, and the consent of, Seller. In addition, the customer shall, upon Seller's acceptance of any cancellation, pay Seller for all completed work for or Product ordered pursuant to the customer's order, all other costs incurred up to the date of cancellation, all lost profits due to the cancellation, and all other reasonable cancellation charges.

12. **INSTALLMENT DELIVERIES:** Seller shall be entitled to make delivery in installments unless otherwise stated in the Quotation. Seller may render a separate invoice for each installment, which invoice shall be paid when due, without regard to subsequent deliveries. Each installment shall be deemed a separate sale. Delay in delivery of any installment shall not relieve the customer of its obligations to accept delivery of remaining installments.

13. **INDEMNITY:** To the fullest extent permitted by law, the customer hereby releases, holds harmless, indemnifies and defends Seller, its officers, agents, employees, affiliates, joint ventures, insurers, successors and assigns, from and against any loss, liability, claims, suits, judgments, decrees, costs and damages ("Damages") resulting in personal injury or death, Damages to any real or personal property, and Damages relating to loss of use or loss of profit caused by, arising out of, or relating to the customer's acts or omissions. The sale of the Product shall not grant to the customer any right or license of any kind under any patent owned by Seller, but the foregoing shall not be understood to limit in any way the right of the customer to use the Product.

14. **MISCELLANEOUS:**

(a) This contract may be performed and/or assigned by Seller, and all rights hereunder against the customer may be enforced, wholly or in part, by Seller or by any one or more present or future partners, distributors, affiliates, joint ventures, transferees or assignees of Seller.

(b) The waiver by Seller of any terms, conditions, or provisions hereof shall not be construed to be a waiver of any other term, condition or provision, nor shall such waiver be deemed a waiver of a subsequent breach by the customer of the same term, condition or provision.

(c) Neither this contract nor the customer's substantive obligations hereunder may be assigned by the customer without the prior written approval of Seller, which approval may be granted or withheld in Seller's sole discretion.

(d) The entire understanding and agreement of the parties hereto with respect to the sale of the Product contemplated in the Quotation is contained therein and in these Terms and Conditions, and all prior understandings, agreements and representations, oral or written, are hereby deemed superseded and merged herein.

(e) This contract shall be deemed to be made in the State of Georgia and shall in all respects be construed and governed by the laws thereof other than its conflict of laws principles. Any disputes arising out of this contract shall be subject to the exclusive jurisdiction of any court of competent jurisdiction located in Fulton County, Georgia. The United Nations Convention of Contracts for the International Sale of Product shall not apply to this contract.

(f) Stenographic and clerical errors, whether in mathematical computations or otherwise, made by Seller in the Quotation or invoice issued pursuant thereto to customer shall be subject to correction.

(g) The remedies and rights reserved to Seller herein shall be cumulative with, and in addition to, all other rights and remedies provided at law or in equity.

ClosureTurf®

ClosureTurf® w 40 mil MicroSpike® Liner

Product Data	Test Method	LLDPE Values	HDPE Values
Thickness (nominal), mil (mm)	ASTM D5994	40 (1.0)	40 (1.0)
Thickness (min. avg.), mil (mm)	ASTM D5994	38 (0.95)	38 (0.95)
Thickness (lowest indiv.), mil (mm)	ASTM D5994	34 (0.85)	34 (0.85)
Asperity Height (min. avg.), mil (mm)	ASTM D7466	20 (0.51)	20 (0.51)
Density, g/cc	ASTM D792, Method B	0.939 (max.)	0.94 (min.)
Tensile Properties (avg. both directions)	ASTM D6693, Type IV		
Strength @Yield (min. avg.), lb/in. width (N/mm)		N/A	88 (15.4)
Elongation @ Yield (min. avg.), % (GL=1.3 in.)		N/A	12
Strength@Break (min. avg.), lb./in. width (N/mm)		112 (19.6)	88 (15.4)
Elongation@Break (min. avg.), %(GL=2.0 in.)		400	350
Tear Resistance (min. avg.), lbs. (N)	ASTM D1004	25 (111)	30 (133)
Puncture Resistance (min. avg.) lbs. (N)	ASTM D4833	50 (222)	90 (400)
Carbon Black Content (range %)	ASTM D4218	2-3	2-3
Carbon Black Dispersion (Category)	ASTM D5596	Only near spherical agglomerates for 10 views in Cat. 1 or 2	
Stress Crack Resistance (Single Point NCTL), hours	ASTM D5397, Appendix	N/A	500
Oxidative Induction Time, minutes	ASTM D3895, 200°C, 1 atm O_2	≥140	≥140

Agru America's geomembranes are certified to pass Low Temp. Brittleness via. ASTM D746 (-80°C), and Dimensional Stability via. ASTM D1204 (± 2% @ 100°C)

ENGINEERED TURF COMPONENT (CT)

Product Data	Test Method	Values
Yarn Type	N/A	Polyethylene, Fibrillated
Yarn Color	N/A	Olive Green, Play Green, Tan
Yarn Weight (Total Product Weight)	ASTM D5261 (sample size, 1 yd^2)	≥20 oz. / sq. yd. (≥ 32 oz. / sq. yd.)
Tensile Strength of Yarn	ASTM D2256	15 lbs. min.
CBR Puncture	ASTM D6241	1,500 lb. (MARV)
Tensile Product (MD/XD)	ASTM D4595	2,100 MD / 1,600 XD lb/ft (MARV)
Interface Friction between ClosureTurf CT and MicroSpike®	ASTM D5321	21°, min. Peak*
Engineered Turf Fiber UV Stability	ASTM G147	>60% retained tensile strength at 100 yrs. (projected)
Backing System UV Stability (Exposed)	ASTM G154 Modified Cycle 1., UVA340	110 lbs./ft. retained tensile strength at 6,500 hrs (projected)
Aerodynamic Evaluation	GTRI Wind Tunnel	120 mph with max. uplift of 0.12 lb/sf
Rainfall Induced Erosion	ASTM D6459	Infill Loss 0.1% at 6 in./hr. Rainfall
Steady State Hydraulic Overtopping (ClosureTurf® w/ HydroBinder®)	ASTM D7277/D7276	5 ft. overtopping resulting in 29 ft/s velocity and 8.8 psf shear stress for Manning's *n* value of 0.02
Full Scale Wave Overtopping Test Cumulative Volume (ClosureTurf® with HydroBinder®)	Colorado State University Wave Simulator	165,000 ft^3/ft
Full Scale Wave Overtopping Test Discharge (ClosureTurf® with HydroBinder®)	Colorado State University Wave Simulator	4.0 $ft^3/s/ft$
HydroBinder® Infill Mix	ASTM C387 / ASTM C109	3/4 in. infill 5,000 psi (min. at 28 days)

*Engineered turf/geomembrane interface. Geomembrane/subgrade interface is site specific and should be evaluated per Engineer of Record's requirements.

SUPPLY INFORMATION (Standard Roll Dimensions)

	Thickness		Width		Length		Area (approx.)		Weight (avg.)	
	mil	mm	ft.	m	ft.	m	ft^2	m^2	lbs	kg
MicroSpike®	40	1.0	23	7	750	229	17,250	1,603	~3,900	~1,770
Turf Component	N/A	N/A	15	4.6	300	91.44	4,500	418	~1,000	~454